IBM® Information Management Software

IBM IMS Version 12 Technical Overview

- Explore the new features and functions of IMS 12
- Understand advantages and applicability of IMS 12
- Plan for installation of or migration to IMS 12

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Note: Before using this information and the product it supports, read the information in “Notices” on page xxiii.

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Preface

IBM® Information Management System (IMS™) provides leadership in performance, reliability, and security to help you implement the most strategic and critical enterprise applications. IMS also keeps pace with the IT industry. IMS, Enterprise Suite 2.1, and IMS Tools continue to evolve to provide value and meet the needs of enterprise customers.

With IMS 12, integration and open access improvements provide flexibility and support business growth requirements. Manageability enhancements help optimize system staff productivity by improving ease of use and autonomic computing facilities and by providing increased availability. Scalability improvements have been made to the well-known performance, efficiency, availability, and resilience of IMS by using 64-bit storage.

IBM IMS Enterprise Suite for z/OS® V2.1 components enhance the use of IMS applications and data. In this release, components (either orderable or downloaded from the web) deliver innovative new capabilities for your IMS environment. They enhance connectivity, expand application development, extend standards and tools for a service-oriented architecture (SOA), ease installation, and provide simplified interfaces.

This IBM Redbooks® publication explores the new features of IMS 12 and Enterprise Suite 2.1 and provides an overview of the IMS tools. In addition, this book highlights the major new functions and facilitates database administrators in their planning for installation and migration.

The team who wrote this book

This book was produced by a team of specialists from around the world working at the International Technical Support Organization (ITSO), San Jose Center.

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Angie Greenhaw is an IT Specialist in the IBM IMS Advanced Technical Skills group. She is a primary resource in the areas of IMS security, dynamic resource definition, Common Service Layer, and Online Change. Previously, she worked in IMS development, specializing in the Online Change function, contributing to new IMS functionality, and devising solutions as a Level 3 Service Representative. She also spent three years as the IMS Development Representative for SHARE. Angie has written a white paper about global online change implementation and has coauthored three Redbooks publications. Angie joined IBM in 2000 after receiving a bachelor degree in Computer Information Systems from Arizona State University.

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IMS 12 at a glance

IBM Information Management System (IMS) 12 provides major enhancements with many new and useful features that improve integration, openness, manageability, and scalability. These enhancements can help address your On Demand Business needs.

With IMS 12, IBM offers enhancements to both major components (transaction manager and database manager) and to other operational areas, to ensure you have the growth, availability, and systems management that newer environments and cost measures require.

This chapter highlights the following major enhancements in IMS 12:

- IMS product positioning
- System enhancements
- Transaction manager and connectivity enhancements
- Database Manager enhancements
- DBRC enhancements
- Main enhancements from IMS 10 to IMS 11

You can find more details about each of these areas in the other chapters of this book.

1.1 IMS product positioning

IMS, the recognized database manager and transaction server in the industry, is critical to your business. Exclusive to the z/OS platform, IMS 12 complements IBM DB2 and WebSphere servers for database and transaction management. All of these are strategic IBM products and continue to be enhanced.

IMS Database Manager uses hierarchical organization technology. DB2 and some other systems use relational database technology. Hierarchical and relational databases have each continued to grow, with their specific characteristics and different roles to play. Hierarchical is best used for mission-critical work and for work that requires the utmost in performance. Relational is best used for decision support.

Hierarchical databases can offer a significant performance edge over relational databases when queries are known beforehand. Query optimization for relational databases ensures good performance where the query is not known in advance. Each type is best at what it does. The products supporting these technologies are enhanced to address different application requirements, and they continue to overlap more and more in their capabilities. However, the product originally designed for a particular capability will inherently be the best.

Relational and hierarchical technologies can work together for optimum solutions. Users can efficiently store operational data in hierarchical form, which can be accessed easily by their favorite relational decision support tools, with minimal impact on the production hierarchical data. IMS data can be accessed directly or propagated and replicated with relational data for summarizing, enhancing, and mining. IBM provides standard application interfaces for accessing IMS and other data. Both relational and hierarchical IMS data can be most efficiently accessed, together or independently, using the IMS Transaction Manager (TM) and WebSphere servers.

IMS Transaction Manager and WebSphere servers are both strategic application managers, and they are enhanced to take advantage of each other. They each have inherently different characteristics. IMS is more efficient in application management, data storage, and data access but applies strict rules for this access. WebSphere makes it easier to serve the web and integrate data that might have been less defined in advance. Thus, they play different roles in the enterprise. Clients use both application managers: WebSphere for newer web-based applications, and IMS for more mission-critical high performance and availability and low-cost and transactional applications and data.

IMS and WebSphere products together have been providing tools to make this combination an optimum environment. Using IMS Connect and IMS TM Resource Adapter, WebSphere development tooling can develop web applications that can serve the web and easily access existing and new critical IMS applications. Using JDBC and IMS Open Database Access, WebSphere applications can also access IMS DB data directly.

IBM demonstrates its commitments to you by continuing to enhance IMS, as highlighted in the following sections.

1.2 System enhancements

This section describes the changes to the IMS system definition and execution parameters that affect functions of the IMS system itself. Definition and execution changes for new functions are provided where the new functions are explained in detail.

Repository

With IMS 12, users of IMS DRD can now use the repository to manage MODBLKS resources in a single location. From this centralized data set, the resource definitions can be stored and retrieved by different IMS systems existing together in an IMSplex by using type-2 commands. They can also be shared among the systems and can be dynamically updated.

The main goal of the IMS repository is to simplify resource management by eliminating the need for multiple resource definition data sets (RDDS) for each IMS system. All IMS systems in the IMSplex share the same IMS repository for their resource definitions. These IMS systems can be cloned or non-cloned. With the IMS repository, users can maintain different attributes for the same resource name for each IMS in the IMSplex.

If you have never implemented DRD, you can use the definitions that exist in your MODBLKS data set as a starting point, eventually porting them to the new repository. Much like the RDDS, a repository contains resource definitions for database, program, routing code and transaction resources and descriptors.

IMPORT UPDATE

IMS 12 brings the new UPDATE option for the type-2 **IMPORT** command. This enables users to change runtime resources and descriptors with the attributes from an imported definition. If no runtime resource or descriptor exists when the **IMPORT OPTION(UPDATE)** command is issued, IMS creates the resource or descriptor with the attributes from the imported definition. For the update of an existing runtime resource or descriptor to succeed, the resource or descriptor must not be in use.

LOGGER

IMS 12 improves the functionality of IMS logging by adding Extended Format support for online data sets (OLDS) and system log data sets (SLDS), allowing them to be striped and providing the buffer allocation beyond the 31-bit, among other improvements.

Also, IMS 12 changes the way that write-ahead data set (WADS) writes are done. The concept of track groups is not used with IMS 12. This changes the calculation for the space required for the WADS and changes the data written by log ahead requests. The benefit of this enhancement is to increase logging rates while releasing storage in the extended common service area (ECSA) for other users.

EAV support of non-VSAM data sets

z/OS Version 1 Release 12 supports non-Virtual Storage Access Method (VSAM) data sets residing in the extended addressing space (EAS). IMS 12 adds the ability for IMS to address specific non-VSAM data sets residing in the EAS of an extended address volume (EAV) volume.

With z/OS 1.12, two new data set types allow applications such as IMS to recognize when data sets are located in the EAS of an EAV. Data sets in EAS are addressed using a new 28-bit cylinder/track addressing format. With EAV volumes, it is now possible to have more than 65 K cylinders, and specific IMS overflow sequential access method (OSAM) data sets can benefit from this capability. Support was added for VSAM data sets to reside in EAS in IMS 11.

The /DIAGNOSE command

IMS 12 improves the reliability of diagnostic information by supporting additional control blocks for the **/DIAG SNAP** command. The **/DIAGNOSE** command enhancements address the need to improve the reliability of diagnostic information and to streamline the problem

determination process. This line item component enhances the **/DIAGNOSE** command SNAP function in the following ways:

- Six new SNAP resource types (AREA, DB, LINE, LINK, PGM, and REGION), which support multiple resource name parameters, have been added.
- A display output option has been added.
- An output filtering option has been provided.

The overall benefits of these enhancements are improved problem diagnosis and resolution.

Common Queue Server trace facilities

Before IMS 12, all Common Queue Server (CQS) structure events were contained in a single trace table. IMS 12 adds two new trace entries. These two new trace event tables are automatically generated by IMS to contain structure event trace entries and structure overflow trace entries. These new tables retain critical trace entries for a longer period of time, which improves CQS serviceability.

All existing trace entries that are not related to client activity are moved to one of the new trace tables and are expanded to benefit from the larger 64-byte trace entry length. The existing CQS structure trace table (STR) now contains only client activity trace entries. The benefit of these separate traces is to provide the IMS support team with valuable diagnostic data for client problem resolution, with the possibility that shared queues-related problems might be resolved faster.

1.3 Transaction manager and connectivity enhancements

This section explains the changes to the IMS system definition and execution parameters that affect functions of the IMS TM and connectivity. Definition and execution changes for new functions are provided where the new functions are explained in detail.

Asynchronous IMS-to-IMS TCP/IP messages

IMS 12 provides the ability to send messages from a local IMS to a remote IMS over a TCP/IP network. The messages are sent over the TCP/IP network by a local IMS Connect and received by a remote IMS Connect. The local IMS communicates with the local IMS Connect, and the remote IMS communicates with the remote IMS Connect. IMS can send messages using Open Transaction Manager Access (OTMA) or Multiple Systems Coupling (MSC) protocols. For OTMA messages, one-way asynchronous messaging is supported. IMS OTMA communicates with IMS Connect using cross-system coupling facility (XCF).

MSC TCP/IP links

Environments that primarily use TCP/IP networks for communications, but require SNA or IBM VTAM® to sustain their MSC links, now have the option of also migrating their MSC connections entirely to TCP/IP. A new TCPIP link type has been added to the MSPLINK macro. These new links can be used to replace, complement, or back up existing MSC VTAM connections. Operationally, the new support is compatible with other link types, such as CTC, MTM, and VTAM, by using the same command structure.

From an MSC perspective, the operation of TCP/IP physical links and VTAM physical links is similar. Depending on various factors such as network traffic and the distance between the two connected IMS systems, a TCP/IP physical link is likely to provide better performance than a VTAM physical link.

IMS Connect type-2 command

The IMS Connect type-2 command line item introduces new type-2 commands for IMS Connect resources into Version 12. These type-2 commands are equivalents and, in some cases, improvements to the existing write to operator with reply (WTOR) and z/OS commands available to IMS Connect commands. With these commands, you can efficiently manage IMS Connect resources in an IMSplex and view consolidated command output. These new commands can be issued from the Operations Manager (OM) API.

OTMA ACEE reduction

IMS 12 also introduces a new maximum aging value for accessor environment elements (ACEEs). The ACEE aging value triggers when an ACEE is refreshed. This value is specified by the OTMA member client during the client-bid process. The maximum has been reduced from 68 years to 11.5 days. Each cached OTMA ACEE will have an aging value based on the OTMA member client using it that has specified the lowest number. This enhancement is important because some OTMA clients, such as the DB2 Stored Procedure DSNAIMS, set '7FFFFFFF'X seconds (68 years) as the ACEE aging value for users sending IMS transactions and commands. The enhancement also detects obsolete ACEEs, thereby improving security.

LU 6.2 Edit exit routine (DFSLUEE0)

The LU 6.2 Edit exit routine (DFSLUEE0) enables you to edit input and output LU 6.2 messages for IMS-managed LU 6.2 conversations. It is also called if a message is inserted from an alternate PCB destined for an LU 6.2 destination. IMS 12 adds to the LU6.2 Input/Output Edit Exit (DFSLUEE0) supports a new return code (RC=2) that requests the dequeuing of an undeliverable asynchronous output message. Previously, IMS requeued the message. The new return code is only valid for *asynchronous* conversations.

APPC and OTMA shared queues

IMS 12 supports the execution of APPC synchronous conversations and OTMA Commit Mode 1 (CM1) or Send-then-Commit transactions with sync level of NONE or CONFIRM in a shared queues (SQ) environment using XCF communications, eliminating the need for Resource Recovery Services (RRS). The use of Synclevel=syncpoint still requires RRS.

1.4 Database Manager enhancements

IMS 12 provides several improvements for traditional databases, high availability large databases (HALDB), and Fast Path databases.

Dynamic full function database buffer pools

With IMS 12, users can add, change, and delete full function buffer pools. With this support, full function buffer pools can be managed without restarting IMS because IMS can internally quiesce application read and update activity so that the **`UPDATE POOL`** command can complete with little disruption to transaction workloads

Parallel migration to HALDB

The IMS Unload utility (**`DFSURGU0`**) has been enhanced to allow the unload of key ranges of an hierarchical direct access method (HDAM) or hierarchical indexed direct access method (HIDAM) database when migrating to HALDB. Multiple unloads for the same database can be run in parallel. This can significantly reduce the elapsed time for a migration to HALDB.

Reorganization of number handling by timestamp recovery

In IMS 12, you do not have to run the **DFSPRECO** utility to rebuild an ILDS. The reorganization number in the data set matches the number in recovery control (RECON) when timestamp recovery is done. Users can avoid running the HALDB Index/ILDS Rebuild utility (**DFSPRECO**) to rebuild the ILDS after recovering a database that has a secondary index when reorganization verification is enabled.

Previous IMS versions did not coordinate the numbers in RECON and the partition data set.

- The reorganization number in the data set was updated from the RECON value by the first IMS subsystem that updated the partition.
- The Index Builder tool created index pointers based on the reorganization number in the data set.
- Index entries needed *healing* when the reorganization number was changed by the updater.

The IMS 12 Database Recovery utility sets the reorganization number of the partition based on the value in RECON.

Fast Path DEDB secondary index support

In IMS 12, you can have a secondary index on a primary data entry database (DEDB) to process a segment type in a sequence other than the one defined by the segment's key. With secondary indexing, you can have an index based on any field in the database, not simply the key field in the root segment. Secondary indices were previously only available for full-function and HALDB databases.

Control Area reclaim support

With the Control Area (CA) Reclaim feature in z/OS 1.12, free CA space can be reused. With CA Reclaim, space fragmentation caused by erasing records from a KSDS will be minimized to reduce the need to reorganize the data set. When the freed CAs are placed in a free chain to be reused, the index structure can be shrunk to facilitate quicker data accesses. CA Reclaim is available for all current IMS releases that use z/OS 1.12.

ACB library enhancements (already in IMS 11)

The application control blocks library (ACBLIB) usability enhancements enable you to cache the application control block (ACB) members into 64-bit storage. Separately, you have to create DFSMDA members for the dynamic allocation of the ACBLIB data sets.

Database pool storage

With IMS 12, you can specify the initial amount of 64-bit storage used for the buffer pool for a DEDB buffer pool in the DBCTL environment. In IMS 12, the storage for certain database pools is now obtained in 31-bit virtual storage backed by 64-bit real storage. IMS 12 expands VSAM full function database buffer pools to be defined for an IMS online system, batch job, or utility to 255.

Lock timeout message and logging

IMS 12 adds optional DFS2291I diagnostic messages for lock timeouts and writes log record x'67D0' subtype x'1B' for lock timeouts. If the wait for a lock exceeds the IMS LOCKTIME value when using the internal resource lock manager (IRLM), the lock request is rejected and the waiter is abended with a U3310 or a 'BD' status code is returned to the program.

Batch data sharing abend elimination

In previous versions of IMS, a batch data sharing job abended with a U3303 when an OSAM or VSAM cache structure access failed. In IMS 12, batch jobs survive when these structure accesses fail. Like online systems, they wait for the resolution to the problem. When the problem is resolved, the batch jobs continue processing. For example, when a rebuild of a structure completes, the batch jobs continue.

Reduced logging for DEDB changed data capture

Some users want to use asynchronous changed data capture, but they do not want to write log records for before images. Prior to IMS 12, asynchronous changed data capture writes before and after image log records (x'99'). By using IMS 12, you can specify that these before image log records are not to be written.

Elimination of OSAM U0080 Open/Close/EOV abends

Previous versions of IMS had rare problems in OSAM open, close, or end-of-volume processing. When they occurred, the entire IMS system terminated with the U0080 abend. IMS 12 has changed this processing. When such problems occur, the database is closed and marked "recovery needed." The abend does not occur. Additionally, message `DFS0730I` is issued for open or close problems.

Optional Release of HALDB OLR

IMS 12 provides an option for the release of ownership of a HALDB Online Reorganization when the IMS system on which it is executing terminates. The termination can be either a normal termination or abnormal termination of IMS. If ownership is released, the OLR can be restarted on another IMS system. If ownership is not released, the OLR cannot be restarted on another IMS system.

1.5 DBRC enhancements

This section outlines the enhancements for Database Recovery Control (DBRC) for IMS 12.

New CLEANUP command parameters

IMS 11 introduced the **`CLEANUP.RECON`** command to delete old or expired recovery-related information from the RECON data set, including image copy, allocation, reorganization, and recovery records as well the log information. IMS 12 adds deletion of change accumulation (CA) execution records information by the new CAGRANGE, CAONLY, and LASTCA keywords.

New user information

To allow clients to add their own control information into some of the important DBRC RECON records related to the data base administration role, you can use IMS 12 to add user data into IC, CA, RECOV, and REORG RECON records by the UDATA optional keyword. The UDATA ('string') is an optional keyword that you use to specify up to 80 bytes of information about the identified record. You can use the variable field of this keyword to describe how the data set was created. The string value must be enclosed in single quotation marks (').

New change accumulation retention period

Earlier versions of IMS use the GRPMAX parameter to control how many versions of CA execution are to be kept in RECON data sets. When the number of times you run the Change Accumulation utility for the specified group exceeds the GRPMAX value, the record with the earliest CA stop time for the group is deleted for CA groups. To improve the control of relevant

information stored in the CA group record, IMS 12 provides the RECOVPD optional keyword, which can be used to set the recovery period for a specified CA group records. The recovery period is the amount of time before the current date for which DBRC maintains CA information in the RECON data set.

GENJCL enhancements

DBRC uses, along another elements, partitioned data set (PDS) members as templates or skeletal job control language (JCL) to correctly run recovery utilities. Usually, you modify the skeletal JCL to reflect your installation's system configuration.

When you issue a **GENJCL** command, it uses a skeletal JCL execution member, which contains symbolic keywords. You can define your own symbolic keywords and use the symbolic keywords that already exist. DBRC substitutes current information for the symbolic keywords.

IMS 12 increases the number of user keys in skeletal JCL from 32 to 64, keeping the same conventions and restrictions applied to earlier versions. In addition, the existing %DBTYPE key can be used when selecting database data sets (DBDS) allocation.

LIST command enhancements

The most common use of the **LIST** command is to produce a formatted printout of all or selected information contained in a RECON data set. Normally, we use the information printed to make an analysis and then take a specific course of action regarding DBRC-controlled resources.

IMS 12 supports an output larger than 32 K for the **/RMLIST** online command, but only when the command is entered through OM API. The output size is restricted by the DBRC private storage available for buffering the output message or OM limitations.

IMS 12 provides the NORCVINF keyword for **LIST.DB** and **LIST.DBDS** commands. This keyword suppresses recovery-related information. ALLOC, IC, RECOV, and REORG records are not listed, which reduces command output.

IMS 12 adds full precision timestamps and more information about the HALDB type of databases such as active DBDS, DDNames of inactive DBDS, and the current reorganization number for the partition in the **LIST.HISTORY** command output.

IMS 12 includes the number of registered databases in the **LIST.RECON** output so that users can see whether they are nearing the 32, 767 limit of registered databases.

1.6 Main enhancements from IMS 10 to IMS 11

This section summarizes the main enhancements in IMS 11, which are new to you if you are migrating from IMS 10. For information about other enhancements that are not explained in this book, see *IMS Version 11 Technical Overview*, SG24-7807.

IMS Connect

The biggest change is for Open Database. IMS Connect becomes the entry point for IBM Distributed Relational Database Architecture™ (IBM DRDA®) requests for access to IMS databases. This means that IMS Connect becomes important also for database-only users of IMS. Two Java drivers, named the IMS Universal drivers, provide Open Database Access (ODBA) either directly using ODBA (if running on the same LPAR) or using DRDA with IMS Connect (if not running on the same LPAR). The drivers handle the various protocols so that the programmer does not have to.

IMS Enterprise Suite

Among other features, the Enterprise Suite contains a new version of the **DLIModel** utility supporting PL/I structures and a number of other enhancements. It also offers IMS Connect APIs to help programmers more easily communicate directly with IMS Connect, and a JMS API for application programs running in a Java-dependent region that want to make synchronous callout requests.

Open Database

The main change introduced by IMS Open Database is the ability to easily access IMS databases from platforms other than z/OS. This access is through TCP/IP by using the DRDA protocol; applications are shielded from the complexity of DRDA by a new set of Java drivers, known as IMS Universal drivers.

User exits

IMS 11 introduces three user exits:

- An initialization/termination exit (invoked at IMS initialization and termination)
- An IMS Common Queue Server (CQS) event exit (invoked when IMS receives a CQS event)
- An IMS CQS structure event exit (invoked when IMS receives a CQS structure event)

Dynamic allocation of ACBLIB

With IMS 11 you can modify the inactive ACBLIB concatenation while IMS is running. This allows you to compress ACB libraries, change the concatenation sequence, and add or remove ACB libraries. This improvement is particularly useful in an IMSplex with Global Online Change, because earlier versions of IMS required an IMSplex outage for such changes.

DBRC

Using IMS 11, you can benefit from Base Primitive Environment (BPE) features for your existing DBRC user exits, such as refreshing them dynamically. You can also collect DBRC performance data by writing a new (or modifying an existing) BPE statistics exit. If you have implemented RECON security, IMS 11 enables you to more easily use copies of the RECON that you might have made for recovery or problem diagnosis. The **CLEANUP.RECON** new command helps you remove obsolete data from the RECONs, which can be tedious to remove by using other means.

IMS commands

IMS 11 introduced four type-2 commands that help you to manage your OTMA environment. These commands provide information about message volumes and associated transaction instances, so that you can take action to prevent potential problems from arising because of high-message volumes OTMA enhancements.

OTMA

IMS 11 introduced OTMA capabilities that improve consistency in the IMS shared queues environment, reduce overall transaction processing costs, and increase resiliency when certain conditions arise that, if left untreated, can result in delays.

Fast Path 64-bit buffer manager

You can choose to store DEDB data buffers in 64-bit storage. If you do this, the new Fast Path 64-bit buffer manager will manage the buffer pool autonomically for you up to the size you originally specified.

ACB caching

IMS 11 introduced the possibility to cache ACB library members in 64-bit storage. This enhancement does not replace the existing program specification block (PSB) and data management block (DMB) pools. Instead, it acts as a buffer for the ACBLIB, reducing ACBLIB I/O for often-used members because these are found in the cache.

2

System enhancements

This chapter describes the major enhancements for the IMS 12 system, including descriptions of the following main components:

- TSO SPOC
- Dynamic resource definition
- ACB online change
- The /DIAGNOSE command
- IMS logger
- CQS trace facilities
- Extended address volume
- Buffer pools allocation
- Miscellaneous other enhancements enhancements

2.1 TSO SPOC

A single point of control (SPOC) is a place where you can handle the operations of all IMS systems within an IMSplex.

IMS 12 adds support to the IMS repository function and enhances the **UPDATE** option of the **IMPORT DEFN** command. The associated benefit simplifies the need to manually coordinate individual resource definition across the IMSplex.

2.1.1 SPOC background information

A SPOC is a collection of programming elements that helps you to handle operations of all IMS systems within an IMSplex instead of using a master terminal for each one. By using a SPOC, you can issue commands to all participant members of an IMSplex at once.

The Time Sharing Option (TSO) SPOC application provides a set of resource management panels that you can use to query IMS resources. Additonally, if dynamic resource definition (DRD) is enabled in your IMS systems, you can also use the TSO SPOC panels to create, delete, export, import, and update IMS resources. You can access the TSO SPOC panels directly from the IMS Application Menu (Figure 2-1).

```
 Help
_______________________________________________________________________________
                              IMS Application Menu
Command ===>

Select an application and press Enter.


         1   Single Point of Control (SPOC)
         2   Manage resources
         3   Reserved for future use
         4   HALDB Partition Definition Utility (PDU)
         5   Syntax Checker for IMS parameters (SC)
         6   Installation Verification Program (IVP)
         7   IVP Export Utility (IVPEX)
         8   IPCS with IMS Dump Formatter (IPCS)
         9   Abend Search and Notification (ASN)


 To exit the application, press F3.


 F1=Help   F12=Cancel
```

Figure 2-1 IMS Application Menu panel

The TSO SPOC communicates with a single Operations Manager (OM), which in a IMSplex is a Common Service Layer (CSL) component that provides an application programming interface (API) for automated operator programs (AOPs). Through the Structured Call Interface (SCI), which is a CSL component that manages communications between the IMSplex members, OM then communicates with all of the other IMS control regions in the IMSplex. TSO SPOC communicates with a single OM.

Figure 2-2 shows the SPOC architecture.

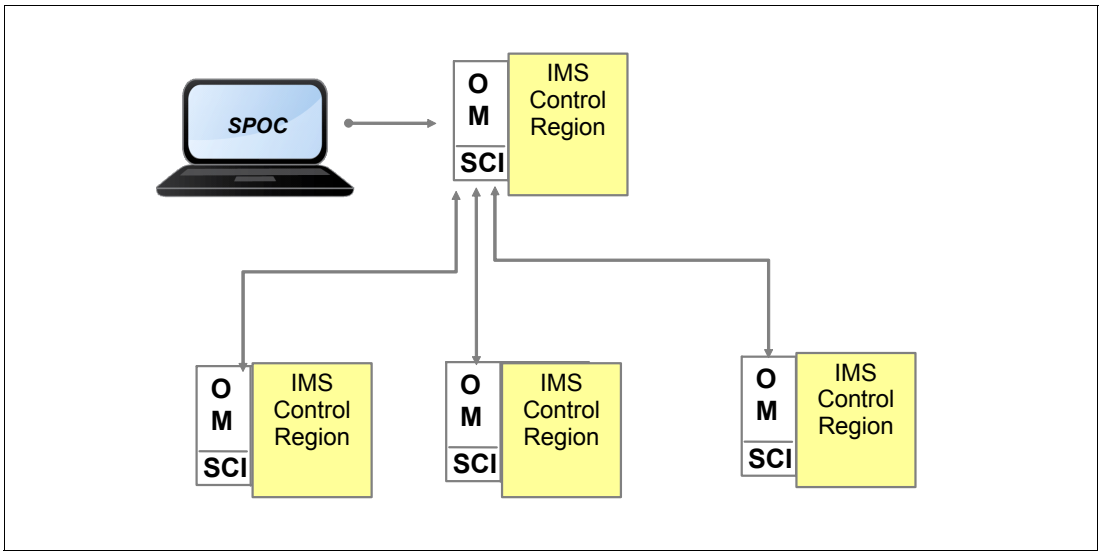

Figure 2-2 The SPOC architecture

You can issue both IMS type-1 commands and type-2 commands by using the TSO SPOC interface. You can issue commands in the IMS TSO SPOC application in the following ways:

- By using the command line
- By retrieving a command
- By defining and using command shortcuts

Figure 2-3 shows the SPOC first panel.

```
 File  Action  Manage resources  SPOC  View  Options  Help
_______________________________________________________________________________
IM12X                    IMS Single Point of Control
Command ===>

 ____________________________ Plex . .        Route . .            Wait . .
Response for:

CSLM000I     Copyright IBM Corp. 2000. All rights reserved.









  F1=Help      F3=Exit      F4=Showlog    F6=Expand    F9=Retrieve F12=Cancel
```

Figure 2-3 TSO SPOC initial panel

2.1.2 SPOC description

The existing command interfaces for the write to operator with reply (WTOR), master terminal operator (MTO), and extended multiple console support (EMCS) console are supported only for type-1 commands. If you want to use type-2 commands, you must use a SPOC. You can use a SPOC instead of the z/OS master console, the IMS master terminal, or a user terminal for most command processing.

The following types of SPOCs are available:

- On a workstation, the SPOC is an IMS Control Center with a graphical user interface (GUI).
- On a 3270 TSO terminal, a TSO SPOC is an application with an Interactive System Productivity Facility (ISPF) panel interface.
- The batch SPOC utility uses OM services to submit IMS operator commands to an IMSplex throughout standard job control language (JCL) statements.
- With the REXX SPOC API, automation programs can use SPOC functions.
- A vendor or user-written SPOC is a program that uses or accesses the OM API to perform SPOC functions.

More than one type of SPOC can be in an IMSplex, and any number of SPOCs can be active.

The TSO SPOC provides the following functions to an IMSplex:

- It presents a single system image for an IMSplex by allowing the user to issue commands to all IMS systems in the IMSplex.
- It displays consolidated command responses from multiple IMS address spaces.
- It sends a message to an IMS terminal connected to any IMS control region in the IMSplex by using the IMS **/BROADCAST** command.
- It helps users to create, query, update, and delete various IMS resources online.
- It displays the OM audit trail log, which records command input, command responses, and selected system messages from across the IMSplex.
- iT Helps users to define input user exits to modify or reject command parameters.

2.1.3 SPOC enhancements with IMS 12

The TSO SPOC application is enhanced in IMS 12 to support the use of the IMS repository function and the **UPDATE** option of the **IMPORT DEFN** command.

For information about the commands on TSO SPOC, see *IMS Version 12 Commands, Volume 1: IMS Commands A-M*, SC19-3009, and *IMS Version 12 Commands, Volume 2: IMS Commands N-V*, SC19-3010.

2.1.4 Using TSO SPOC

This section explains the **QUERY** and the **IMPORT DEFN** commands under TSO SPOC.

QUERY commands

You use the IMS **QUERY** commands to display information about IMS resources. The **QUERY** commands are type-2 commands and return information based on the keyword specified.

Figure 2-4 shows an example of the **QUERY DBDESC** command being issued through TSO SPOC.

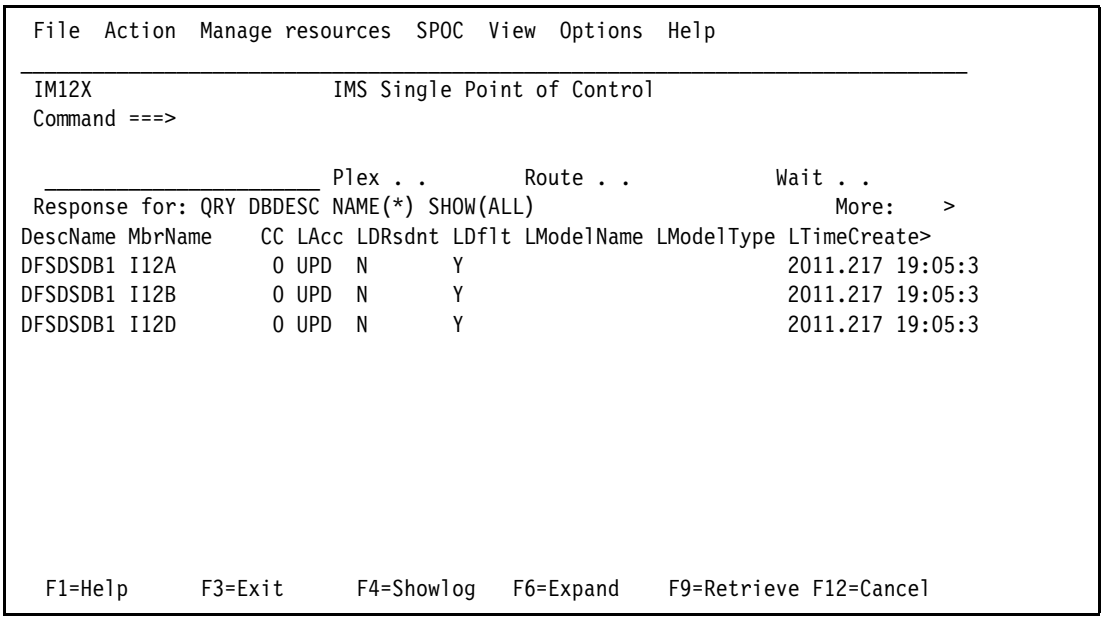

Figure 2-4 A QUERY DBDESC Command

IMPORT UPDATE commands

Before you create, delete, export, import, or update IMS resources through TSO SPOC by using the dynamic resource definition commands, be aware of the following points:

- You must enable DRD in the target IMS systems.
- Changes made to IMS resources are not saved across an IMS cold start.

You can create, delete, export, import, and update the following IMS resources and resource descriptors in DRD-enabled systems:

- Application programs
- Databases
- Fast Path routing codes
- Transactions

For more information about DRD, see 2.2, “Dynamic resource definition” on page 17.

You can use the **IMPORT** command to create resource and descriptor definitions or replace existing resource and descriptor definitions in an online IMS system by using the definitions in a resource definition data set (RDDS) or the IMSRSC repository. The **IMPORT** command can be issued through TSO SPOC or the Manage Resources options in the IMS Applications menu. This command can also be issued to an IMSplex by using the batch SPOC utility.

The **UPDATE** option indicates that if the definition being imported is for a resource or descriptor that already exists in IMS, the imported definition should be used to replace the existing runtime resource or descriptor definition. If the definition being imported is for a resource or descriptor that does not exist, the imported definition should be used to create the runtime resource or descriptor definition. If the **UPDATE** option is not specified and a runtime definition already exists for the resource or descriptor, the import of the resource or descriptor definition fails.

In most cases, the affected resource must not be in use when the **IMPORT OPTION(UPDATE)** command is entered. If the resource is in use, the import of the stored definition fails. The following transaction attributes can be updated if the transaction is in use: CLASS, LCT, LPRI, NPRI, MAXRGN, PARLIM, PLCT, PLCTTIME, SEGNO, SEGSZ, and TRANSTAT. The TRANSTAT program attribute can be updated while the program is in use.

To minimize the likelihood of the import of a resource definition failing, complete the following steps before issuing the **IMPORT** command:

1. Stop the resource.
2. Query the resource to check for work in progress.
3. Complete the work, if any.

If the imported definition is for a resource or descriptor that already exists in IMS, the import time stamp in the existing runtime definition is replaced with the time the **IMPORT** command was received by OM. If one or more of the attributes in the existing runtime definition are different from the attributes in the imported definition, the update time stamp is also updated with the time the **IMPORT** command was received by OM. The access and create time stamps in the existing runtime definition are unchanged.

If the imported definition is for a resource or descriptor that does not exist in IMS, the import time stamp in the newly created runtime definition is set to the time the **IMPORT** command was received by OM. The create time stamp is obtained from the imported definition and stored in the new runtime definition.

If the imported definition is for a descriptor that has **DEFAULT(N)** defined and the runtime descriptor is the current default descriptor, the default value is not updated. The runtime descriptor remains the default descriptor. Other attributes are updated, but the default value remains unchanged. To change the default descriptor so that it is no longer the default descriptor, you must update another descriptor to be the default descriptor. If the imported definition has **DEFAULT(Y)** defined, the updated runtime descriptor becomes the current default descriptor. The **DEFNTYPE** of a newly created definition is set to **IMPORT**. The **DEFNTYPE** is set to **IMPORT** when an existing definition is replaced with a new definition.

Figure 2-5 shows the **IMPORT UPDATE** option through TSO SPOC. In this example, the resource already exists.

```
 File  Action  Manage resources  SPOC  View  Options  Help
_______________________________________________________________________________
 IM12X                    IMS Single Point of Control
Command===>IMPORTDEFNSOURCE(RDDS)NAME(IVPDB1)RDDSDSN(IMS12Q.RRDS)OPTION(UPDATE)
  _____________________ Plex . .        Route . .            Wait . .
 Response for: IMPORT DEFN SOURCE(RDDS) NAME(IVPDB1) RDDSDSN(IM...
Name     Type     MbrName    CC ImpType
IVPDB1   DB       I12A        0
IVPDB1   DB       I12B        0
IVPDB1   DB       I12D        0









  F1=Help      F3=Exit      F4=Showlog   F6=Expand    F9=Retrieve F12=Cancel
```

Figure 2-5 The IMPORT UPDATE command

2.1.5 Considerations for using the IMPORT command

The **IMPORT** command imports resource and descriptor definitions from an RDDS or the repository and uses the definitions to create the runtime resource and descriptor definitions in the online IMS system. Therefore, the same rules and restrictions that apply to the **CREATE** commands for databases, programs, routing codes, and transactions also apply to the **IMPORT** command.

- The **IMPORT** command can be issued only through the OM API.
- This **IMPORT** command applies to DB/DC, Database Control (DBCTL), and Data Communications Control (DCCTL) systems.
- The **IMPORT** command is not valid on the extended recovery facility (XRF) alternate, Remote Site Recovery (RSR) tracker, or Fast Database Recovery (FDBR) region.
- The **IMPORT** command is valid only in a DRD environment.

The runtime resource and descriptor definitions that are created by the **IMPORT** command exist in the online system until IMS terminates, unless they are deleted using a **DELETE** command. They are recoverable across an IMS warm start or emergency restart.

To preserve the resource and descriptor definitions across a cold start, export the definitions to an RDDS or the repository before IMS terminates. Then import the stored definitions from the RDDS or the repository back into IMS either during cold start processing by using the automatic import function or, when IMS is up and running, by using the **IMPORT** command.

2.2 Dynamic resource definition

DRD is an IMS function that you can use to manage IMS resources dynamically, without using the traditional IMS system generation. IMS 12 brings several enhanced DRD ISPF panels to support the use of the IMS repository function.

The aggregated benefits of providing support to the IMS Resource Definition Repository (Repository) are to simplify the management of IMS system and to provide a single safe source for information about IMS resources.

2.2.1 Background information about DRD

A request to add or modify the current set of programs, transactions, and database does not necessarily force a complete system definition and an IMS recycle. You can evaluate the request and if does not involve changes to the IMS network or the use of static terminals as defined in the current IMS system definition, then you can use the online change process to make the changes while the IMS system is up and running.

IMS systems uses the online change process to add, change, and delete resource definitions while the system is running. The online change process requires that you perform the following tasks:

- Generate the resource into IMS and store them in an MODBLKS staging library data set.
- Run the Online Change Copy utility (DFSUOCU0) to copy into an inactive library.
- Run a series of online change commands to cause the change to take effect.

Figure 2-6 shows the online change process.

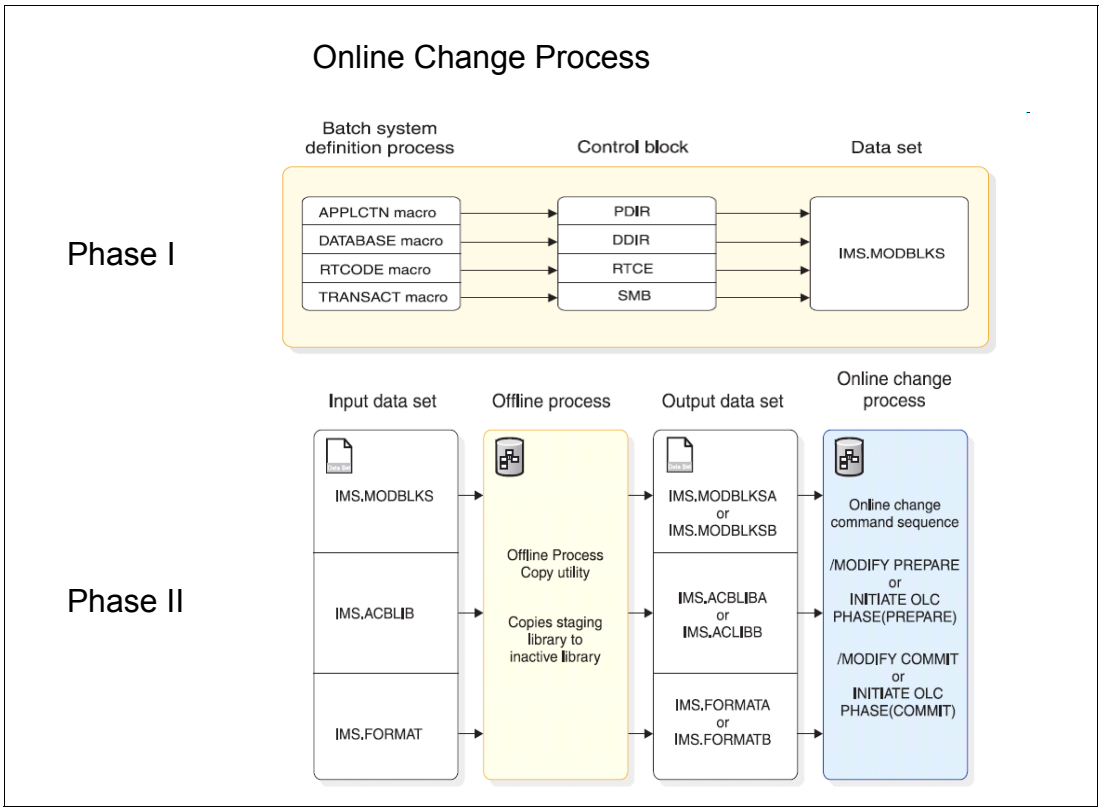

Figure 2-6 Online change process

DRD is an IMS function that enables users to create, update, query, and delete IMS resources and their descriptors dynamically, without using the batch system definition or online change processes. Using the DRD, you can handle the following IMS resources:

- Transactions
- Application programs
- Databases
- Fast Path routing codes

With DRD enabled, the **APPLCTN**, **DATABASE**, **RTCODE**, and **TRANSACT** macros are optional in the IMS system generation input deck. You can either use type-2 commands to define resources to IMS dynamically or import resource definitions into IMS from a RDDS.

Figure 2-7 shows the DRD flow.

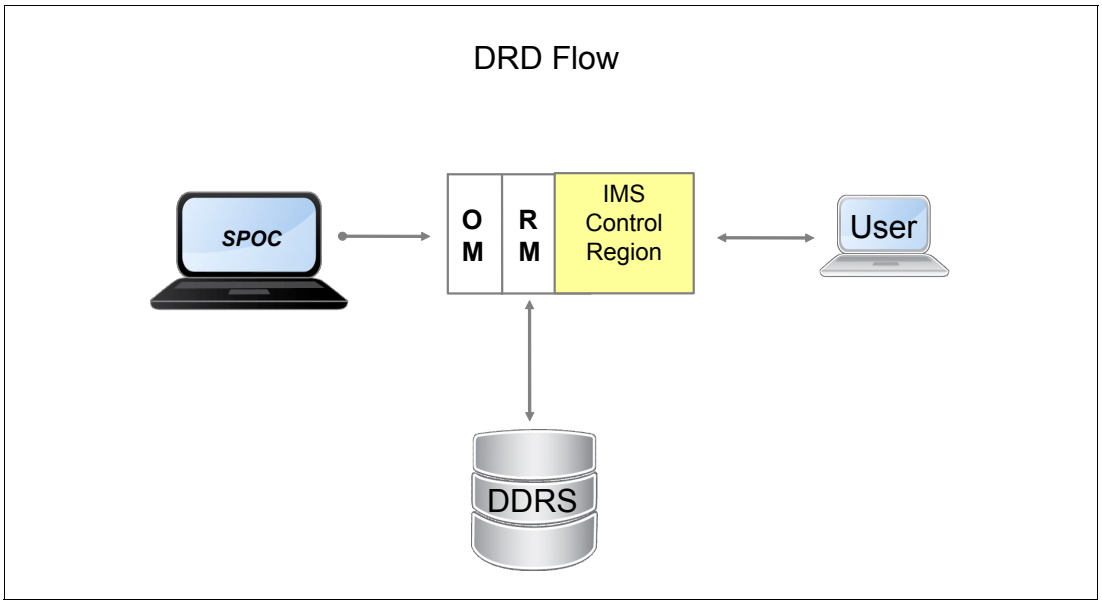

Figure 2-7 DRD flow

2.2.2 Description of DRD

With DRD enabled, you can use the **CREATE**, **IMPORT**, **UPDATE**, and **DELETE** type-2 commands to dynamically create, update, and delete application program, database, routing code, and transaction resource and descriptor definitions.

You can issue these type-2 commands either from a TSO SPOC or by using the IMS Manage Resources application that is available from the IMS Application Menu at option 2.

Figure 2-8 shows the first DRD panel.

```
Help
_____________________________________________________________________________
IM12X                          IMS Manage Resources

Command ===>

Select an action and press Enter.


* Action . . . . . .    1. Create new resources
                        2. Delete resources
                        3. Query resources
                        4. Update resources
                        5. Export resources
                        6. Import resources
                        7. Manage RDDS

 F1=Help   F12=Cancel
```

Figure 2-8 IMS Managed Resources panel for DRD

With DRD enabled, you can perform several tasks to manage the resource and descriptor definitions for your IMS system:

- Create resources or descriptors.
- Update resources or descriptors.
- Delete resources or descriptors.
- Query definitional attributes of resources or descriptors.
- Export resource and descriptor definitions.
- Import resource and descriptor definitions.

Resource descriptors are templates that can be used to define new resources and descriptors. IMS supplies four resource descriptors, one for each resource type. The descriptors contain IMS-system default values for each resource attribute. These IMS-supplied descriptors cannot be deleted or modified. The following resource descriptors are IMS-supplied:

- DFSDSDB1 (database descriptor)
- DFSDSPG1 (application program descriptor)
- DBFDSRT1 (Fast Path routing code descriptor)
- DFSDSTR1 (transaction descriptor)

When you create a resource without specifying a model (that is, you do not specify the LIKE keyword), any attribute values that are not specified on the **CREATE** command are inherited from the default descriptor. When you create a resource that is modeled from a descriptor (using the LIKE keyword), any attribute values that are not specified on the **CREATE** command are inherited from the descriptor.

Similarly, when you create a resource using an existing resource as a model (using the LIKE keyword), any attribute values that are not specified on the **CREATE** command are inherited from the existing resource.

These resource definitions can then be imported from the RDDS during cold start processing. To ensure that your changes are recovered across a cold start, set up your system to automatically export your resource and descriptor definitions at checkpoint time and to automatically import the definitions from the RDDS or the repository during cold start processing.

Specify parameters related to DRD in the DFSDFxxx member of the IMS.PROCLIB data set. The DFSDFxxx member of the IMS.PROCLIB data set contains parameters for the IMS CSL, shared queues, databases, restart exit routines, DRD, the IMSRSC repository, dynamic database buffer pools, the Fast Path 64-bit buffer manager, and the IMS abend search and notification procedure.

The MODBLKS= keyword enables either DRD (MODBLKS=DYN) or the online change process (MODBLKS=OLC). The MODBLKS= keyword can only be changed as part of a cold start. MODBLKS=OLC and MODBLKS=DYN are mutually exclusive. You can specify the MODBLKS= keyword in either the DFSCGxxx member, or in the CSL section of the DFSDFxxx member. If you specify a value for the MODBLKS= keyword in the DFSCGxxx member, that value overrides the value specified for the MODBLKS= keyword in the DFSDFxxx member.

If the online change process is disabled (DRD is enabled), the IMS, DBC, and DCC procedures no longer require the DD statements for the IMS.MODBLKS data sets, IMS.MODBLKSA, and IMS.MODBLKSB.

Tip: To ease the transition from using the online change process to using DRD, you can create runtime resource definitions using the batch system definition process and then enable DRD so that you can use the DRD commands. IMS systems can export resources that are defined by the batch system definition process and resource definitions that have been created or updated dynamically, to an RDDS or a repository, using the **EXPORT DEFN** command. You can also set up your system for automatic export to an RDDS.

2.2.3 DRD enhancement with IMS 12

DRD is enhanced for IMS Version 12 in the following areas: the Manage Resources ISPF panels are enhanced, the use of the **IMPORT** command with a new **UPDATE** option, and DRD can use the IMS resource definition (IMSRSC) repository.

The following Manage Resources ISPF panels are enhanced in IMS 12:

- DELETE DEFN
- EXPORT DEFN
- IMPORT DEFN
- QUERY DB
- QUERY DBDESC
- QUERY PGM
- QUERY PGMDESC
- QUERY RTC
- QUERY RTCDESC
- QUERY TRAN
- QUERY TRANDESC

For information about the **IMPORT** command with the new **UPDATE** option, see 2.1, “TSO SPOC” on page 12. For information about the IMS resource definition (IMSRSC) repository, see Chapter 7, “IMS repository” on page 199.

If you use the DRD function for the first time when running on IMS Version 12, you can use the IMS repository function without ever using a RDDS. Although support for RDDSs continues in IMS Version 12, the IMSRSC repository is a strategic alternative to the RDDS.

2.2.4 Using DRD

With DRD enabled, you can perform several tasks to manage the resource and descriptor definitions for your IMS system:

- Update IMS resources or resource descriptors by using the IMS **UPDATE** command.
- Delete Language Environment® runtime options, resources, and resource descriptors by using the IMS **DELETE** command.
- Display information about IMS resources by using the IMS **QUERY** command.
- Export runtime resource and descriptor definitions from the online IMS system to a RDDS or the IMSRSC repository as stored resource definitions by using the **EXPORT** command.
- Create resource and descriptor definitions or replace existing resource and descriptor definitions in an online IMS system by using the **IMPORT** command and by using the definitions in a RDDS or the IMSRSC repository.

Following are examples of creating and updating resources in DRD enabled IMS environment.

Creating resources or descriptors

Use the IMS **CREATE** commands to create resources and resource descriptors. Figure 2-9 shows the panel to introduce the definition of the new transaction resource, called DLRINQ, for the I12A IMS of the IMSplex.

```
 File  Action  Manage resources  SPOC  View  Options  Help
_______________________________________________________________________________
IM12X                      IMS Create New Resource
Command ===>

_____________________ Plex . .        Route . . I12A       Wait . .
Select a resource. To base a resource on a template, specify the template
information. Press Enter to continue.

                                                                    More:     +
* Resource  . . . . . . . . . 4  1. Database
                                 2. Program
                                 3. Routing Code
                                 4. Transaction

Resource name . . . . . . . . DLRINQ
Resource type . . . . . . . . 1  1. Resource
                                 2. Descriptor

Definition template . . . . . 1  1. System default
                                 2. Existing resource

 F1=Help   F12=Cancel
```

Figure 2-9 Creating a new transaction called DLRINQ (part 1 of 2)

Figure 2-10 shows the panel to define the properties of the DLINQ transaction.

```
 File  Action  Manage resources  SPOC  View  Options  Help
_______________________________________________________________________________
IM12X              IMS Create Transactions
Command ===>

_____________________ Plex . .        Route . . I12A       Wait . .
Press Enter to continue
                                                                More:   -+
  LPRI     Limit priority . . . . . . . . . 1          0-14
  MAXRGN   Maximum region count . . . . . . 0          0-999
  MSGTYPE  Message type . . . . . . . . . . MULTSEG    Snglseg, Multseg
  MSNAME   MSC logical link path name . . .
  NPRI     Normal scheduling priority . . . 1          0-14
  PARLIM   Parallel limit count . . . . . . 65535      0-32767, 65535
  PGM      Program name . . . . . . . . . . DEALER99   Name of program
  PLCT     Processing limit count . . . . . 65535      1-65535
  PLCTTIME Processing limit count time. . . 6553500    1-6553500
  RECOVER  Recovery option. . . . . . . . . Y          Y, N
  REMOTE   Remote option. . . . . . . . . . N          Y, N
  RESP     Resp ·····································
  SEGNO    Seqm ·Transaction DLRINQ created successfully.  · 5
  SEGSZ    Seqm ····································· 5
 F1=Help      F3=Exit      F4=Showlog   F6=Expand    F9=Retrieve F12=Cancel
```

Figure 2-10 Creating a new transaction called DLRINQ (part 2 of 2)

Importing resources

Import resource and descriptor definitions from an RDDS or a repository into IMS.
Figure 2-11 shows the panel to identify the type of resource to be imported as a transaction, DLRINQ, in this case from I12A IMS system to I12B IMS system.

```
 File  Action  Manage resources  SPOC  View  Options  Help
_______________________________________________________________________________
 IM12X                        IMS Import Resources

 Command ===>

_____________________________ Plex . .        Route . . I12C Wait . .
 Press Enter to continue.

                                                                    More:     +

 Source . . . . . . . . . : RDDS

 Source RDDS data set . . 'IMS12Q.IMS12A.RDDS2'

 Resource name  . . . . . DLRINQ

 Resource type
   Enter "/" to select types
      ALL     All RSCs & DESCs
      ALLRSC  All resources             ALLDESC  All descriptors
      DB      Database resource         DBDESC   Database descriptor
     PGM     Program resource          PGMDESC  Program descriptor
     RTC     Routing code resource     RTCDESC  Routing code descriptor
  /  TRAN    Transaction resource      TRANDESC Transaction descriptor

OPTION
  Enter "/" to select options
     ABORT   Abort import if error     ALLRSP   Show all responses
  /  UPDATE  Update runtime defs
 F1=Help   F12=Cancel
```

Figure 2-11 Import DLRINQ Transaction to I12C IMS system (part 1 of 2)

Figure 2-12 shows the panel to create the imported copy.

```
 File  Action  Manage resources  SPOC  View  Options  Help
_______________________________________________________________________________
 IM12X                    IMS Single Point of Control
 Command ===>

_____________________________ Plex . .        Route . . I12C       Wait . .
 Response for: IMP DEFN SOURCE(RDDS) RDDSDSN(IMS12Q.IMS12A.RDDS...
Name     Type     MbrName    CC ImpType
DLRQUERY TRAN     I12C        0 CREATE
```

Figure 2-12 Import DLRINQ transaction to I12C IMS system (part 2 of 2)

2.2.5 Considerations for using DRD

Unless you have a simple system and the online change process fully meets your requirements, use DRD with repositories or DRD with RDDSs rather than the IMS.MODBLKS data set.

Attention: DRD changes are not necessarily made across all IMS systems in an IMSplex. Changes might be successful on some IMS systems but fail on others. You must verify that changes have been made across all systems.

If you plan to use DRD in your IMS system, be aware that several restrictions apply to your use of DRD, as explained here:

- When DRD is enabled, you cannot perform online change for the resources that are typically defined in the IMS.MODBLKS data set. If you have a simple system such as a single IMS and online change meets your requirements, consider continuing to use online change and not enabling DRD.
- In an IMSplex with only one IMS and DRD enabled, the **/MODIFY PREPARE MODBLKS** and **INITIATE OLC PHASE(PREPARE) TYPE(MODBLKS)** commands are rejected. The **/MODIFY PREPARE ALL** and **INITIATE OLC PHASE(PREPARE) ALL** commands do not apply to the IMS.MODBLKS data set.
- When DRD is disabled, **CREATE**, **DELETE**, **IMPORT**, and most **UPDATE** commands that change the definitional attributes of a resource are rejected. The following parameters for the **UPDATE TRAN** command are permitted regardless of whether DRD is enabled:
  - **CLASS(class)**
  - **CPRI(value)**
  - **LCT(value)**
  - **LPRI(value)**
  - **MAXRGN(number)**
  - **MSNAME(name)**
  - **NPRI(value)**
  - **PARLIM(value)**
  - **PLCT(value)**
  - **SEGNO(number)**
  - **SEGSZ(size)**
  - **TRANSTAT(Y | N)**
- You cannot delete an IMS-supplied descriptor. The only attribute you can update on an IMS-supplied descriptor is the DEFAULT attribute.
- Because of the default OM routing in a sysplex, DRD commands are routed to all the IMS systems, unless you specify otherwise. However, the commands are not coordinated across the sysplex, so a command can succeed on some IMS systems and fail on others.
- The Multiple Systems Verification utility (**DFSUMSV0**) can verify resources defined only by the batch system definition process; it cannot verify resources that were created using DRD. Use the **/MSVERIFY** command to verify resources that are created dynamically.
- You can update a resource or a descriptor definition, but the changes to that resource or descriptor definition are not propagated to the resource or descriptor definitions that were built from the updated resource or descriptor definition.
- You can import a resource or descriptor and it affects any resource or descriptor explicitly specified in the **IMPORT DEFN** command or RDDS, but it does not affect any resources or descriptors built from the specified resource or descriptor.

2.3 ACB online change

The global online change function modifies resources online for all IMS systems in an IMSplex. With IMS, you can perform an online change only for the DBDs and PSBs that are specified in the appropriated command.

The benefit is that in an IMSplex environment, you can use the application control block (ACB) member online change (OLC) function with **OPTION(NAMEONLY)** specified on the appropriated command to process only the DBDs and PSBs that are specified.

2.3.1 Background information about online change

The global online change function changes resources online for all IMS systems in an IMSplex, bringing the following benefits:

- Simplified process for changing resources online for all IMS systems in the IMSplex
- Continuous processing because each IMS in the IMSplex is not manually coordinated
- Avoidance situations where online change is committed just for some IMS systems

With global online change, the master IMS control region coordinates online changes of the following resources:

- Databases (data management block (DMB) in the ACB library (ACBLIB))
- Database directories (DL/I database directory (DDIR) in MODBLKS)
- MFS formats (FMTLIB)
- Programs (PSB in ACBLIB)
- Program directories (PSB directory (PDIR) in MODBLKS)
- Transactions (scheduler message blocks (SMBs) in MODBLKS)
- Routing codes (Fast Path routing codes (RCTEs) in MODBLKS)

Use the **INITIATE OLC** command to initiate the global online change process.

The **INITIATE OLC** command master usually performs the online change phase locally. If it fails locally, the command master usually skips sending the online change phase to the other IMS systems, sets a completion code for each other IMS indicating that the online change phase was not attempted, and terminates command processing. However, if the **INITIATE OLC PHASE(COMMIT)** command fails on the local IMS because of work in progress for resources that are directly affected by the online change, the command master still sends the commit phase 1 to the other IMS systems. The purpose is to report work in progress for all the IMS systems in the IMSplex, to facilitate completion of the work in progress.

Before you can use online change, you must create three copies of each of the following libraries:

IMS.MODBLKS This library contains the control blocks to support online change of databases, programs, transactions, and MFS formats.

IMS.ACBLIB This library contains database and program descriptors.

IMS.FORMAT This library contains your MFS maps produced by the MFS Language and Service utilities.

These libraries are for the exclusive use of IMS offline functions and are called the staging libraries. Two copies are made of each library, producing data sets with a data set name suffixed with A and B, for example, IMS.MODBLKSA and IMS.MODBLKSB. These two copies of each library are used by the IMS online system.

Figure 2-6 on page 18 shows the online change process.

2.3.2 Description of online change

The global online change process operates through a master IMS control region, which uses the Resource Manager (RM) to coordinate the phases of online change with the other IMS systems in the IMSplex. If you are running an IMSplex that does not use RM, you can specify the CSL global parameter **RMENV=N** in the DFSCGxxx IMS.PROCLIB member. If this parameter is specified, IMS does not require RM and will use type-2 command support.

The following components are required for a global online change in the IMSplex:

- An IMSplex defined with CSL and at least one OM
- Common Queue Server (CQS), if there is a resource structure in the IMSplex
- OLCSTAT data set, which must be initialized by the Global Online Change utility (**DFSUOLC0**)
- **OLC=GLOBAL** and **OLCSTAT=** parameters in the DFSCGxxx PROCLIB member data set
- **CSLG=** parameter in the IMS EXEC statement

If you exclude RM from the IMSplex by specifying **RMENV=N**, each IMS system must have its own OLCSTAT data set and that OLCSTAT data set must contain the IMSID of the IMS system that owns it and no other IMSIDs.

At least one RM and a resource structure are recommended for global online change, but they are not required. Take into consideration that, if you do not use an RM in your IMSplex, the OLCSTAT data set can contain only the IMSID of the IMS system that owns that OLCSTAT data set. Any attempt to restart an IMS system that contains an OLCSTAT data set with a different or multiple IMSIDs results in an abend. IMS rejects **INITIATE OLC** and **TERMINATE OLC** commands that are issued by an IMS system other than the IMS system that owns the OLCSTAT data set.

To enable an IMSplex for global online change, you must perform the following tasks:

- Run the Global Online Change utility (**DFSUOLC0**) to initialize the OLCSTAT data set.
- For each IMS in the IMSplex, perform these steps:
  - Remove the MODSTAT DD and MODSTAT2 DD statements from the IMS control region JCL.
  - Define DFSCGxxx IMS.PROCLIB member parameters related to global online change, or in the CG section of DFSDFxxx member.

The **INITIATE OLC** (initiate online change) command is provided to support global online change, where online change is coordinated across IMS systems in the IMSplex. The **INITIATE OLC** command is similar to the **/MODIFY PREPARE** and **/MODIFY COMMIT** commands, except that it applies to an IMSplex-wide global online change.

If the **INITIATE OLC PHASE(COMMIT)** command fails for any IMS before the OLCSTAT data set is updated, either correct the errors and try the commit again or terminate the online change with a **TERMINATE OLC** command. If the **INITIATE OLC PHASE(COMMIT)** command fails for any IMS after the OLCSTAT data set has been updated, correct the errors and try the commit again. The online change cannot be terminated

If you want to fall back to the previous version of the changed resource, perform a full online change process with a full library switch.

2.3.3 ACB online change IMS 12 enhancements

IMS 10 added, in an IMSplex environment, the possibility to use the ACB member OLC function to add or change individual members of the ACB library, or the entire ACB library, and bring these new or changed members online without quiescing the IMSplex or refreshing the active ACB library. Members that are not affected by the member OLC are not quiesced.

With IMS 12, the ACB member online change function is enhanced to process only the DBDs and PSBs that are specified in **NAME()** keyword of the **INIT.OLC TYPE(ACBMBR)** command.

Figure 2-13 shows the syntax of the **INITIATE** command.

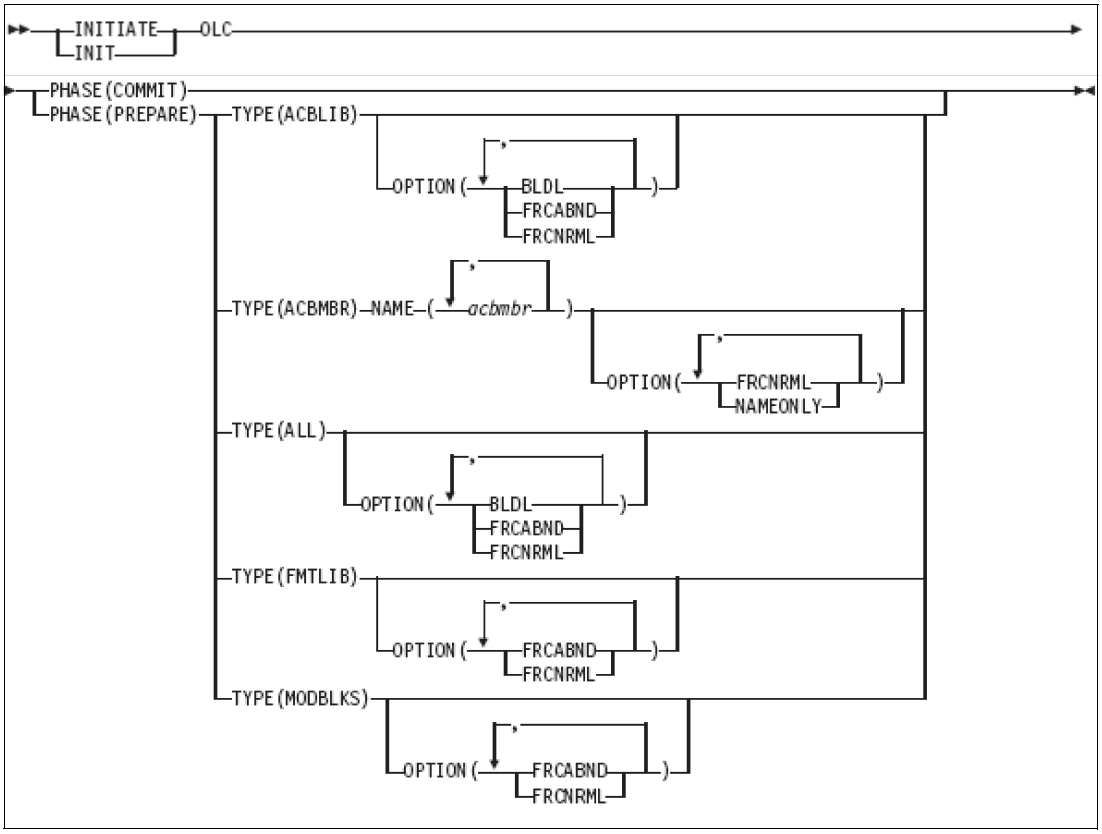

Figure 2-13 INITIATE command syntax

The NAME(acbmbr) parameter

The **NAME(acbmbr)** parameter specifies that one or more ACB library members are to be copied from the staging ACB library to the active ACB library. The **acbmbr** parameter can be a DBD or PSB that is being changed or added. Wildcard characters are not supported in the member names.

If a DBD is being changed and **OPTION(NAMEONLY)** is not specified, you do not have to specify the associated PSBs on the command because all of the PSBs that are associated with the changed DBD are copied automatically from the staging ACB library to the active ACB library.

If a DBD that is being changed or added has external references and **OPTION(NAMEONLY)** is not specified, the secondary index DBD does not have to be specified on the **acbmbr** parameter. The **INIT OLC TYPE(ACBMBR)** command processing copies all externally referenced members of the DBD from the staging ACB library to the active ACB library.

The OPTION NAMEONLY parameter

The **OPTION NAMEONLY** parameter specifies that only the DBDs and PSBs that are specified in the NAME keyword are to be processed.

If a PSB is specified in the NAME keyword, the following rules apply:

- Regardless of whether a PSB is new to the active ACB library or not, if the DBDs in the intent list have not been modified, this PSB is copied to the active ACB library.
- If a PSB is not new to the active ACB library and the DBDs in the intent list have been modified, this PSB is not copied to the active ACB library and a completion code 12B is returned.

If a DBD is specified in the NAME keyword, the following rules apply:

- If a DBD is new to the active ACB library and the DBDs in the reference list have not been modified, this DBD is copied to the active ACB library. After an **INITIATE OLC PHASE(COMMIT)** command, when the **TYPE(ACBMBR)** online change completes successfully, the active and inactive ACB library suffixes and the MODID are not updated in the OLCSTAT data set or in the IMS control blocks because ACB library member online change processing changes or adds ACB members directly into the active ACB library.
- If a DBD is new to the active ACB library and the DBDs in the reference list have been modified, this DBD is not copied to the active ACB library and a completion code 12C is returned.
- If a DBD is not new to the active ACB library and has been modified, this DBD is not copied to the active ACB library and a completion code 12A is returned.

2.3.4 Using ACB online change

The ACB member online change uses IMS type-2 commands only. The following commands are involved in performing an ACB library member online change:

- **INITITATE OLC PHASE(PREPARE)**
- **INITIATE OLC PHASE(COMMIT)**
- **TERMINATE OLC**
- **QUERY MEMBER TYPE(IMS)**
- **QUERY OLC SHOW(RSCLIST)**

The INIT.OLC PHASE(PREPARE) TYPE(ACBMBR) command

The **INIT.OLC PHASE(PREPARE) TYPE(ACBMBR)** command specifies that an ACB library member online change process is to be performed for the specified ACB library member name or names. The command response lists all the members that are to be copied from the staging ACB library to the active ACB library during the **COMMIT** command processing.

Figure 2-14 shows the **INITIATE OLC** command using a TSO SPOC in an IMSplex.

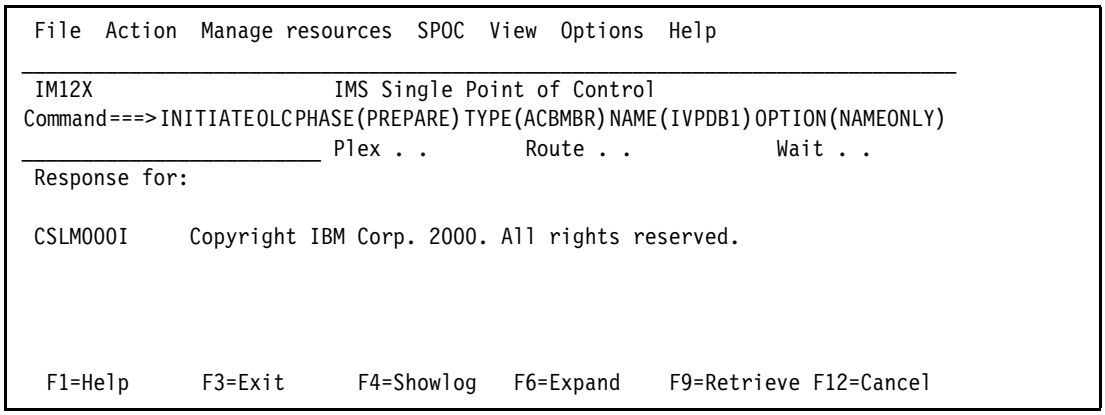

Figure 2-14 The Online Change prepare phase

The INIT.OLC PHASE(COMMIT) command

The **INIT.OLC PHASE(COMMIT)** command performs the online change commit phase on each IMS listed in the OLCSTAT data set, which commits the online changes by bringing all the newly defined resources online, updating the changed resources, and removing the deleted resources.

The commit phase consists of commit phase 1, the OLCSTAT data set update, commit phase 2, and commit phase 3. The OLCSTAT data set is updated with the new current online change libraries and the list of IMS systems that are current with the current online change libraries. The commit phase 2 switches the online environment from the active ACBLIB, FORMAT, or MODBLKS libraries to the inactive libraries containing the new or changed resource descriptions.

Figure 2-15 shows the sequence to perform a online change in an IMSplex.

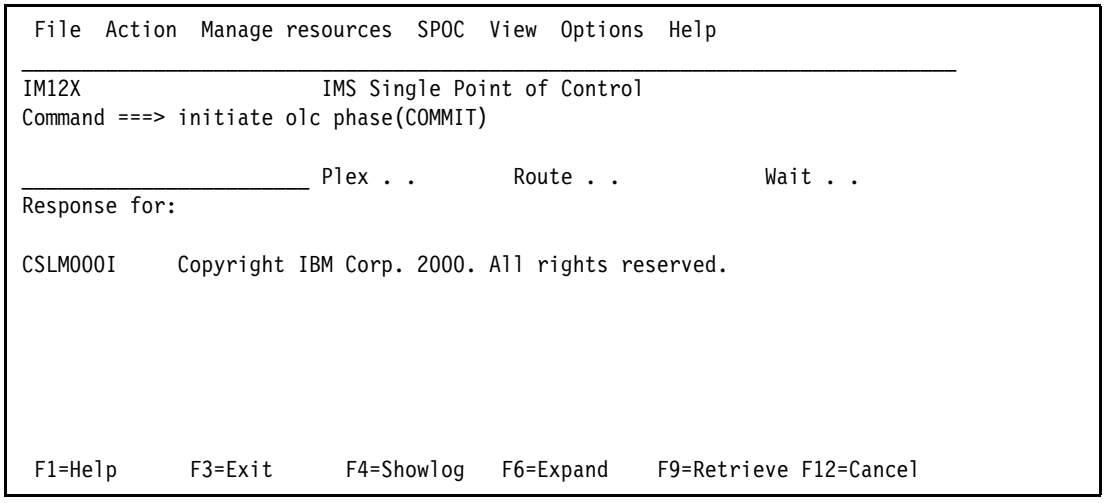

Figure 2-15 The online change commit command

2.3.5 Considerations for the ACB online change

Use the Global Online Change utility with caution, so that you do not inadvertently destroy valid OLCSTAT data set contents. If you do destroy valid OLCSTAT data set contents, global online change and initialization of additional IMS systems fail until the OLCSTAT data set is re-initialized.

Establish an OLCSTAT data set recovery procedure to deal with the loss of the OLCSTAT data set. After every successful global online change, record the modify ID, the active online change library suffixes, and the list of IMS systems that are current with the online change libraries. If the OLCSTAT data set is destroyed, run the initialize function of the Global Online Change utility with the saved data to re-initialize the OLCSTAT data set.

Consider the following points:

- The **INITIATE OLC** command is not supported if local online change is enabled.
- This command is invalid on XRF alternate, RSR tracker, and FDBR systems.

2.4 The /DIAGNOSE command

The **/DIAGNOSE** command retrieves diagnostic information for system resources such as IMS control blocks and user-defined resources at any time without creating a disruptive situation.

IMS 12 improves the reliability of diagnostic information by supporting additional control blocks for **/DIAG SNAP** command. The overall benefit of these enhancements is an improved reliability of diagnostic information and, ultimately, to streamline the problem determination process.

2.4.1 Background on the /DIAGNOSE command

Users should have the ability to gather diagnostic information without affecting the normal business operations. In most cases, gathering a console dump in a productive environment is disruptive and can negatively impact the service level agreement (SLA). Therefore, users are obligated to produce these dumps off the business prime hours.

The **/DIAGNOSE** command alleviates this situation by allowing you to take a snapshot of IMS system resources at any time without affecting system availability. The **/DIAGNOSE** command enables users to retrieve diagnostic information for system resources such as IMS control blocks, user-defined nodes, or user-defined transactions at any time without taking a console dump.

The **/DIAGNOSE** command SNAP function takes a current snapshot of system resources and displays the response into the issuing LTERM. Optionally, the resource information can be sent to either an online log data set (OLDS) or trace data sets as type X'6701' log records

The **/DIAGNOSE** command SNAP function captures information for the following resources:

- A specific IMS control block.
- A user-defined resource.
- Primary control blocks for a dependent region.
- Any area of storage within the region address space.
- Prolog information for an IMS load module.
- A user-defined shared queues structure.

2.4.2 Description of the /DIAGNOSE command

The **/DIAGNOSE** command SNAP function provides a non-intrusive way to capture IMS resources and control blocks. Using this command can decrease the time needed to generate problem determination data.

The **/DIAGNOSE** command SNAP function takes a current snapshot of system resources at any time without negatively impacting the IMS system. The SNAP function of the **/DIAGNOSE** command captures storage information and shows information about the issuing LTERM. Optionally, the resource information can be sent to either an OLDS or trace data sets as type X'6701' log records.

The **/DIAGNOSE** command is a standard type-1 command. It can be issued from an IMS terminal, a console WTOR, APPC and OTMA clients, an AOI program, MCS/EMCS consoles, and any OM command clients including SPOC.

The **/DIAGNOSE** command SNAP function captures information for the following areas:

- A specific IMS control block. The **/DIAGNOSE SNAP BLOCK(CSCD)** command captures storage information for the APPC/OTMA SMQ SCD Extension control block.
- A user-defined database, communication line, logical link, node, program, transaction, logical terminal (LTERM), or USER.
- Primary control blocks for a dependent region.
- Any area of storage within the control region address space (by specifying the address of that storage area).
- Prolog information for an IMS load module. The **/DIAGNOSE SNAP MODULE(modname)** command identifies the entry point address and captures prolog information for the specified IMS module. The prolog information contains the current maintenance level for a module on your system, which can help you to determine if any maintenance is missing.
- A user-defined shared queues structure. The **/DIAGNOSE SNAP STRUCTURE(structurename)** command captures storage information for the DFSSQS control block storage for the specified shared queues structure.

The SNAP function of the command captures storage, both addresses and raw data, for the requested IMS control blocks and resources. The information in the blocks is copied to a copy storage area to avoid holding enqueues, locks, latches, and others. The environment is further protected by a separate ESTAE routine that protects the copy process and also prevents an IMS failure.

You can also use the **/DIAGNOSE** command SNAP function to perform these tasks:

- Show filtered resource information captured by the SNAP function.
- Specify a limit for the number of lines to display.
- Specify the control blocks to be captured by the SNAP function

Table 2-1 shows the valid environments for commands and keywords.

Table 2-1 /DIAG valid environments and keywords

Commands or keywords	DB/DC	DBCTL	DCCTL
/DIAGNOSE	X	X	X
ADDRESS	X	X	X
AOSLOG	X		X

Commands or keywords	DB/DC	DBCTL	DCCTL
AREA	X	X	
BLOCK	X	X	X
DB	X	X	
JOBNAME	X	X	X
LINE	X		X
LINK	X		X
LTERM	X		X
MODULE	X	X	X
NODE	X		X
OPTION	X	X	X
PGM	X	X	X
REGION	X	X	X
SET	X	X	X
SHOW	X	X	X
SNAP	X	X	X
STRUCTURE	X		X
TRAN	X		X
USER	X		X

2.4.3 /DIAGNOSE IMS 12 enhancements

The **/DIAGNOSE SNAP** command is enhanced in IMS 12 to improve the reliability of diagnostic information and to streamline the problem determination process.

The **/DIAGNOSE** command supports the following additional control blocks:

AREA(areaname) Captures control block information for the Fast Path area.

DB(dbname) Captures control block information for the database.

LINE(linenumber) Captures control block information for the communication line.

LINK(linknumber) Captures control block information for the logical link specified

PGM(pgmname) Captures control block information for the program

REGION(regionnumber)
Captures control block information for the dependent region

The **/DIAGNOSE** command SNAP function has the following new options:

- A **DISPLAY** option to route output back to the issuing LTERM
- A **LIMIT** option to restrict the number of lines of output going to LTERM
- A **SHOW** parameter to control the type and amount of output produced

For detailed information, see *IMS Version 12 Commands, Volume 1: IMS Commands A-M*, SC19-3009.

2.4.4 Using the /DIAGNOSE command

Use the **/DIAGNOSE** command to retrieve diagnostic information about system resources at any time, and to enable and disable diagnostic features such as the facility to capture the events related to APPC and OTMA synchronous transactions in a shared-queues environment.

The following new keywords are introduced by IMS 12:

The /DIAGNOSE SNAP AREA command

The **/DIAGNOSE SNAP AREA** command captures control block information for the Fast Path area specified in the **areaname** parameter. The **areaname** parameter specified must be alphanumeric, no longer than 8 characters, and identify a currently defined Fast Path area. Multiple **areaname** parameters can be specified with each parameter separated by a comma or a blank.

The **/DIAGNOSE SNAP AREA()** command is available in a DB/DC or DBCTL environment where Fast Path is defined. The DEDB extended area control block (EMAC) is available only in an RSR tracker environment.

Table 2-2 shows the **/DIAGNOSE SNAP AREA()** control blocks.

Table 2-2 The /DIAGNOSE SNAP AREA() control blocks

Name	Block description	Macro	Primary	Optional
ADSC	DEDB area data set control block	DBFADSC		X
ALDS	DEDB area name list entry	DBFAREA	X	
DDIR	Database directory block	DFSDDIR		X
DMAC	DEDB area control block	DBFDMAC	X	
DMAX	DMAC ERE extension block	DBFDMHV		X
DMCB	DEDB master control block	DBFDMCB		X
DMHR	DEDB buffer header (SDEP)	DBFDMHR		X
DMSL	Data space map list	DBFDMSL		X
DSME	Data space mapping entry	DBFDSME		X
EMAC	DEDB extended area control block	DBFEMAC		X
MRMB	DEDB randomizing module block	DBFDMRMB		X

The /DIAGNOSE SNAP DB command

The **/DIAGNOSE SNAP DB** command captures control block information for the database specified in the **dbname** parameter. The **dbname** parameter specified must be alphanumeric, no longer than 8 characters, and identify a currently defined database. Multiple **dbname** parameters can be specified with each parameter separated by a comma or a blank.

The **/DIAGNOSE SNAP DB()** command is available in a DB/DC or DBCTL environment. If the **/DIAGNOSE SNAP DB()** command is issued in a DCCTL environment, a DFS110I error message is issued in response.

Table 2-3 shows **/DIAGNOSE SNAP DB()** control blocks.

Table 2-3 The /DIAGNOSE SNAP DB() control blocks

Name	Block description	Macro	Primary	Optional
DDIR	Database directory block	DFSDDIR	X	
DMB	Data management block	DFSDMB		X
DMCB	DEDB master control block	DBFDMCB		X
BHDR	MSDB header	DBFDMSDB		X

The /DIAGNOSE SNAP LINE command

The **/DIAGNOSE SNAP LINE** command captures control block information for the communication line specified in the line# parameter. The line# parameter specified must be numeric, in the range 1–1000, and identify a currently defined communication line. Multiple line# parameters can be specified with each parameter separated by a comma or a blank.

The **/DIAGNOSE SNAP LINE()** command is available in a DB/DC or DCCTL environment. If the **/DIAGNOSE SNAP LINE()** command is issued in a DBCTL environment, a DFS110I error message is issued in response. The extended communication name table (ECNT) is available only in an IMS system where Fast Path is defined.

Table 2-4 shows **/DIAGNOSE SNAP LINE()** control blocks.

Table 2-4 The /DIAGNOSE SNAP LINE() control blocks

Name	Block description	Macro	Primary	Optional
ECB	Event control block	IEPF	X	
CLB	Communication line block	ICLI	X	
CTB	Communication terminal block	ICLI		X
CTT	Communication translate table	ICLI		X
CRB	Communications restart block	ICLI		X
SPQB	Subpool queue block	ICLI		X
SPQBEXT	Subpool queue extension block	ICLI		X
EMHB	Expedited message handler block	DBFEMHB		X
CNT	Communication name table	ICLI		X
ECNT	Extended communication name table	DBFECNT		X
CCB	Conversational control block	ICLI		X
CIB	Communication interface block	ICLI(CIB)		X
INBUF	Input line buffer			X
OUTBUF	Output line buffer			X

The /DIAGNOSE SNAP LINK command

The **/DIAGNOSE SNAP LINK()** command captures control block information for the logical link specified in the link# parameter. The link# parameter specified must be numeric, in the range 1– 675, and identify a currently defined logical link. Multiple link# parameters can be specified with each parameter separated by a comma or a blank.

The **/DIAGNOSE SNAP LINK()** command is available in a DB/DC or DCCTL environment. If the **/DIAGNOSE SNAP LINK()** command is issued in a DBCTL environment, a DFS110I error message is issued in response.

Table 2-5 shows the **/DIAGNOSE SNAP LINK()** control blocks.

Table 2-5 The /DIAGNOSE SNAP LINK() control blocks

Name	Block description	Macro	Primary	Optional
ECB	Event control block	IEPF	X	
LLB	Link link block	ICLI	X	
LTB	Link terminal block	ICLI		X
CTT	Communication translate table	ICLI		X
CRB	Communications restart block	ICLI		X
SPQB	Subpool queue block	ICLI		X
SPQBEXT	Subpool queue extension block	ICLI		X
EMHB	Expedited message handler block	DBFEMHB		X
LNB	Link name table	ICLI		X
ECNT	Extended communication name table	DBFECNT		X
CCB	Conversational control block	ICLI		X
CIB	Communication interface block	ICLI(CIB)		X
INBUF	Input line buffer			X
OUTBUF	Output line buffer			X
LCB	Link control block	LCB		X
LXB	Link extension block	LXB		X

The /DIAGNOSE SNAP PGM command

The **/DIAGNOSE SNAP PGM** command captures control block information for the program specified in the **pgmname** parameter. The **pgmname** parameter specified must be alphanumeric, no longer than 8 characters, and identify a currently defined program. Multiple **pgmname** parameters can be specified with each parameter separated by a comma or a blank.

Table 2-6 shows **/DIAGNOSE SNAP PGM()** control blocks.

Table 2-6 The /DIAGNOSE SNAP PGM() control blocks

Name	Block description	Macro	Primary	Optional	Work	No work
PDIR	Program directory block	DFSPDIR	X			X
RSCX	Resource extension block	DFSRSCX	X			X
INTLIST	Intent list	INTLIST		X		X
PSB	Program specification block	DFSPSB		X		X
PST	Partition specification table	IPST		X		X
CNT	Communication name table	ICLI		X		X
SMB	Scheduler message block	IAPS		X		X
DMBL	Data management block list	DFSDMBL		X		X
XPCB	Program communication block index maintenance	DFSPCBS		X		X
PCB	Program communication block	DFSPCBS		X		X
PCBX	Program communication extension block	DFSPCBS		X		X
EPCB	Program communication block extension	DBFEPCB		X		X
MP62 MPOT	Message prefix (LU62) Message prefix (OTMA)	DFS62PRE DFSYPRE		X		X
PSBPRM	User parameter list block	IDLI		X		X
WKCDS	Data capture segment work area			X	X	
WKNDX	Index maintenance work area			X	X	
WKXIO	Index I/O work area			X	X	
WKSEG	Segment work area			X	X	
WKIOA	I/O work area			X	X	
WKSSA	Segment search argument work area			X	X	
WKIFP	Fast Path control block work area			X	X	

The /DIAGNOSE SNAP REGION command

The **/DIAGNOSE SNAP REGION** command captures control block information for the dependent region specified in the region# parameter. The region# parameter specified must be numeric, in the range 1–999, and identify a currently active dependent region. Multiple region# parameters can be specified with each parameter separated by a comma or a blank.

The dependent region might also be identified using the **SNAP JOBNAME(jobname)** format of the **SNAP REGION()** resource type. The **jobname** parameter specified must be alphanumeric, no longer than eight characters, and identify a currently active dependent region. Multiple **jobname** parameters can be specified with each parameter separated by a comma or a blank.

The **REGION(region#)** and **JOBNAME(jobname)** formats can both be specified on the same command.

The **SNAP JOBNAME(jobname)** format of the **SNAP REGION()** resource type cannot be used to identify a CCTL thread. All CCTL threads have the same job name and the CICS region, and therefore it is impossible to identify the correct thread by the job name. If multiple regions are started with the same job name, only the first region will be found using the **SNAP JOBNAME(jobname)** format of the **SNAP REGION()** resource type.

Figure 2-7 shows the **/DIAGNOSE SNAP REGION()** control blocks.

Table 2-7 The /DIAGNOSE SNAP REGION() control blocks

Name	Block description	Macro	Primary	Optional	System	Application
VTD	SVC vector table directory entry	DFSVDIR	X		X	
ASCB	MVS™ address space control block	IHAASCB		X	X	
ASSB	MVS address space secondary block	IHAASSB		X	X	
DPDIR	Dependent region directory block	DFSDPDIR		X	X	
IWALE	Internal work area list elements block	DFSIQALE		X	X	
LESEP	Local external entry table prefix block	DFSLESEP		X	X	
DRAT	DRA thread control block	DFSDRAT		X	X	
IDT	Identify table entry	DFSIDT	X		X	
TCB	MVS task control block (IDT)	IKJTCB		X	X	
TCB	Task control block (PST)	IKJTCB		X	X	
SAP	Save area prefix block	ISAP	X		X	
DSPWRK1	Dispatch block: work area part 1 (current)	IDSPWRK		X	X	
DSPWRK2	Dispatch block: work area part 2 (current)	IDSPWRK X		X	X	
TCB	MVS task control block (CDSP)	IKJTCB		X	X	
RB	MVS associated request block (CDSP)	IHARB		X	X	
RBP	MVS associated request block prefix (CDSP)	IHARB		X	X	
XSB	MVS extended status block (CDSP)	IHAXSB		X	X	
DSPWRK1	Dispatcher block: work area part 1 (home)	IDSPWRK		X	X	
DSPWRK2	Dispatcher block: work area part 2 (home)	IDSPWRK		X	X	
DSPPST	PST dispatching control block	IDSPWRK		X	X	
XMCI	Cross-memory control block, ITASK level	DFSXMC		X	X	
SSVPL	System service parameter list block	DFSSSVPL		X	X	

Name	Block description	Macro	Primary	Optional	System	Application
DMIB	Directed message manager interface block	DFSDMIB		X	X	
CULE	Common use list element block	DFSCULE		X	X	
CLLE	Common latch list element block	DFSCLLE		X	X	
LSMB	Logging secondary master block	DFSLSMB		X	X	
SSIDX	Subsystem status index entry	DFSSSIE	X		X	X
LCRE	Local current recovery entry	DFSLCRE	X		X	X
RRE	Residual recovery element block (LCRE)	DFSRRE		X		X
TIB YTIB	APPC transaction instance block OTMA transaction instance block	DFSTIB DFSYTIB		X		X
PCENTRY	Protected conversation task table entry	DFSRRSIB		X		X
RRE	Residual recovery element block (PC)	DFSRRE		X		X
PST	Partition specification table	IPST	X		X	X
CNT	Communication name table	ICLI		X		X
SMB	Scheduler message block	IAPS		X		X
SQPST	Scheduler queue element	ISQPST		X		X
UOW	Unit of work value (QMGR)	DFSUOWE		X		X
UOWE	Unit of work table entry	DFSUOWE		X		X

The /DIAGNOSE SET AOSLOG command

The **/DIAGNOSE SET AOSLOG** command updates the attributes of the specified facility. The SET keyword is mutually exclusive with the SNAP keyword.

The AOSLOG parameter

The **AOSLOG** parameter enables or disables logging of events related to APPC and OTMA synchronous transactions in a shared queues environment. When enabled, the events are written to the OLDS as type X'6701' records.

If **AOSLOG(ON)** is specified in a non-shared-queues environment or when **AOS=N** is specified in the DFSDCxxx PROCLIB member, the command is rejected with a DFS2859I message.

ON Enables AOS logging
OFF Disables AOS logging

2.4.5 Using the /DIAG SNAP command

Example 2-1 shows the **/DIAG SNAP LINE()** command being issued and its results.

Example 2-1 The /DIAG SNAP commands

```
DIAG SNAP LINE(3) SHOW(ALL) I12A
44I DISPLAY FROM ID=I12A  982
/DIAGNOSE SNAP STORAGE DISPLAY

Resource: LINE(3)

ECB      Event Control Block              Loc: 0004B700
---- -------- -------- -------- --------  ----------------
0000 809A60BB 0400005D 0004C988 00000000 |..-....)..Ih....|
0010 0016D698 08000016 00100000 C1E500D3 |..Oq........AV.L|

CLB      Communication Line Block         Loc: 0004B720
---- -------- -------- -------- --------  ----------------
0000 00000000 00000000 0004C988 0304C930 |..........Ih..I.|
0010 00082200 0004CEF0 00000000 063C0023 |.......0........|
0020 2011221F 19241539 1356016D 03000000 |............_....|
0030 00010000 001AFA5C 0004CEF0 80000000 |.......*...0....|
0040 00000000 001AF998 00000001 00000001 |......9q........|
0050 0004C988 00000000 00000000 00000000 |..Ih............|
0060 00000000 00000000 00000000 00000000 |................|
0070 00000000 00000000 00000000 00000000 |................|
0080 00000000 00000000 00000000 00000000 |................|
0090 00000000 00000000 00000000 00000000 |................|
00A0 00000000 00000000 0004B7B0 40404040 |............    |
00B0 40404040 00000000 00000000 00000000 |    ............|
00C0 00000000 00000000 00000000 00000000 |................|
00D0 00000000 00000000 00000000 00000000 |................|
00E0 00000000 40404040 40404040 00000000 |....        ....|
00F0 00000000 00000000 00000000 00000000 |................|
0100 0FC4E2D7 00000000 00000000 00000000 |.DSP............|
0110 000A0000 20FF4820 8004FCF8 00000000 |...........8....|

CTB      Communication Terminal Block     Loc: 0004CEF0
---- -------- -------- -------- --------  ----------------
0000 0004E888 0004B700 F0F0F040 000B0000 |..Yh....000 ....|
0010 00004000 C0000004 01350000 25C5FB98 |.. ..........E.q|
0020 00000000 00000000 00000000 00007FFF |..............".|
0030 F0007FFF F00040E3 00000000 00000000 |0.".0. T........|
0040 00000000 25C5FB98 00000000 00000000 |.....E.q........|
0050 00000000 00000000 00000000 259D03B6 |................|
0060 00000000 00000000 00000003 00000001 |................|
0070 00000000 00000000 00000000 00000000 |................|
0080 00000000 00000000 00000000 00040000 |................|
0090 00000000 00000000 00000000 00000000 |................|
00A0 00000000 00000000 00000000 00000000 |................|
00B0 00000000 00000000 00000000 00000000 |................|
00C0 00000000 00000000 00000000 00040000 |................|
00D0 00000000 00000000 00000000 00000000 |................|
00E0 00000000 00000000 00000000 00000000 |................|
CTT      Communication Translate Table    Loc: 0004E888
```

```
---- -------- -------- -------- --------  ----------------
0000 0F000000 00000000 00000000 00076CF0 |.............%0|
0010 00000000 00000000 002000A8 67200000 |...........y....|
0020 00000000 00000000 00000000 00000000 |................|

CRB      Communications Restart Block     Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable

SPQB     Subpool Queue Block              Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable

SPQBEXT  Subpool Queue Extension Block    Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable

EMHB     Expedited Message Handler Block  Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable

CNT      Communication Name Table         Loc: 25C5FB98
---- -------- -------- -------- --------  ----------------
0000 0004B75C 00000000 00000000 00000000 |...*............|
0010 00000000 00820171 00220022 E2D4C1E2 |.....b......SMAS|
0020 E3C5D940 40000001 0004CEF0 25C5F328 |TER  ......0.E3.|
0030 00000000 00004400 00000000 00000000 |................|
0040 25C5FC10 00000000 0004B7B0 00000000 |.E..............|
0050 00010001 00000000 00000000 00000000 |................|
0060 00000000 00000000 00000000 00000000 |................|

CNT      Communication Name Table         Loc: 25C5F328
---- -------- -------- -------- --------  ----------------
0000 00000000 00000000 00000000 00000000 |................|
0010 00000000 00820059 00000000 C9E5D7E2 |.....b......IVPS|
0020 D7D3F140 00000001 0004CEF0 00000000 |PL1 .......0....|
0030 00000000 00004400 00000000 00000000 |................|
0040 25C5F3A0 00000000 0004B7B0 00000000 |.E3.............|
0050 00010001 00000000 00000000 00000000 |................|
0060 00000000 00000000 00000000 00000000 |................|

CCB      Conversational Control Block     Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable

CIB      Communication Interface Block    Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable

INBUF    Input Line Buffer                Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable
```

```
OUTBUF   Output Line Buffer               Loc: 00000000
---- -------- -------- -------- --------  ----------------
         Storage unavailable
```

Example 2-2 shows the sample JCL to extract these DIAG records with DFSERA10 and print them with exit DFSERA30.

Example 2-2 JCL for printing DIAG records with exit DFSERA30

```
//PO1O EXEC PGM=DFSERA1O
//STEPLIB DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSUT1 DD DISP=SHR,DSN=IMS12Q.IMS12A.OLP05
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
CONTROL CNTL
OPTION PRINT O=5,V=6701,L=2,C=M,E=DFSERA30
OPTION PRINT O=9,V=DIAG,L=4,T=C,C=E,E=DFSERA30
END
/*
```

2.4.6 Considerations for the /DIAGNOSE command

To capture data from a series of **/DIAGNOSE** commands in a trace data set, issue the commands in the following order:

```
/TRACE SET ON TABLE DIAG OPTION LOG
/DIAGNOSE
/TRACE SET OFF TABLE DIAG
```

2.5 IMS logger

IMS creates logs of activity that are performed during online executions. These log records are initially written to an OLDS, and then copied to the system log data set (SLDS). The log records that reflect completed operations not yet written to an OLDS is recorded on a write-ahead data set (WADS).

IMS 12 improves the functionality of IMS logging by adding Extended Format support and providing the buffer allocation beyond the 31-bit, among other improvements. The benefits of this enhancement is to increase logging rates while releasing storage in the extended common service area (ECSA).

2.5.1 Background on IMS logger

Logs are the list of all activities being performed by the system such as work that has been done and changes that have been made. By knowing the state of the system when things were functioning properly and knowing what the system has done since then, you can recover it in the event of a failure. Logs make recovery and restart possible. As IMS operates, it constantly writes its event information in log records. The log records contain information about:

- When IMS starts and shuts down
- When programs start and terminate
- Changes made to the database

- Transaction requests received and responses sent
- Application program checkpoints
- System checkpoints

Figure 2-16 illustrates the logging process in an IMS online environment.

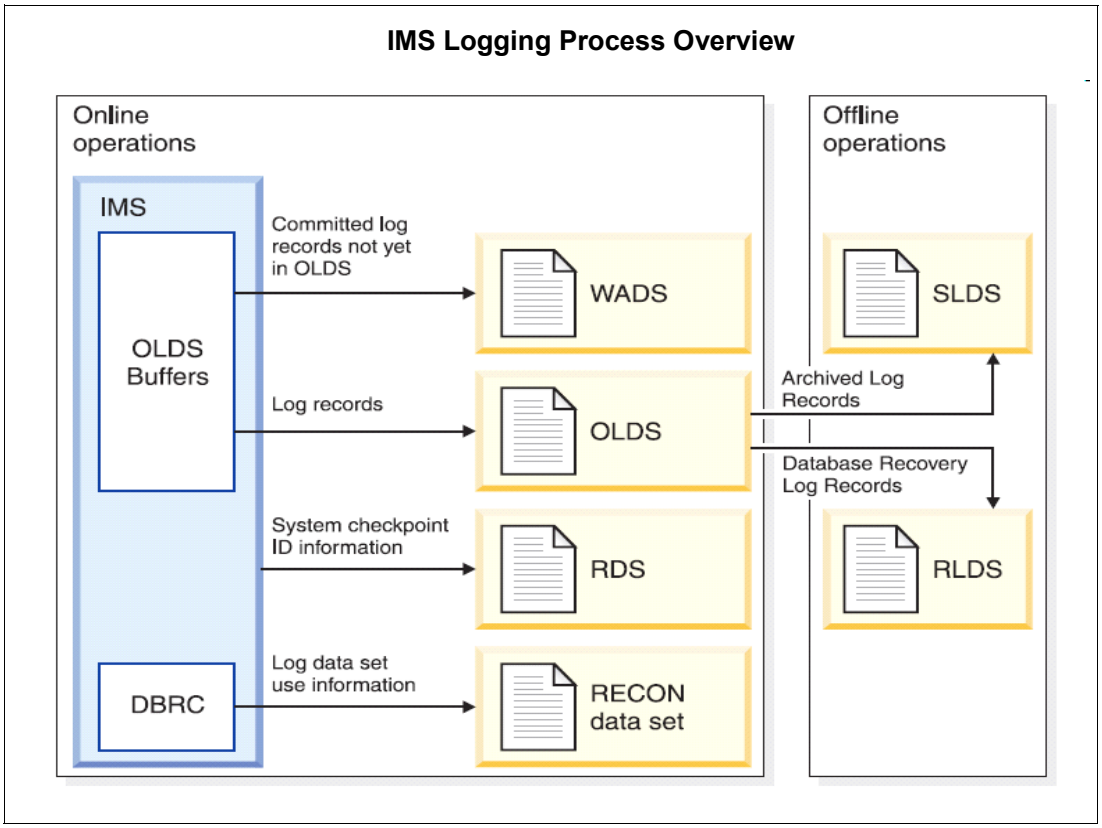

Figure 2-16 IMS logging process overview

Extended format data set is a type of SMS-managed physical sequential data set that, externally, has the same characteristics as sequential data sets. However, records are not necessarily stored in the same format or order as they appear. Sequential data striping is implemented through the use of extended format data sets.

Data striping is the technique of segmenting logically sequential data, such as a file, in a way that accesses of sequential segments are made to different physical storage devices.

Figure 2-17 shows how sequential data set striping works.

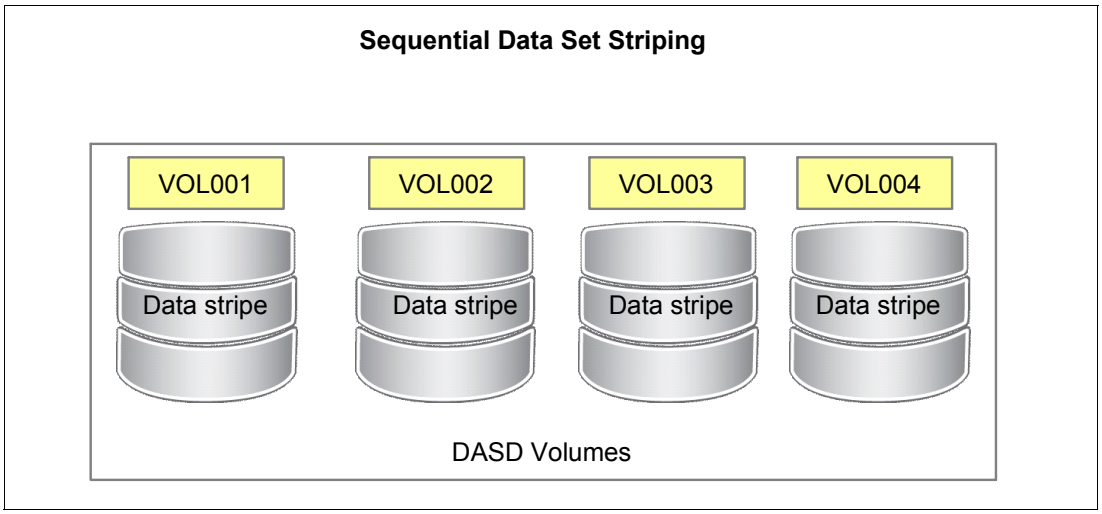

Figure 2-17 Sequential data set striping

2.5.2 Description of IMS logger

IMS externalizes log records by writing them to an OLDS.

OLDS

IMS uses a set of OLDSs in cyclical processing, which enables IMS to continue logging after an individual OLDS is filled. Also, if an I/O error occurs while writing to an OLDS, IMS can continue logging by isolating the defective OLDS and switching to another one. After an OLDS is used, it is available for archiving to a SLDS on DASD or tape by the IMS Log Archive utility.

The utility can be executed automatically through an IMS startup parameter (**ARC=**). When IMS is close to filling the last available OLDS, it warns you so that you can ensure that archiving completes for used OLDSs or add new OLDSs to the system. You can also manually archive the OLDSs to SLDSs using the IMS Log Archive utility. An SLDS can reside on DASD or tape. After an OLDS is archived, it can be reused for new log data. You use SLDSs as input to the database recovery process.

IMS uses the OLDS only in the online environment. The OLDS contains all the log records required for restart, recovery, and both batch and dynamic backout. The OLDS holds the log records until IMS archives them to the SLDS. Define all of the OLDSs in the IMS procedure library (IMS.PROCLIB) using the OLDSDEF statement. The OLDS must be preallocated on a direct-access device. You can also dynamically allocate additional OLDSs while IMS is running by using the **/START OLDS** command.

IMS uses the Basic Sequential Access Method (BSAM) to write log records to the OLDS, and the Overflow Sequential Access Method (OSAM) to read the OLDS when IMS performs dynamic backout. Although referred to as a data set, the OLDS is actually made up of multiple data sets that wrap around, one to the other. You must allocate at least three, but no more than 100 data sets for the OLDS.

You can specify that the OLDS use dual logging, which is the duplication of information for two logs. When you use dual logging, an I/O error on the primary or secondary data set causes IMS to close the non-error OLDS and mark the error OLDS in the recovery control (RECON) data set as having an I/O error and a close error. IMS then continues logging with the next

available pair. For dual logging, the minimum number of data sets is three pairs, and the maximum number is 100 pairs.

IMS uses as many OLDSs as you allocate. IMS issues a message each time it changes the current OLDS. This message identifies the OLDS being closed and the next OLDS to be used.

Write-ahead data set

To enhance performance and to optimize space on OLDSs, incomplete or partially filled buffers are written to a WADS when necessary for recoverability. The WADSs are high speed DASD data sets with a high write rate. Only complete log buffers are written to OLDSs. When the log data is on an OLDS, the equivalent WADS records are ignored.

IMS continually reuses WADS space after writing the appropriate log data to the OLDS. The log write-ahead function ensures that all log records are on the log before IMS writes changes to a database. IMS updates a database in any of the following situations:

- When IMS needs to reuse the database buffer (if this is before commit)
- During commit
- During VSAM background write

If IMS fails, you use the log data in the WADS to complete the content of the OLDS and then close the OLDS as part of an IMS emergency restart or as an option of the Log Recovery utility. If you close the OLDS during emergency restart, you must include the WADS in use at the time of the failure.

You can change any of the following specifications for the WADS during an IMS restart:

- Number of WADSs
- Sequence of WADSs
- WADS names
- Use of single or dual WADSs

The DFSVSMxx PROCLIB member contains the log data set definition information, and it specifies the allocation of OLDS and WADS and the number of buffers to be used for the OLDS. It also specifies the mode of operation of the OLDS (single or dual).

Attention: To eliminate a potential resource contention, place the WADS on a low-use device that is different from the device you use for the OLDS. If you place the WADS on the same device as one of your OLDSs and use full-track blocking for the OLDS (in which a block is equal to a full track), the device should be able to handle infrequent OLDS seeks. Contention can still occur. If the WADS and OLDS are on the same device, the Log Archive utility (DFSUARC0) or dynamic backout can cause severe contention between an OLDS being archived and an active WADS.

Data striping

Usually, sequential access processing does not allow for any type of parallelism for I/O operations. This means that when an I/O operation is executed for an extent in a volume, no other I/O activity from the same task or same data set is scheduled. In a situation where I/O is the major bottleneck, and there are available resources in the channel subsystem and controllers, it is a waste of these resources. Data striping addresses this sequential access performance problem by adding two modifications to the traditional data organization:

- The records are organized in stripes along the volumes.
- Parallel I/O operations are scheduled to sequential stripes in different volumes.

Sequential data striping can be used for physical sequential data sets that are subject to intensive I/O for critical applications. Sequential data striping uses extended-format sequential data sets that SMS can allocate over multiple volumes, preferably on different channel paths and control units, to improve performance. These data sets must reside on volumes that are attached to IBM 9340 or RAMAC Array Subsystems, to IBM 3990 Storage Subsystems with the extended platform, ESS, or DS8000®.

Sequential data striping can reduce the processing time required for long-running batch jobs that process large, physical sequential data sets. Smaller sequential data sets can also benefit because of the improved buffer management of DFSMS for QSAM and BSAM access methods for striped extended-format sequential data sets. By striping a data set, the access method can spread simultaneous I/Os across multiple devices.

With this format, a single application request for records in multiple tracks and records can be satisfied by concurrent I/O requests to multiple volumes. The result is improved performance by achieving data transfer into the application at a rate greater than any single I/O path.

Data striping distributes data for one data set across multiple volumes.

- A data set can have a maximum of 59 stripes.
- Each stripe must reside on one volume and cannot be extended to another volume.
- I/O can be done in parallel with striped data for better performance.
- To specify extended format, data set type (DSNTYPE) in data class needs to be set to “Extended” and sustained data rate in storage class needs to be set to the number of stripes needed.

2.5.3 IMS 12 enhancements for logging

IMS 12 improves the functionality of IMS logging in the following ways:

- It offers Extended Format support for OLDS and SLDS, allowing them to be striped.
- The IMS log buffers can be moved into 64-bit virtual storage to free ECSA storage space for other uses. Log buffers are obtained in 64-bit storage when all the following are true:
  - The new **BUFSTOR** parameter of the DFSVSMxx PROCLIB member specifies **BUFSTOR=64**.
  - The OLDS block size is a multiple of 4096.
  - The OLDS are on extended format data sets.
- WADS management is changed to be more efficient.
  - Track groups are no longer used.
  - WADS are written in a simple wrap-around fashion.
- Archive (DFSUARC0) is enhanced to write “undo” records for non-recoverable databases.

2.5.4 Using IMS logger

The following sections show examples of how to use the new enhancements.

Striping

An OLDS can be defined as a DFSMS extended-format, striped data set. Set the data type of the OLDS data class to EXT to define it as an extended-format data set, and set the storage class SDR to a value that results in multiple stripes. In JCL allocation, the data class is

specified by the DATACLAS parameter and the storage class is specified by the **STORCLAS** parameter of the DD statement.

Example 2-3 shows the sample JCL to allocate OLDS as a striped data set.

Example 2-3 JCL to allocate OLDS

```
//P010 EXEC PGM=IEFBR14
//OLDS00 DD DSN=IMS12.OLDS00,DISP=(,CATLG,DELETE),
//          SPACE=(CYL,(100)),
//          DATACLASS=STRCLAS,STORCLASS=STRSTOR
/*
//
```

64-bit virtual storage

The IMS log buffers can be moved into 64-bit virtual storage to free ECSA storage space for other uses. Log buffers are obtained in 64-bit storage when all the following are true:

- The new BUFSTOR parameter of the DFSVSMxx PROCLIB member specifies **BUFSTOR=64**.
- The OLDS block size is a multiple of 4096.
- The OLDS are on extended format data sets.

Example 2-4 shows a sample of the DFSVSMxx using the new **BUFSTOR** parameter.

Example 2-4 DFSVSMxx using the new BUFSTOR parameter

```
VSRBF=4096,5
VSRBF=2048,5
VSRBF=1024,5
VSRBF=512,5
IOBF=(8192,5,Y,Y)
IOBF=(2048,5,Y,Y)
SBONLINE,MAXSB=10
OPTIONS,BGWRT=YES,INSERT=SKP,DUMP=YES,DUMPIO=YES
OPTIONS,VSAMFIX=(BFR,IOB),VSAMPLS=LOCL
OPTIONS,DL/I=OUT,LOCK=OUT,DISP=OUT,SCHD=OUT,DLOG=OUT,LATC=ON,SUBS=ON
OPTIONS,STRG=ON
OLDSDEF OLDS=(00,01,02,03,99),BUFNO=005,MODE=DUAL,BUFSTOR=64,BLKS=8192
WADSDEF WADS=(0,1,8,9)
ARCHDEF ALL MAXOLDS(1) JOB(JOBJCLA)
```

WADS management

IMS 12 changes the way that WADS writes are done; it no longer uses the concept of track groups. This changes the calculation for the space required for the WADS and also changes the data written by log ahead requests.

In IMS 12, the WADS should be sized to provide enough space for the data in the OLDS buffers that have not yet been written to disk at any, plus one track. In previous versions, the WADS was sized by using the WADS track group concept.

A track group was the OLDS block size/WADS segment size plus 1. A WADS segment size was 2 K for OLDS buffers below the bar in real storage and 4 K for OLDS buffers above the bar in real storage.

The maximum WADS size was (OLDS block size/WADS segment size) + 1) x (number of OLDS buffers) tracks. For example, an installation defined with 200 OLDS buffers of 24 K size above the bar used a WADS with 1400 tracks. With IMS 12, it requires no more than enough tracks to hold 200 x 24 K plus one track, which is approximately 101 tracks.

In previous versions of IMS, the WADS was written in segments from the OLDS buffers. Successive writes were to different tracks. The scheme is much simpler in IMS 12. Each WADS write is to the next block in the data set. The data written to the WADS includes the data that was not previously written up to the last record in the buffer.

2.5.5 Considerations for IMS logger

This is a list of possible migration steps to implement striping with OLDS and buffers in 64-bit storage:

1. Define new OLDS data sets with extended formatting:
   - Use a data class in which the data set type is “EXT”.
   - Use a storage class with SDR >= 5 MBps.
   - Define MDA members for dynamic allocation.
2. Start a new OLDS data sets with **/START OLDS** commands.
   - Striping will be used for these data sets
   - A mixture of format in OLDS is acceptable when buffers are below the 2 GB bar
3. Stop old OLDS data sets with **/STOP OLDS** commands.
4. Specify **BUFSTOR=64** in the OLDSDEF statement. Also specify **BLKSZ=** in the OLDSDEF statement.
5. Terminate and restart IMS to get buffers above the bar.

Using striped data sets for OLDS and moving log buffers above the 2 GB boundary increases the log rate and frees ECSA storage for other users, respectively. Striping can be beneficial when your IMS system is experiencing a significant number of Wait-for-Writes or Wait-for-Buffers. For Geographically Dispersed Parallel Sysplex (GDPS®) users, keep the number of stripes low.

2.6 CQS trace facilities

The CQS is the interface between IMS and the shared queues. IMS can experience problems that must be diagnosed and corrected quickly. Usually, IMS displays symptoms that can help you with your diagnosis, but often you need to gather more information such as the IMS trace.

IMS 12 adds three separate trace tables for shared queues. In addition, you can move Base Primitive Environment (BPE) tracing to an external data set. The benefit of these separate traces is to provide the IMS support team with valuable diagnostic data for client problem resolution, which can help to resolve shared queues-related problems more quickly.

2.6.1 Background on CQS

IMS shared queues were introduced in an earlier version of IMS to provide dynamic workload balancing among multiple IMS subsystems. Using the shared queues, multiple IMS subsystems can share just one set of message queues, which provides the following benefits:

- Workload balancing

  Messages in the shared queues can be processed by any IMS subsystem in the sysplex.
- Increased capacity

  Any number of IMS subsystems can be used to handle the transaction workload.
- Improved availability

  If an IMS subsystem fails, other IMS subsystems can continue to process.

The CQS handles elements on the shared queue structures for its clients. CQS is a general purpose programming facility that provides clients such as IMS with an API for accessing the shared queues.

All IMS subsystems register and communicate with the CQS to receive messages from or send messages to the shared queues. CQS notifies registered clients when there is work for them on the shared queue structures. In an IMS shared-queues environment, the IMS online subsystem identifies itself to the CQS subsystem during IMS initialization or restart.

The BPE configuration parameter member of the IMS PROCLIB data set can be used whenever you are using an IMS address space that uses BPE, such as CQS.

Figure 2-18 shows the shared queues environment.

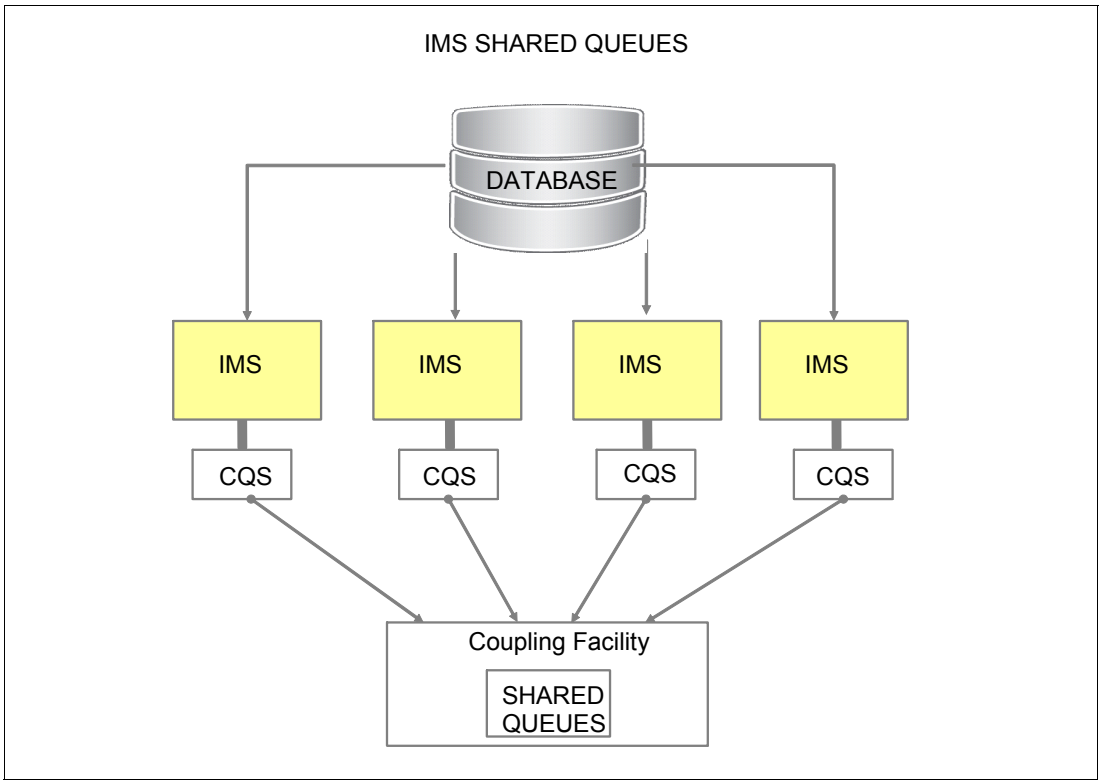

Figure 2-18 Shared queue environment

2.6.2 Description of CQS

To enable shared queues, you must define a CFRM policy that contains structure names and attributes for all message queues. If you use Fast Path and share EMH queues, you must also include structure names and attributes for EMHQ structures. As many as 32 different clients on the same z/OS image can connect to coupling facility structures through a single CQS by using the CQSCONN request. IMS starts the CQS address space if it is not currently active. If CQS is already active, IMS registers with the active CQS address space.

Several different resources can be stored in the resource structure. It is important to create a resource structure of sufficient size to accommodate these resources. An IMS system with a defined resource structure stores transaction names in the resource structure. Additional resources can be stored in the resource structure, depending on the IMS functions that you enable.

Each resource is stored on the resource structure using a 128-byte entry, and either zero, one, or more 512-byte data elements. The 128-byte entry contains 64 bytes for z/OS control information, and 64 bytes for user data in an adjunct area. Both IMS and CQS use a portion of the 512-byte data element as a prefix. The remaining bytes are available for client data.

Use the entry-to-element ratio when allocating the resource structure to reserve portions for entries and data elements. The more accurate the ratio is for actual resources stored on the resource structure, the less storage is wasted. The number of entries is equal to the number of resources. The number of data elements depends on the number of resources for each resource type.

CQS produces SDUMPs for internal errors. The CQS dumps are in the SYS1.DUMP data sets. CQS can also produce LOGREC data set entries for errors.

CQS-related problems

For a CQS environment, related problems might include:

- IMS WAIT problems
- CQS WAIT or HANG problems
- CQS checkpoint problems
- CQS restart problems
- CQS structure rebuild problems

Trace record eye-catchers in a formatted dump provide clues about which functions resulted in errors. You might be able to correct environmental problems immediately. Refer internal IBM problems to IBM with appropriate documentation, such as system console logs and dumps.

CQS trace records are written to one or more of the trace tables shown in Table 2-8.

Table 2-8 Trace tables that contain CQS trace records

Table name	Number of tables	Table description
ERR	1	Errors
CQS	1	CQS activity, including errors
INTF	1	CQS interface events
OFLW	1 per structure	Structure overflow events
SEVT	1 per structure	Structure event activity
STR	1 per structure	Client activity for this structure

Each CQS trace record is 32 bytes long, except records in the SEVT and OFLW tables. Those tables use an expanded 64-byte format. In a standard 32-byte trace entry, the first byte is the trace code and the second byte is the trace subcode. The expanded 64-byte format used by trace records in the SEVT and OFLW tables contains 16 words of trace data.

Use the BPE configuration parameter member of the IMS PROCLIB data set to define the BPE execution environment, as explained here:

- Whether trace entries are written to an external data set
- The external data set to which trace entries are written
- The language used for BPE and IMS component messages
- The trace level settings for BPE and IMS component internal trace tables
- The name of a BPE exit list member of the IMS PROCLIB data set where configuration information for IMS component user exit routines is stored
- The time interval between calls to the BPE statistics exit routines

Specify the member name by coding **BPECFG=member_name** on the EXEC PARM= statement in the address space startup JCL (Example 2-5).

Example 2-5 CQS JCL sample

```
//IEFPROC  EXEC PGM=CQSINIT0,REGION=3000K,
// PARM=('BPECFG=BPECONFG','CQSINIT=12A','SSN=C12A')
//*
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//PROCLIB  DD  DSN=IMS12Q.PROCLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//*
```

2.6.3 CQS enhancements with IMS 12

Before IMS Version 12, all CQS structure events were contained in a single trace table. The following two new trace tables are added:

- The structure event trace table (SEVT) contains all structure event trace entries except entries that are related to overflow events.
- The structure overflow event trace table (OFLW) contains only trace entries that are related to overflow events.

These two new trace event tables are automatically generated by IMS to contain structure event trace entries and structure overflow trace entries. These new tables retain critical trace entries for a longer period of time, which improves CQS serviceability.

All existing trace entries that are not related to client activity are moved to one of the new trace tables and are expanded to take advantage of the larger 64-byte trace entry length. The existing CQS structure trace table (STR) now contains only client activity trace entries.

The following IMS components are updated to support the new trace event table:

- The BPE configuration PROCLIB member
- The CQS BPE EXTERNAL TRACE FORMATTING MENU panel of the IMS Dump Formatter
- The BPE **DISPLAY TRACETABLE** and **UPDATE TRACETABLE** commands

  The BPE **DISPLAY TRACETABLE** and **UPDATE TRACETABLE** commands are enhanced to display information about the trace tables for the Repository Server address space and the new Repository Server DIAG trace table.

TIP: Request response processing for authorized CQS clients in IMS 12 is executed under enclave service request blocks (SRBs). In IMS 12 and subsequent releases, IMS will request z/OS to process such work on an available System z9 Integrated Information Processors (zIIP).

2.6.4 Using CQS

BPE trace records can be written to internal (memory only) trace tables and to external data sets. The default is to write to internal trace tables (**EXTERNAL=NO**). To write to an external data set, you must set **EXTERNAL=YES** on the TRCLEV statement and specify the **EXTTRACE** parameter in the BPE configuration parameter member. You must also define a generation data set group (GDG) for BPE to trace into. If you specify **EXTERNAL=YES**, trace data is written to both an external data set and internal trace tables.

Example 2-6 shows the BPE configuration with new trace entries.

Example 2-6 BPE configuration with new trace entries

```
#
# DEFINITIONS FOR BPE SYSTEM TRACES
#
TRCLEV=(AWE,LOW,BPE)    /* AWE SERVER TRACE */
TRCLEV=(CBS,LOW,BPE)    /* CONTROL BLK SRVCS TRACE */
TRCLEV=(DISP,LOW,BPE)   /* DISPATCHER TRACE */
TRCLEV=(LATC,LOW,BPE)   /* LATCH TRACE */
TRCLEV=(SSRV,LOW,BPE)   /* GEN SYS SERVICES TRACE */
TRCLEV=(STG,LOW,BPE)    /* STORAGE TRACE */
```

```
TRCLEV=(USRX,LOW,BPE)   /* USER EXIT TRACE */
#
# DEFINITIONS FOR CQS TRACES
#
TRCLEV=(CQS,LOW,CQS)    /* CQS GENERAL TRACE */
TRCLEV=(ERR,LOW,CQS)    /* CQS ERROR EVENTS */
TRCLEV=(INTF,LOW,CQS)   /* CQS INTERFACE TRACE */
TRCLEV=(OFLW,LOW,CQS)   /* CQS STRUCTURE OVERFLOW TRACE */
TRCLEV=(SEVT,LOW,CQS,EXTERNAL=YES) /* CQS STRUCTURE EVENTS TRACE */
TRCLEV=(STR,LOW,CQS)    /* CQS CLIENT ACTIVITIES TRACE */
```

You can dynamically change the external trace data set specification in the BPE configuration PROCLIB member and refresh the member while an address space is running. For example, if you are running without an external trace data set, you can edit your BPE PROCLIB member, add an external trace data set specification, and start using external trace without having to restart the address space.

You can dynamically modify BPE tracing by using the z/OS **MODIFY** command with the **UPDATE TRACETABLE** command as shown in Example 2-7.

Example 2-7 DISPLAY and UPDATE CQS trace command sample

```
/F IM12ACQS,DISPLAY TRACETABLE NAME(SEVT) OWNER(CQS)
BPE0030I TABLE  OWNER  LEVEL  #PAGES  EXT  #ENTRIES   #CYCLES  C12ACQS
BPE0000I SEVT   CQS    LOW        12  NO          8         0  C12ACQS
BPE0032I DISPLAY TRACETABLE COMMAND COMPLETED C12ACQS

/F IM12ACQS,UPDATE TRACETABLE NAME(OFLW) OWNER(CQS) LEVEL(HIGH)
BPE0032I UPDATE TRACETABLE COMMAND COMPLETED C12ACQS
```

2.6.5 Considerations for CQS

The overflow (OFLW) event trace table includes activity related to CQS structure overflow events. CQS defines one OFLW trace table for each structure pair defined to CQS. Trace entries in this table are 64 bytes long. The default number of pages for this table is 12.

The SEVT includes activity related to CQS structure events. CQS defines one SEVT trace table for each structure pair defined to CQS. Trace entries in this table are 64 bytes long. The default number of pages for this table is 12.

The client (STR) event trace table includes CQS client activity events. CQS defines one STR trace table for each structure pair defined to CQS. The default number of pages for this table is 8.You cannot set the level for the ERR trace table. BPE forces the level to HIGH to ensure that error diagnostics are captured.

2.7 Extended address volume

The largest DASD volume was restricted to 65,520 cylinders when EAV was first introduced to support VSAM data sets. Now, the z/OS operating system supports also non-VSAM data sets residing in the extended addressing space (EAS).

IMS 12 takes advantage of that enhancement. Now it can address specific non-VSAM data sets residing in the EAS of an EAV. The actual benefits are that users can manage fewer numbers of larger volumes and have less need for multivolume OSAM.

2.7.1 Background on EAV

Before EAV was introduced, the largest DASD volume was restricted to approximately 54 GB (65,520 cylinders), with the track–address restricting DASD volume growth.

Table 2-9 shows the 3390 DASD volume characteristics.

Table 2-9 3390 DASD volume characteristics

Model	Model 1	Model 2	Model 3	Model 9	Model 27	Model 54
Tracks per Volume	16,695	33,390	50,085	150,255	491,400	982,800
Cylinders per Volume	1,113	2,226	3,339	10,017	32,760	65,520
Bytes per Volume	946 MB	1.89 GB	2.84 GB	8.51 GB	27.84 GB	55.68 GB

IBM raised the limit on volume sizes introducing a new DASD family with more than 65,520 cylinders in capacity and increasing the amount of addressable DASD storage per volume beyond 65,520 cylinders by changing how tracks on extended count key data (ECKD™) volumes are addressed.

Figure 2-19 shows the EAV characteristics.

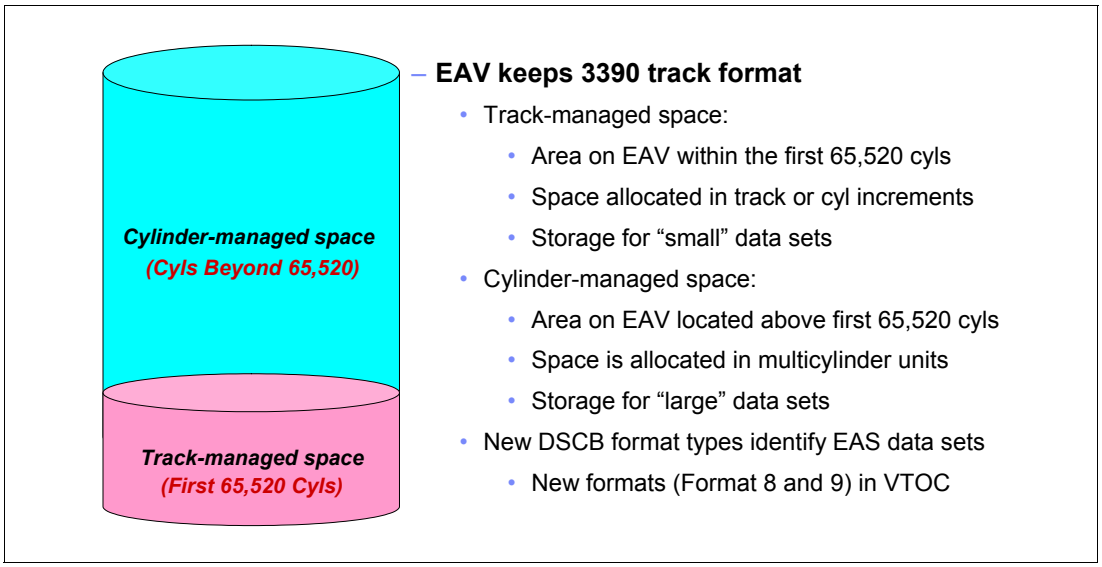

Figure 2-19 EAV characteristics

Exploiting the capabilities of a new 3390 device model A on IBM System Storage® DS8000 storage subsystems, EAV is designed to provide a new architectural limit of hundreds of TB per volume, while keeping the fully compatible access to data residing on cylinders below 65,520.

In z/OS V1.10, support is for SMS and non-SMS managed VSAM data sets (entry-sequenced data set (ESDS), key-sequenced data set (KSDS), relative record data set (RRDS), and linear data set (LDS)) at any location on an EAV. In z/OS, Version 1 Release 12 supports is for non-VSAM data sets.

2.7.2 Description of EAV

An EAV is a volume with more than 65,520 cylinders. An EAV increases the amount of addressable DASD storage per volume beyond 65,520 cylinders by changing how tracks on ECKD volumes are addressed.

A track address is a 32-bit number that identifies each track within a volume.

The address is in the format hexadecimal CCCCcccH where:

CCCC The low order 16-bits of the cylinder number.
ccc The high order 12-bits of the cylinder number.
H The four-bit track number.

The combination of the 16-bits and 12-bits for the low order and high order cylinder number represents a 28-bit cylinder number.

For an EAV, the EAS is cylinders whose addresses are equal to or greater than 65,536. The ccc portion is non-zero for the cylinders of EAS. These cylinder addresses are represented by 28-bit cylinder numbers. For compatibility with older programs, the ccc portion is hexadecimal 000 for tracks in cylinders whose addresses are below 65,536. These cylinder addresses are represented by 16-bit cylinder numbers. This is the base addressing space on an EAV.

The *cylinder-managed space* is space on the volume that is managed only in multicylinder units (a multi-cylinder unit is a fixed unit of disk space that is larger than a cylinder). Cylinder-managed space begins at cylinder address 65,520. Each data set occupies an integral multiple of multicylinder units. Space requests targeted for the cylinder-managed space are rounded up to the next multicylinder unit. The cylinder-managed space only exists on EAVs.

The *track-managed space* is space on a volume that is managed in tracks and cylinders. Track-managed space ends at cylinder address 65,519. Each data set occupies an integral multiple of tracks. Track-managed space exists on all volumes.

2.7.3 EAV support in IMS 12

IMS 12 provides support for OSAM data sets to be allocated in the EAS of an EAV. The following types of data sets can be allocated:

- OSAM data sets
  - OSAM database data sets
  - Restart data set (RDS)
  - Message queue blocks data set
  - Long and short message data set
- IMS OLDS
- IMS log WADS
- IMS Spool and Disk Data Sets (that is, **`UNITYPE=SPOOL`** and **`UNITYPE=DISK`** on the IMS **`TERMINAL`** macro)
- BPE external trace data sets
  - Specified on **`EXTTRACE`** in BPE configuration

2.7.4 Using EAV

For all data set types a new data set attribute, EATTR, has been added so that a user can control whether a data set can have extended attribute DSCBs and can be allocated in EAS.

- EATTR of NO indicates that the data set cannot have extended attributes or reside in EAS. This is the default for non-VSAM data sets.
- EATTR of OPT indicates that the data set can have extended attributes and can optionally reside in EAS. This is the default for VSAM data sets.

Additionally, the user must specify an EAV on the appropriate volume specification using:

- AMS DEFINE CLUSTER (VOL (xxxxxx))
- ALLOCATE
- JCL (VOL=SER=xxxxxx)
- Dynamic allocation
- Data class

The following sections describe how some IMS sequential data sets can benefit from EAV support.

Online log data sets

IMS creates logs of activity that are based on online executions. Log records are initially written to an OLDS, and then archived into the SLDS. When allocating space for OLDSs, consider how many data sets your system needs, the track size of the storage device, and whether you intend to use dual logging. You can allocate OLDSs as DFSMS extended- format data sets to improve logging performance.

Define the initial set of OLDSs to be acquired by restart initialization in the OLDSDEF control statement in the DFSVSMxx member of IMS.PROCLIB. You can dynamically allocate this set of OLDSs, or specify them through DD statements.

DASD space for each OLDS must be contiguous, and secondary extents are not permitted. Pairs of OLDSs (primary and secondary) must have the same space allocation.

Example 2-8 shows an OLDS allocation using EAV.

Example 2-8 Allocate OLDS

```
//*************
//*   ALLOCATE OLDS
//*************
//OLDS    EXEC PGM=IEFBR14
//SYSPRINT DD  SYSOUT=*
//DFSOLP00 DD  DSN=IMS12Q.IMS12X.OLDSP0,UNIT=SYSDA,VOL=SER=EAS001,
//             DISP=(,CATLG),EATTR=OPT,SPACE=(CYL,(50)),
//             DCB=(RECFM=VB,BLKSIZE=22528,LRECL=22524,BUFNO=15)
/*
```

Write-ahead data set

The WADS is a small DASD data set containing a copy of log records reflecting committed operations in the OLDS buffers that have not yet been written to the OLDS. WADS space is continually reused after the records it contains are written to the OLDS. The recommended size for your WADS can vary by storage device.

You can define up to 10 WADSs to use as spares. IMS automatically switches to a spare WADS if the current WADS becomes unusable after an error occurs. If a write error occurs, logging to the WADS continues if at least one WADS is available (for single logging) or two WADSs are available (for dual logging). For additional resiliency, define each WADS on a different hardware device

You can enable your WADS to use EAVs that are available in z/OS V1.12 or later by specifying an EAV volume on the VOLSER parameter of the DFSWADSnn DD statement when you allocate the data set. In addition, you can specify the attribute EATTR to indicate whether the data set supports extended attributes.

Example 2-9 shows a WADS allocation using EAV.

Example 2-9 WADS allocation

```
//*************
//*   ALLOCATE WADS
//*************
//WADS    EXEC PGM=IEFBR14
//SYSPRINT DD  SYSOUT=*
//WADS00   DD  DSN=IMS12Q.IMS12X.WADS0,UNIT=SYSDA,VOL=SER=EAS001,
//             DISP=(,CATLG),EATTR=OPT,SPACE=(CYL,(3)),
//             DCB=(RECFM=F,BLKSIZE=4096,LRECL=4096)
/*
```

Restart data set

While IMS is running and logging its activities, it takes periodic system checkpoints and writes the checkpoint notification to another data set called the RDS. IMS uses the RDS when it restarts to determine the correct checkpoint from which to restart.

A minimum of five tracks must be allocated to the restart data set because it contains the checkpoint-ID table and other control information.

Example 2-10 shows an RDS allocation using EAV.

Example 2-10 RDS allocation

```
//*************
//*   ALLOCATE RESTART DATA SET
//*************
//RDS     EXEC PGM=IEFBR14
//SYSPRINT DD  SYSOUT=*
//LGMSG    DD  DSN=IMS12Q.IMS12X.RDS,UNIT=SYSDA,VOL=SER=EAS001,
//             DISP=(,CATLG),EATTR=OPT,SPACE=(CYL,(1)),
//             DCB=(RECFM=FBS,BLKSIZE=4096,LRECL=4096)
/*
```

Message queue data set

Message queue data sets are allocated in DB/DC and DCCTL environments. They are the amount of DASD space allocated to the message queue, and this depends on how many transaction codes and logical terminal names you specify during system definition, and how many short and long messages are to be held by the system during any period.

Allocate message queue data set space in terms of contiguous cylinders for most efficient operation. Secondary allocation is ignored unless the secondary space has been preallocated (that is, multiple volume data sets with preallocated space on both volumes).

You can change the amount of direct access storage space allocated to the message queue data sets before a cold start of IMS. Reallocation of the message queue data sets with a warm start requires the use of the **FORMAT** and **BUILDQ** parameters with either the **/NRESTART** or **/ERESTART** command. Allocating less space (than in the previous execution) before an **/NRESTART** or **/ERESTART BUILDQ** can cause the restart to abend.

You can allocate up to 10 data sets for the long message queue and 10 data sets for the short message queue. Each data set requires an additional DD statement. Ensure that all data sets of a given message queue type are the same size. If the data sets have different sizes, the smallest size is used for all.

Example 2-11 shows a message queue allocation using EAV.

Example 2-11 Message queue allocation using EAV

```
//*************
//*   ALLOCATE MESSAGE QUEUE
//*************
//WADS    EXEC PGM=IEFBR14
//SYSPRINT DD  SYSOUT=*
//LGMSG    DD  DSN=IMS12Q.IMS12X.LGMSG,UNIT=SYSDA,VOL=SER=EAS001,
//             DISP=(,CATLG),EATTR=OPT,SPACE=(CYL,(25)),
//             DCB=(RECFM=FBS,BLKSIZE=3360,LRECL=6720)
/*
```

2.7.5 Considerations for EAV

Non-VSAM EAV support has the following requirements:

- z/OS Version 1 Release 12 or later
- IBM System Storage DS8000 devices or DS8700 devices configured as 3390 Model A devices

Important: Even if you are not going to use the non-VSAM support, IMS 12 requires that you install DFSMS APAR/PTF OA33409/UA55338 on z/OS V1R11.

Data sets with **EATTR=OPT** specified cannot be shared with an IMS Version 10 or IMS Version 11 system because those IMS versions do not support extended attributes.

2.8 Buffer pools allocation

IMS performance is directly impacted by several variables such as hardware, operating system, application design or even IMS definitions. Virtual storage and the way you allocate buffer pools is one of these variables.

In IMS 12, the storage for certain database pools is now obtained in 31-bit virtual storage backed by 64-bit real storage. Also, IMS 12 has changed the storage requirements for OSAM data extent blocks (DEBs).

As an immediate benefit, large database pools can now be fixed. Previously, these pools were unable to be fixed due a shortage of 31-bit real storage.

2.8.1 Background on buffer pools

Generally speaking, the way you tune your buffer pools depends directly on how much real storage is available in the environment. In most cases, increasing the size of the pool means increases paging activity. However, reducing pool sizes reduces paging of those areas.

For an IMS system, each application program requires its PSB, the PSBW, the intent list, and the DMBs to be scheduled. These control blocks are loaded into some of the buffer pools existing in the IMS system.

The PSB pool holds all PSBs for scheduled application programs. A specific scheduled PSB remains in the pool until space is needed to load another PSB. Then, if all space is used, the least-referenced inactive PSB is freed.

PSBs that are made resident and are not parallel scheduled are exceptions to this rule. These PSBs do not take from the pool allocation and are usually designated for highly referenced (usually, preloaded) programs. If the DL/I address space option is used, two resident PSB pools exist, one in the z/OS common area and one in the DL/I address space.

A portion of the PSB work pool is required by each active PSB, but the total size does not need to be larger than the maximum. When you use the technique of starting large and reducing to some value greater than the maximum amount used, scheduling stops when any pool space failure occurs.

The DMB pool holds the DMB that describes and controls a physical database. We recommend that you make the DMBs for all databases resident. If all the DMBs are made resident, the inactive DMBs can be allowed to page out without significantly affecting the active DMBs, but paging them back into storage can suspend processing in the control region or the DL/I secondary address space (SAS). Opening and closing databases suspends either the IMS control region or the DL/I SAS, depending on the specification of the LSO= option, and increases DL/I call elapsed time.

Allocate sufficient buffers in the IMS buffer pools to prevent I/O. If the IMS pools are subject to paging, you can consider page fixing the significant buffers, if necessary.

The principal IMS pools that can be page fixed are:

- Message queue pool (QBUF)
- DMB pool (DLDP)
- PSB pool (DLMP)
- Message format buffer pool (MFBP)
- Database subpools

If the DL/I address space option is used, two PSB pools exist: DLMP in the z/OS common area, and DPSB in the DL/I address space.

2.8.2 Description of buffer pools allocation

The **BUFPOOLS** macro statement specifies default storage buffer pool sizes for the DB/DC and DBCTL environments. The storage buffer pool sizes that are specified on the **BUFPOOLS** macro are used unless otherwise expressly stated for that buffer or pool at control program execution time for an online system.

Figure 2-20 shows the syntax of BUFPOOLS macro. For more information, see *IMS Version 12 System Definition*, GC19-3021.

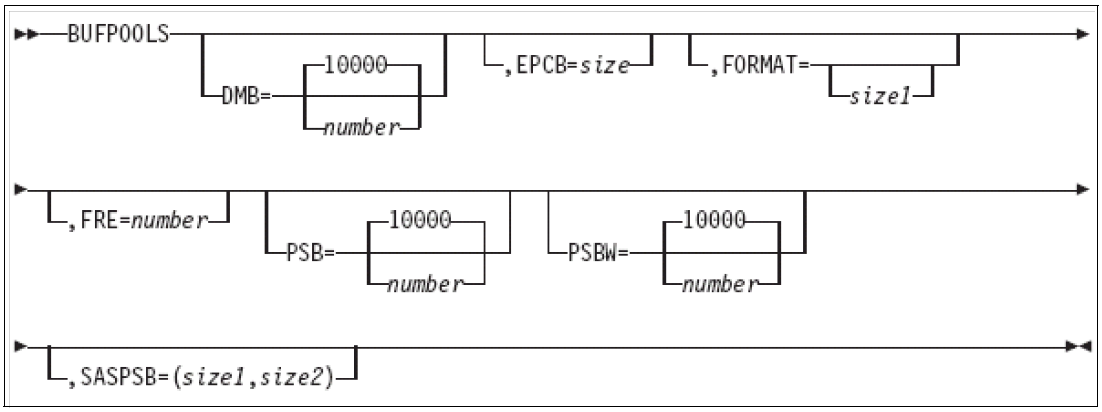

Figure 2-20 BUFPOOLS macro syntax

DMB This specifies the size of the DMB control block pool. The default is 10,000 bytes. The maximum allowable specification is 9,999,000 bytes. The minimum allowable specification is 8 bytes.

PSB This specifies the size of the PSB control block pool if the DL/I address space option is not used. The **SASPSB** parameter specifies the size of the PSB control block pool when the DL/I address space option is used. The default is 10000 bytes, with a maximum of 9,999,000 bytes. The minimum allowable specification is 8 bytes.

PSBW This specifies the size of the PSB work area pool. The default is 10,000 bytes. The maximum allowable specification is 9,999,000 bytes. The minimum allowable specification is 8 bytes.

SASPSB This is used only if the DL/I separate address space option is selected. If you are not using this option, the size of the single PSB control block pool is specified with the PSB parameter. With the DL/I address space option, two PSB control block pools exist. Size1 is the size of the pool in the z/OS common storage area (CSA). Size2 is the size of the pool in DL/I local storage. The maximum allowable for either is 9,999,000 bytes.

Using **EXEC** parameters, you can override definitions for data communication that were initially set during IMS system definition. Table 2-10 shows the cross reference between **BUFPOOLS** macro definitions and **EXEC** parameters.

Table 2-10 BUFPOOLS and EXEC cross reference

BUFPOOLS macro	EXEC parameters
	DBWP
DMB	DMB
PSB	PSB
PSBW	PSBW
SASPSB(size1)	CSAPSB
SASPSB(size2)	DLIPSB

DBWP This specifies the amount of subpool 231 storage to be allocated to the database work area pool. The value can be specified as either one- to six-numeric characters, or one- to five-numeric characters followed by either K (kilobyte), M (megabyte), or G (gigabyte). If K, M, or G is not specified, K is the default. The maximum value is 2 G-1. If the value specified exceeds 2 G-1, the default is 2 G-1. The pool size specified is rounded up to the nearest page boundary.

The DBWP size must be specified as the largest logical record length parameter size of any database you might run.

DMB This specifies the amount of subpool 231 storage to be allocated to the DMB pool. The value can be specified as either one- to six-numeric characters, or one- to five-numeric characters followed by either K (kilobyte), M (megabyte), or G (gigabyte). If K, M, or G is not specified, K is the default. The maximum value is 2 G-1. If the value specified exceeds 2 G-1, the default is 2 G-1.

The pool size specified is rounded up to the nearest page boundary. The output of the **ACBGEN** utility indicates the size of each DMB processed.

Examine this output before you specify the **DMB=** parameter.

PSB This specifies the amount of subpool 231 storage to be allocated to the PSB pool. The value can be specified as one-to-six numeric characters or one-to-five numeric characters followed by K (kilobyte), M (megabyte), or G (gigabyte). If K, M, or G is not specified, K is the default. The maximum value that can be specified is 2 G-1. If the value specified exceeds 2 G-1 the default is 2 G-1. The value specified is rounded up to the nearest page boundary. The default is 0.

The output of the **ACBGEN** utility indicates the maximum PSB size and the size of each PSB processed. Examine this output before you specify the **PSB=** parameter.

PSBW This specifies the amount of subpool 231 storage to be allocated to the PSB work area pool. The value can be specified as one- to six-numeric characters or one- to five-numeric characters followed by either K (kilobyte), M (megabyte), or G (gigabyte). If K, M, or G is not specified, K is the default. The maximum value that can be specified is 2 G-1. If the value specified exceeds 2 G-1 the default is 2 G-1. The pool size specified is rounded up to the nearest page boundary.

The output of the **ACBGEN** utility indicates the maximum work area size among the work area sizes required by each PSB. Depending on the execution environment, the work area size for a given PSB can be increased to the size of the long message queue buffer or to the size specified plus the maximum segment size of the segments processed by this PSB.

Examine the **ACBGEN** output before you specify the **PSBW=** parameter. This parameter is not needed for an RSR tracking subsystem. For **CSAPSB** and PSBW, **DFSIINSO** obtains contiguous space in the z/OS common area. If this storage is unavailable in the z/OS common area, ABENDU0717 occurs.

CSAPSB When the DL/I address space option (**LSO=S**) is specified, two program specification block pools are used. **CSAPSB** specifies the size of pool in the z/OS CSA, and **DLIPSB** specifies the size in the DL/I address space. In an LSO=S system, the **PSB=** parameter is ignored.

The output of the **ACBGEN** utility indicates maximum CSA space, average CSA space, and the CSA space required by each PSB in the pool. This output is useful in determining what value to specify for the **CSAPSB=** parameter. Before specifying the **DLIPSB=** parameter, consider the SAS size required for each PSB, maximum SAS space, and average SAS. Neither parameter should be zero. Normally, **DLIPSB** should be larger than **CSAPSB**.

The values for the pool sizes can be specified as either one- to six-numeric characters, or one- to five-numeric characters followed by either K (kilobyte), M (megabyte), or G (gigabyte). If K, M, or G is not specified, K is the default. The maximum value is 2 G-1.

The upper limit defaults to 2 G-1 if any of the following statements are true:

- The value specified is not large enough to hold the largest primary and secondary storage allocations that are defined.
- The value specified exceeds 2G-1.
- No value is specified.

The sizes specified are rounded up to the nearest page boundary.

The sizes of the two pools can also be specified during IMS system definition, using the **SASPSB** parameter in the **BUFPOOLS** macro. The sum of the values for the **CSAPSB** and **DLIPSB** defines the PSB pool size. If PSB is also specified, the larger value (PSB or the sum of **CSAPSB** and **DLIPSB**) is used.

For **CSAPSB** and **PSBW**, DFSIINS0 obtains contiguous space in the z/OS common area. If this storage is unavailable in the z/OS common area, ABENDU0717 occurs.

DLIPSB

When the DL/I address space option (**LSO=S**) is specified, two program specification block pools are used. **CSAPSB** specifies the size of pool in the z/OS CSA, and **DLIPSB** specifies the size in the DL/I address space. In an **LSO=S** system, the **PSB=** parameter is ignored.

The output of the **ACBGEN** utility indicates maximum CSA space, average CSA space, and the CSA space required by each PSB in the pool. This output is useful in determining what value to specify for the **CSAPSB=** parameter.

Before specifying the **DLIPSB=** parameter, consider the SAS size required for each PSB, maximum SAS space, and average SAS space. Neither parameter should be zero. Normally, **DLIPSB** should be larger than **CSAPSB**. The values for the pool sizes can be specified as either one- to six-numeric characters, or one- to five-numeric characters followed by either K (kilobyte), M (megabyte), or G (gigabyte). If K, M, or G is not specified, K is the default. The maximum value is 2 G-1.

The upper limit defaults to 2 G-1 if any of the following statements are true:

- The value specified is not large enough to hold the largest primary and secondary storage allocations that are defined.
- The value specified exceeds 2G-1.
- No value is specified.

The sizes specified are rounded up to the nearest page boundary.

The sizes of the two pools can also be specified during IMS system definition, using the SASPSB parameter in the BUFPOOLS macro. For the FDR procedure, the sum of the values for the **CSAPSB** and **DLIPSB** defines the PSB pool size. If PSB is also specified, the larger value (PSB or the sum of **CSAPSB** and **DLIPSB**) is used.

Use the DFSFIXnn member of the IMS PROCLIB data set to specify that portions of the control region (for example, certain control blocks, buffer pools, loaded modules, and part of the IMS nucleus) are to be fixed in address space during.

Figure 2-21 shows the BLOCKS specification syntax. For more information, see *IMS Version 12 System Definition*, GC19-3021.

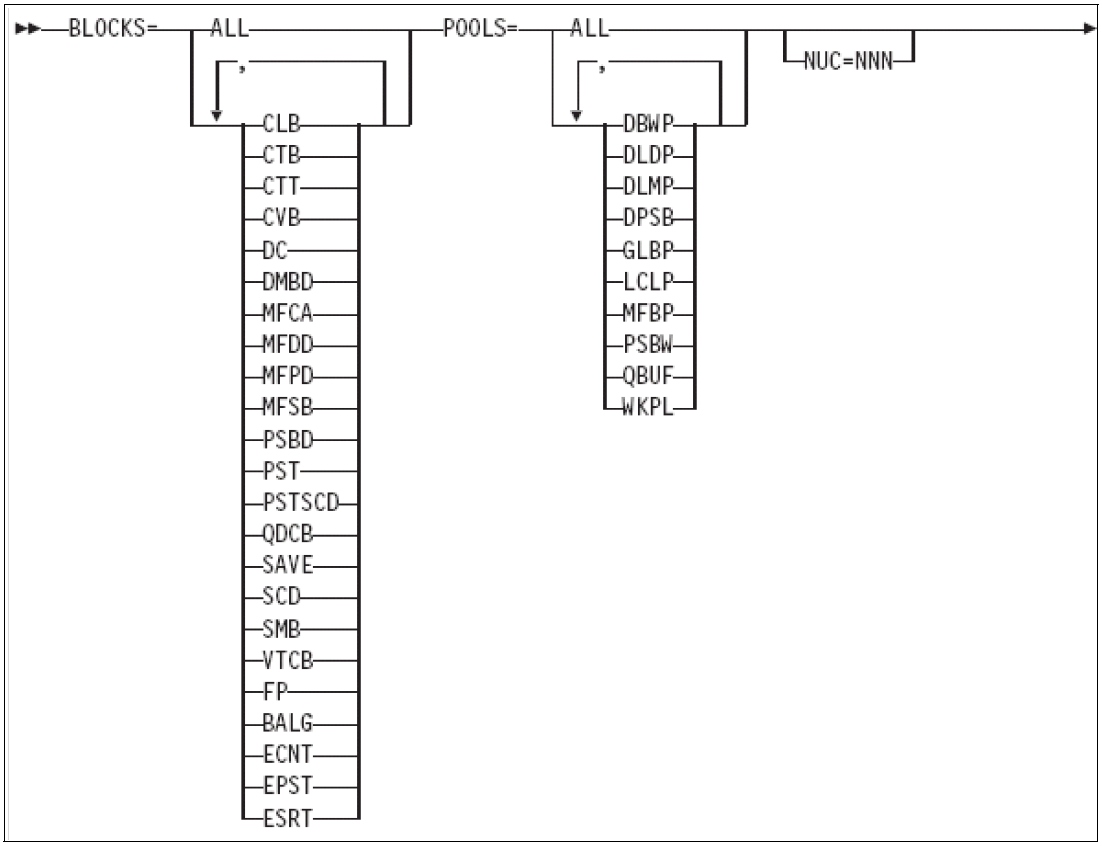

Figure 2-21 DFSFIXnn BLOCKS syntax

POOLS The dynamic area acquired by IMS during initialization and used for various buffer pools.

DBWP DMB work pool.

DLDP DMB pool.

DLMP With the DL/I address space option, that portion of the PSB pool in the z/OS common area.

DPSB With the DL/I address space option, the portion of the PSB pool in DL/I local storage. Specification is ignored if the DL/I address space option is not in effect.

GLBP The WKPL, DLMP, PSBW, DLDP, and DBWP storage pools are included. If the DL/I address space is used, DLDP and DBWP are not included.

LCLP	The QBUF and MFBP storage pools are included. If the DL/I address space is used, the DPSB, DLDP, and DBWP storage pools are also included.
MFBP	Message format buffer pool.
PSBW	PSB work pool.
QBUF	Message queue buffer pool.
WKPL	General working pool.

2.8.3 Buffer pools allocation with IMS 12

In IMS 12, the storage for certain database pools is now obtained in 31-bit virtual storage backed by 64-bit real storage. If you page fix any of these pools and have 64-bit real storage on your processor, you might see a reduction in the use of 31-bit fixed real frames.

The 31-bit virtual storage for the following database pools is now backed by 64-bit real storage:

- DBWP DB work pool
- DLDP DMB pool
- DLMP PSB CSA pool
- DPSB DLI PSB pool
- PSBW PSB work pool

Large database pools that were unable to be page fixed previously due to 31-bit real storage constraints, might now be able to be fixed because the fixed pages are backed by 64-bit real storage.

2.8.4 Using buffer pools allocation

To page fix the PSB pool (keep the pool in storage for the long term), specify **POOLS=DLMP** and **POOLS=DPSB** in the DFSFIXxx member in the IMS.PROCLIB data set. To page fix the resident PSB pool, include the module names DFSPSBRS and DFSDLIRS in the DFSFIXxx member.

Example 2-12 shows a sample to fix pools.

Example 2-12 DFSVSMxx sample to fix pools

```
NUC=033,POOLS=DBWP,DLDP,DLMP,DPSB,PSBW
```

2.8.5 Considerations for buffer pools allocation

The pools listed here are moved from 31-bit real storage to 64-bit real storage. They remain in 31-bit virtual storage.

2.9 Miscellaneous other enhancements

IMS 12 also adds other enhancements to improve product serviceability. In this publication we cover the following topics:

- IMS Dump Formatter utility
- EOM/EOT trace

- OSAM data extent blocks
- Reduced aliases in RESLIB

2.9.1 IMS Dump Formatter

Use the Offline Dump Formatter utility (**DFSOFMD0**) to format internal IMS control blocks in a dump that is both independent of a failure and independent of the dumping process. With this utility, you can tailor the dump to print and format only the data areas needed to analyze a particular problem. Use the Offline Dump Formatter utility to perform the following tasks:

- Establish the environment needed for offline dump formatting
- Read and check the dump format control statements
- Relocate or load the dump formatting modules
- Direct the offline dump formatting process

The Offline Dump Formatter utility is invoked as a verb exit from the Interactive Problem Control System (IPCS).

The Offline Dump Formatter utility modules are included in the dumped storage to ensure that the modules used for formatting the dump match the level of the dumped IMS control blocks. These modules can be relocated from the dumped storage, or a fresh copy can be loaded from the program library.

Using the IMS Dump Formatter gives you a menu-driven way to run the Offline Dump Formatter utility without complicated editing of the DFSFRMAT file. IPCS uses menus to run the IMS Dump Formatter. With these menus, you can specify the information to be contained in the dump. The IMS Dump Formatter calls the Offline Dump Formatter utility to perform the required formatting tasks. The output is returned in a format that you can read on the terminal.

IMS 12 adds support to IMS Dump Formatter for the following areas:

- The Repository Server address space by using the Other IMS Components (6) section of the Dump Formatter
- The Repository Client address space by using the Other IMS-Related Products (7) section of the Dump Formatter
- The OTMA C/I by using the Other IMS Components (6) section of the Dump Formatter

2.9.2 EOM/EOT trace

There are certain situations where an IMS dependent region that was executed as a batch job ended abnormally due to storage constraints. The severe storage conditions within the address space caused the normal IMS dependent region termination clean-up services to fail. In earlier IMS versions, there was no diagnostic information to determine whether the end-of-memory (EOM) service had been invoked or whether the service failed or had been successful. EOM service diagnostic information was introduced in IMS 10 and has been helpful in resolving this problem.

IMS 12 adds support for the end-of-task (EOT) process similar to that employed by the EOM process. This function traces the step-by-step flow through the EOT process by updating a nibble trace double-word in the IDT (IDTEOTTR) of the region with a unique marker for each successful step processed or for each decision point reached and evaluated.

The EOM/EOT Tracing Facility produces a step trace of the actions taken by the EOM service each time it is invoked for a dependent region. Trace data is stored in the region's IDT entry in the following fields:

- IDTASCBT - EOM trace: ASCB address stack
- IDTASIDT - EOM trace: ASID number stack
- IDTEOMTR - EOM trace: 16 nibble stack
- IDTEOTTR - EOT trace: 16 nibble stack

The EOM/EOT trace information captured by the service is recorded, using WTO, in message DFS0798I, which is issued at the end of the End of Memory call (no action is required):

DFS0798I eee PROCESSING COMPLETE FOR jjjjjjjj RC=0000 RSN=00000000 ASCB=aaaaaaaa ASID=dddd TRC=ttttttttttttttt:zzzzzzzz

This message indicates that an EOM event for an IMS dependent region has been detected and processed. In the message text, note the following explanation:

eee	SSI call type: EOM (end of memory) or EOT (end of task).
jjjjjjj	Dependent region job name.
aaaaaaaa	Dependent region ASCB (address space control block).
dddd	Dependent region ASID (address space identifier).
ttttttttttttttt	Trace string (IDTEOMTR or IDTEOTTR).
zzzzzzzz	Address of the IDT entry.
System action	The results of EOM processing are displayed in the message. The region has terminated, clean up processing was successful, and the IDT and VTD entries for the region are cleared.
Response	No action is required.

If something goes wrong, the EOM or EOT trace information captured by the service is recorded, using WTO, in message DFS0798W, which is issued at the end of the EOM call. Contact IBM Software Support for help.

DFS0798W eee PROCESSING COMPLETE FOR jjjjjjjj RC=rrrr RSN=ssssssss ASCB=aaaaaaaa ASID=dddd TRC=ttttttttttttttt:zzzzzzzz

This message indicates that an EOM event for an IMS-dependent region has been detected and processed. In the message text, note the following explanation:

eee	SSI call type: EOM or EOT.
rrrr	Return code.
ssssssss	Reason code.
jjjjjjj	Dependent region job name.
aaaaaaaa	Dependent region ASCB (address space control block).
dddd	Dependent region ASID (address space identifier).
ttttttttttttttt	Trace string (IDTEOMTR or IDTEOTTR).
zzzzzzzz	Address of the IDT entry.
System action	The results of EOM processing are displayed in the message.

2.9.3 OSAM data extent blocks

Previous IMS versions created two DEBs for each OSAM data set. The DEB contains information about the physical characteristics of the data set and other information that the control program uses. For database data sets, these DEBs were in the DLISAS region. For system data sets, these DEBs were in the control region.

IMS 12 has changed the storage requirements for OSAM DEBs. IMS 12 eliminates one of the DEBs for each OSAM data set. Because each DEB requires approximately 300 bytes, this reduction might be significant for users with many OSAM database data sets.

2.9.4 Reduced aliases in RESLIB

Various IMS load modules contain aliases, which make them error-prone when service affects these modules. Common practice when implementing selected service is to individually copy modules affected by the service. When modules being copied contain aliases it is easy to overlook this and not propagate the aliases.

IMS 12 starts to remove as many aliases from IMS load modules as possible.

3

Database enhancements

Databases in IMS are hierarchical databases. They are fast, reliable, and can take advantage of the IBM z/Architecture®. They can be split into three domains:

- Traditional full function databases (hierarchical indexed sequential access method (HISAM), simple hierarchical sequential access method (SHISAM), hierarchical direct access method (HDAM), and hierarchical indexed direct access method (HIDAM))
- High available databases (partitioned HDAM (PHDAM), partitioned HIDAM (PHIDAM), and partitioned secondary index (PSINDEX))
- Fast Path databases (data entry database (DEDB) and main storage database (MSDB))

IMS 12 has both functional and performance enhancements in the database support area. The performance enhancements benefit from the z/Architecture (64 real and virtual bit support, new instructions), and also offer new implementations that are transparent for existing applications. Functional enhancements introduce additional exploitation capabilities of the existing databases.

This chapter includes the following sections:

- Full function database enhancements
- High availability large database enhancements
- Fast Path database enhancements
- CICS threadsafe support
- Miscellaneous enhancements

For reference documentation that relates to this chapter, see the following publications:

- *IMS Version 12 Database Administration*, SC19-3013
- *IMS Version 12 Exit Routines*, SC19-3016
- *IMS Version 12 System Utilities*, SC19-3023

3.1 Full function database enhancements

IMS 12 provides several improvements for traditional databases. Within this category, the database types HIDAM, HDAM, HISAM, and SHISAM are classified, with or without secondary indexes and logical relationships.

3.1.1 Overview of the database pool storage enhancements

In IMS Version 12, the storage for certain database pools is now obtained in 31-bit virtual storage backed by *64-bit real storage*. If you page fix any of these pools and have 64-bit real storage on your processor, you might see a reduction in the use of 31-bit fixed real frames, which can influence system paging.

The 31-bit virtual storage for the following database pools is now backed up by 64-bit real storage:

- DBWP: DB work pool
- DLDP: DMB pool
- DLMP: PSB CSA pool
- DPSB: DLI PSB pool
- PSBW: PSB work pool

Large database pools that were unable to be page fixed before, due to 31-bit real storage constraints, might be able to be fixed because the fixed pages are backed by 64-bit real storage.

You can use the DFSFIXnn member of the IMS PROCLIB data set to specify the buffer pools to be fixed in address space during initialization.

3.1.2 Dynamic full function database buffer pools

With IMS 12, users can add, change, and delete full function buffer pools. This support is provided using new specifications in the DFSDFxxx proclib member in conjunction with the **UPDATE POOL** command. With this support, full function buffer pools can be managed without restarting IMS.

IMS can internally quiesce application read and update activity so that the **UPDATE POOL** command can complete with little disruption to transaction workloads (Figure 3-1).

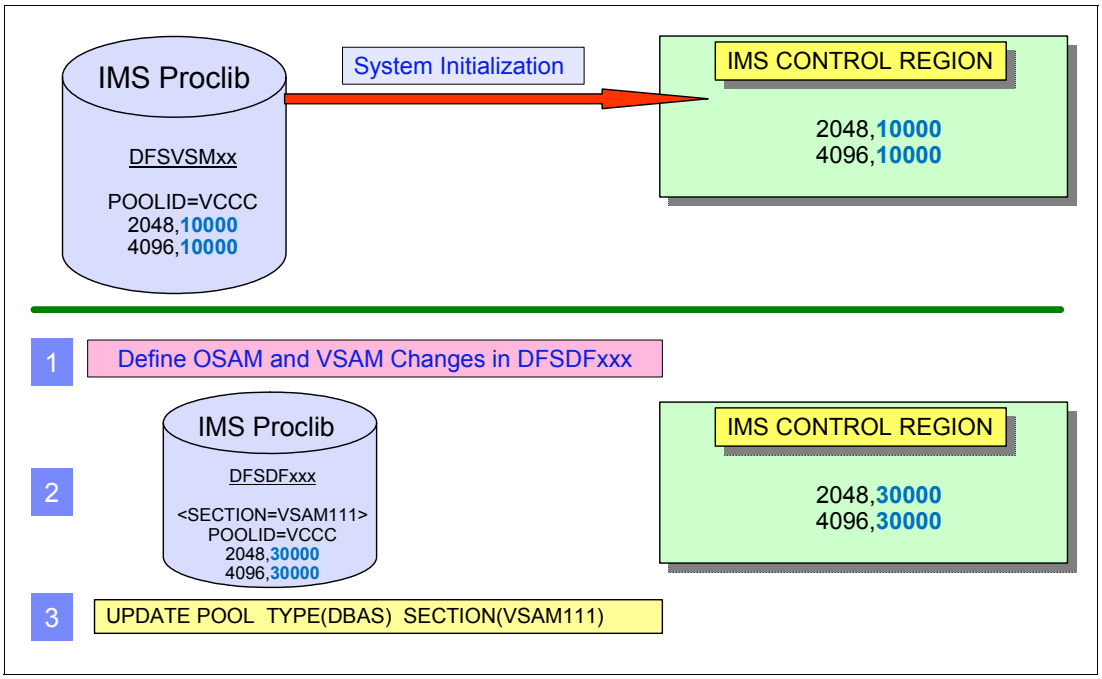

Figure 3-1 Overview of dynamic full function buffer pools

In IMS 11 and earlier releases, the Virtual Storage Access Method (VSAM) and overflow sequential access method (OSAM) buffer pool definitions were only stored in the DFSVSMxx proclib member. This member is loaded only one time during IMS initialization. No facility is available to change the buffer pool definitions without first changing the DFSVSMxx member in proclib and then restarting IMS.

IMS 12 offers a new feature for dynamically adding, updating, and deleting VSAM and OSAM buffer pools. The initial VSAM and OSAM buffer pool specifications still exist in the DFSVSMxx proclib member and they are loaded during normal restart. However, new VSAM and OSAM buffer pools can be added and existing buffer pools can be changed using specifications in one or more DFSDFxxx proclib members with the type-2 **UPDATE POOL** command.

Example 3-1 shows the initial and pool specifications for VSAM.

Example 3-1 VSAM buffer pool specifications in DFSVSMxx

```
POOLID=VCCC
VSRBF=2048,8000,I
VSRBF=2048,26000,D
VSRBF=4096,32767,I,HSO,HS40000
VSRBF=8192,32767,I,HSR,HS40000
DBD=PVHDJ5B(B,VCCC,ERASE=YES,FREESPACE=YES)
```

The specifications in Example 3-1 on page 69 can be dynamically changed by using buffer pool specifications in the DFSDFxxx proclib member section (Example 3-2).

Example 3-2 Changed VSAM specifications in DFSDFxxx

```
<SECTION=VSAMEXM>
POOLID=(VCCC,
               VSRBF=(2048,12000,I),
               VSRBF=(2048,12000,D),
               VSRBF=(4096,32767,I,HSO,HS80000),
               VSRBF=(8192,32767,I,HSR,HS80000))
DBD=(PVHDJ5B,B,VCCC,ERASE=YES,FREESPACE=YES)
```

For VSAM the specifications in DFSDFxxx are located behind a <SECTION=xxxxxxx> indication. The information is similar to that in DFSVSMxx, except that the “VSRBF” definitions are part of the POOLID statement. The name of the section can be chosen, as it will be indicated during the update process.

OSAM buffers can be treated the same way. Example 3-3 shows the initial pool specifications for OSAM.

Example 3-3 OSAM buffer pool specifications in DFSVSMxx

```
IOBF=(8192,8000,N,N,OCCC)
DBD=POHIDKA(B,OCCC)
```

The specifications in Example 3-3 can be dynamically changed using buffer pool specifications in the DFSDFxxx proclib member section (Example 3-4).

Example 3-4 changed OSAM specification in DFSDFxxx

```
<SECTION=OSAMEXM>
IOBF=(8192,12000,N,N,OCCC)
DBD=(POHIDKA,B,OCCC)
```

For OSAM the specifications in DFSDFxxx are also located behind a <SECTION=xxxxxxx> indication. The information is similar to that in DFSVSMxx

The VSAM and OSAM buffer pool specifications can be placed into different DFSDFxxx members in proclib, because with the **UPDATE POOL** command, the user can specify the MEMBER keyword identifying the suffix of the DFSDFxxx proclib member in the proclib data set.

Alternatively, the user can specify multiple VSAM and OSAM sections within one or more DFSDFxxx members.

The update of the pool specifications is done with the type-2 **UPDATE POOL** command identifying the statement sections. The **UPDATE POOL** command can be issued individually for specific VSAM and OSAM sections, or the command can be issued for both VSAM and OSAM sections in the same command. The **UPDATE POOL** command can also reference a specific DFSDFxxx proclib member in the proclib data set using the MEMBER(yyy) keyword. In this case, *yyy* is the suffix used in DFSDFyyy. The default for yyy is 000.

Example 3-5 shows **UPDATE** command examples.

Example 3-5 Add and change commands

```
#Add or Change VSAM or OSAM buffer pool definitions:
UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx)
UPDATE POOL TYPE(DBAS) SECTION(VSAMxxx)
#VSAM and OSAM buffer pool change in one command:
UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx,VSAMxxx)
#Add or Change definitions in an alternate DFSDFyyy proclib member
# notice the "member" keyword
UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx) MEMBER(yyy)
```

It is possible to delete a VSAM buffer pool by specifying a **POOLID** in a VSAM section with the VSRBF statement for the size of the buffer and a "0" for the number of buffers. The **UPDATE POOL** command is needed to complete the deletion of the VSAM buffer pool.

The database data set association with a subpool is established when the database data set is opened. If a database data set using a subpool is to be deleted, the **UPDATE POOL** command must wait until the access to the subpool is completed before it can delete the subpool.

The **QUERY POOL** command (Example 3-6) can be used to query information about the new and changed VSAM and OSAM buffer pools. The user can specifically limit the output to:

- OSAM or VSAM buffer pools
- Buffers of a particular size
- Specific pool IDs

Example 3-6 Type-2 QUERY command

```
QUERY
   POOL
   TYPE(DBAS)
   SUBTYPE(OSAM,VSAM) SIZE() POOLID()
   SHOW( ALL/MEMBER/STATISTICS)
```

By using the options for **SHOW**, you can show only statistical information that is similar to the current **/DIS POOL DBAS** command. Alternatively, you can show the proclib member information used to add or update a buffer pool specification. It is also possible to show both statistical and member information using the **ALL** parameter. Example 3-7 shows a Time Sharing Option (TSO) single point of control (SPOC) example. The command can also be issued by an **OM API** command, in which case the output is XML tagged.

Example 3-7 TSO SPOC samples

```
TSO SPOC input:
QUERY POOL TYPE(DBAS) SUBTYPE(OSAM,VSAM) SHOW(MEMBER)

TSO SPOC output:
Subpool  MbrName    CC BufSize PoolId  NBuf ProcMbr  Section
OSAM     I12A        0    2048            5 DFSVSM2A
OSAM     I12A        0    8192            5 DFSVSM2A
VSAM-D   I12A        0     512 XXXX       5 DFSVSM2A
VSAM-D   I12A        0    1024 XXXX       5 DFSVSM2A
VSAM-D   I12A        0    2048 XXXX       5 DFSVSM2A
VSAM-D   I12A        0    4096 XXXX       5 DFSVSM2A
```

When VSAM or OSAM buffers are updated or deleted, the system is obliged to execute quiescing activity to implement the new values. This is differs for VSAM and OSAM, as explained here:

- For VSAM, when the **UPDATE POOL** command is issued to add, change, or delete one or more VSAM buffer pools, IMS must internally quiesce application activity against the affected buffer pools. The **UPDATE POOL** command must wait until all update activity has been committed and hardened to the database data sets
- For OSAM, when the **UPDATE POOL** command is issued to add, change, or delete one or more OSAM buffer pools, IMS must wait for the use of the affected buffers by applications to go down to zero. Before the usage count is zero, applications can use the buffers affected by the **UPDATE POOL** command. After the usage count goes to zero, the buffer can be reconfigured.

The buffer pool statistics are handled differently for VSAM and OSAM following an **UPDATE POOL** command. For VSAM, the buffer pool statistics are reset and the old statistics are not carried over. Use the **QUERY POOL** command for the VSAM buffer pool statistics before issuing the **UPDATE POOL** command. The OSAM statistics are carried over and are not reset with the **UPDATE POOL** command.

Committed buffer pool changes are written to restart data set (RDS).

- Emergency restart restores buffer pools using RDS.
- Normal restart initializes buffer pools from DFSVSMxx.

The **UPDATE POOL** command logs information in the x'22' log record for informational purposes only. The **UPDATE POOL** command itself is non-recoverable.

3.2 High availability large database enhancements

Within the group of high availability large databases (HALDBs), the PIHDAM, PHDAM and PSINDEX database are classified. This group gained specific improvements in IMS 12. Figure 3-2 shows an overview of HALDBs, although they are not new in IMS 12.

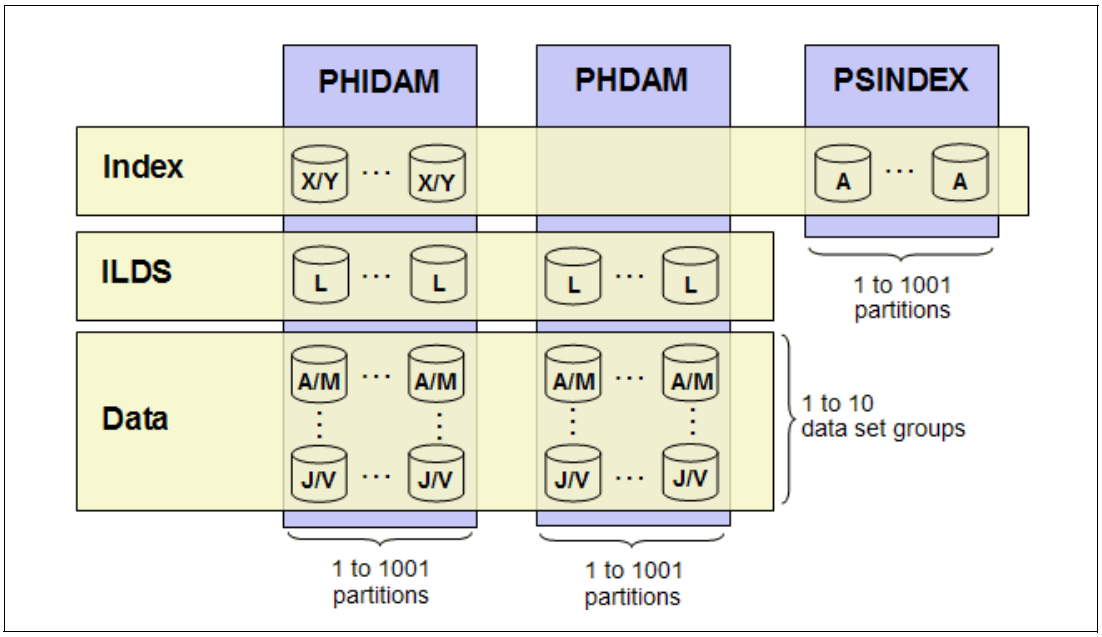

Figure 3-2 HALDB databases

Each partition must have a name of maximum 7 characters, so that appending the suffixes as indicated in Figure 3-2 makes it possible to distinguish the data sets within the partition. The data sets in a partition have generated data set names and DDNAMEs. The letters are used to distinguish the data sets as shown here:

Y/X	PHIDAM index
L	Indirect list data set (ILDS)
A through J	Database data sets
M through V	Database data sets
A	PSINDEX

For HALDB, no dynamic allocation members are used; instead, all HALDBs must be registered in the recovery controls (RECONs). The dynamic allocation is based on information in the RECON and the partition ID that is stored in the RECON and in the “A” data set of the partition for verification. This partition ID is defined by the creation pattern of the HALDBs and its value has no sequence meaning.

DDNAMES are defined by the partition name appended with the functional letters as shown in Figure 3-2. Data set names contain a prefix, chosen by the user, followed again by the functional letter and a partition ID. All allocations are dynamic, except for a few areas where the DDNAMES must be used.

HALDB databases can be reorganized online, and have a HALDB self-healing pointer process.

3.2.1 HALDB online reorganization ownership release

IMS 12 adds the capability to release ownership of an online reorganization (OLR) when IMS terminates. The IMS termination can be normal or abnormal. In previous versions, OLR ownership was kept by a terminated IMS system.

In IMS 12, the **RELOLROWNER-Y/N** parameter in the <DATABASE> section of the DFSDFxxx PROCLIB member indicates whether OLR is restarted on the non-owning IMS system (Example 3-8).

Example 3-8 Ownership release indication

```
<SECTION=DATABASE>
RELOLROWNER=Y|N
```

RELOROWNER=N is the default and does not release ownership when the IMS system terminates. The **RELOLROWNER=** value can be overridden by specifying one of the following values on the **INIT OLREORG**, **/INIT OLREORG**, **UPD OLREORG**, or **/UPD OLREORG** command:

- **OPTION(REL)**
- **OPTION(NOREL)**

When **RELOLROWNER=Y** or **OPTION(REL)** is not specified, OLR is automatically restarted when the terminated IMS system is restarted.

When **RELOLROWNER=Y** is specified, OLR is not automatically restarted unless it was overridden with **OPTION(NOREL)** on the command. If the OLR is not automatically restarted by IMS restart, it must be restarted with the **INIT OLREORG** or **/INIT OLREORG** command.

3.2.2 Parallel migration to HALDB: IMS 10 and IMS 11 small programming enhancement

The IMS Unload utility (**DFSURGU0**) has been enhanced in IMS 10, IMS 11, and IMS 12 to allow unloads of key ranges of an HDAM or HIDAM database when migrating to HALDB. Multiple unloads for the same database can be run in parallel. This can significantly reduce the elapsed time for a migration to HALDB.

An execution of HD Unload can be restricted to a range of keys when the **MIGRATE=YES** control statement is included for migration to HALDB. The low (FROMKEY) and high (TOKEY) values must be specified in hexadecimal. These values can be obtained from the output of a **LIST.DB DBRC** command for the partition.

Before this enhancement the migration unload of a logically related database often took a long time. When a logical child segment is unloaded, its logical parent must be read in most cases. This is a random read. These random reads account for almost all of the elapsed time of the unload.

The logically related database must be read unless the unload is for the physical logical child of a bidirectional logical relationship with virtual pairing when the PHYSICAL option was specified the database description (DBD) to include the concatenated key in the physical logical child. The logical related database is always read with the following logical relationships:

- Unidirectional logical relationships
- Physically paired bidirectional relationships
- Virtually paired bidirectional logical relationships when reading the virtual logical child
- Virtually paired bidirectional logical relationships when reading the physical logical child and the VIRTUAL option has been specified in the DBD (the concatenated key of the logical parent is not stored in the physical logical child).

Figure 3-3 illustrates the improved process.

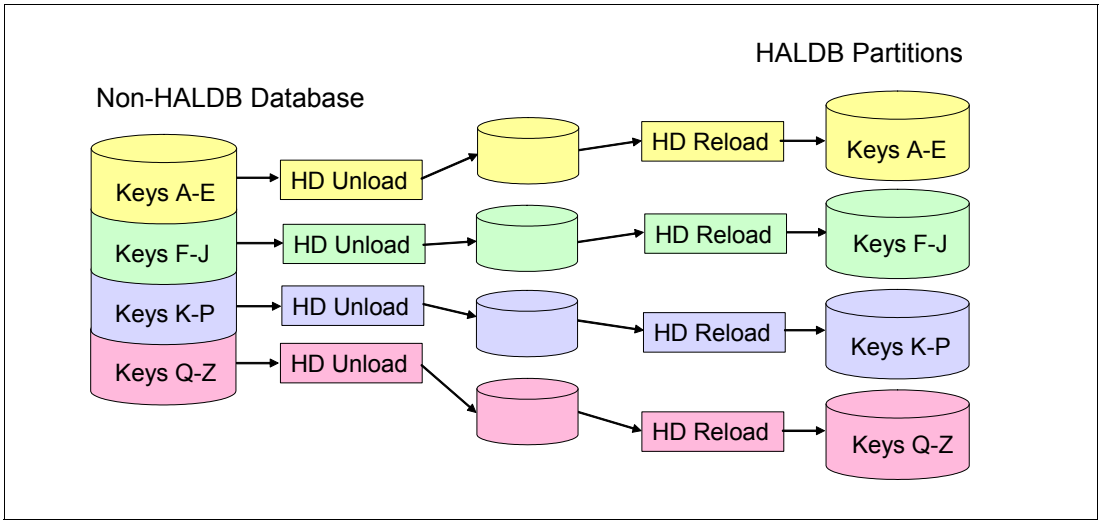

Figure 3-3 Parallel unload

The four HD Unload jobs process different key ranges in the non-HALDB database. They are run in parallel. Their individual outputs are fed to four different HD Reload jobs which load the four partitions in the new HALDB database. The reload jobs are also run in parallel.

Multiple executions of HD Unload can be run in parallel. The key ranges must correspond to the key ranges for HALDB partitions so that the subsequent HD Reload executions can be run in parallel. Use “cut and paste” for the hexadecimal key values from a RECON listing.

Example 3-9 shows the control input by using SYSIN DD.

Example 3-9 Control parallel unload

```
MIGRATE=YES
KEYRANGE FROMKEY(key value) TOKEY(key value)  KEYLEN(key lth)
#Recommendation: Cut and paste key values from RECON listing, Example:
MIGRATE=YES
KEYRANGE FROMKEY(F0F0F0F0F0) TOKEY(D2F2F0F0F0)  KEYLEN(5)
```

MIGRATE=YES must be specified.

The new capability cannot be used for unloading HALDB databases. Also, **MIGRATX=YES** cannot be used with the KEYRANGE statement. **MIGRATX=YES** is used only for databases with secondary indexes. It cannot be used with the KEYRANGE statement because the key ranges appropriate for a secondary index would not be those used for the unload of the indexed database. If your database has secondary indexes, you can use **MIGRATE=YES** and create the secondary indexes with a tool such as IBM IMS Index Builder.

The records unloaded must match the HALDB partition boundaries. This is true because only one output data set from HD Unload can be used as input to HD Reload. Similarly, all of the records for a partition must be unloaded with one execution of HD Unload.

The job control language (JCL) must specify **DISP=SHR** for the unloads to run in parallel. If the data sets are VSAM, you must also specify share options that allow concurrent reads. **SHAREOPTIONS(3 3)** can be used for this purpose.

This capability was retrofitted into IMS 10 (APAR PM06635) and IMS 11(APAR PM06639).

3.2.3 Reuse of HALDB partition database names

The improvement regarding the reuse of HALDB partition database names is about partition names, not database names. Each partition of a HALDB has a name. The name must be unique among all partitions and database names in a set of RECONs. Describing the data in the partition name can cause problems because the name can lose significance if the volume of data grows.

Before IMS Version 12, when a HALDB partition was removed from the HALDB master and information about the partition was removed from the RECON data set, IMS retained information about the deleted partition name and prevented the name from being reused for a non-HALDB database.

IMS 12 now discards the residual information about the partition name so that it can be reused for a non-HALDB database. When a HALDB master is deleted, all of its partition names become available for reuse.

3.2.4 Reorganization numbers handled differently by timestamp recovery

Reorganizations of HALDB databases with logical relationships and secondary indexes do not require the execution of utilities to update pointers. Instead, HALDB uses a self-healing pointer process to correct logical relationship and secondary index pointers.

This process is implemented by placing a target key and an extended pointer set (EPS) in the secondary index or logically related database and by using an ILDS in each partition of PHDAM and PHIDAM databases.

The partition reorganization number is used to ensure that secondary index and logical relationship pointers are accurate. The reorganization number for a partition is stored in the partition data set. It is incremented by each reorganization of the partition. The reorganization number is also stored in the EPS of secondary index entries and logical children. If the value in the EPS does not match the value in the partition data set, the pointer is healed by updating it from the ILDS. The reorganization number is also stored in the partition database record in the RECON.

When a timestamp recovery is done to a time before the last reorganization, the reorganization number in partition data set is returned to its previous value by the actions of the Database Recovery utility (**DFSURDB0**) in previous versions of IMS. IMS 12 changes this. The IMS 12 Database Recovery Utility takes the reorganization number from the RECONs, increments it, and stores it in both the RECONs and the partition data set. This makes the reorganization numbers in the partition data set and the RECON match. Previously, a mismatch occurred until the first update job for the partition was executed. An update batch job or online system takes the value from the RECON and writes it to the partition data set.

Two problems can occur with previous releases of IMS:

- If a user created indexes by using the Index Builder tool after a timestamp recovery, the EPSs in the index entries might contain the reorganization values from the partition data set. These do not match the values in the RECON. After the first update job, the reorganization number in the partition data set is updated, which caused a mismatch with the values in the EPSs. When the index entries were used, IMS *healed* the pointers, which was unnecessary overhead. The new process eliminates this healing because the values in the EPSs match the values in the partition data set.
- The second problem occurred with the Pointer Checker tool. When the values in the pointers do not match those in the partition data set, the Pointer Checker produces error or warning messages. The new process eliminates these messages.

3.3 Fast Path database enhancements

Fast Path databases also received a lot of attention in IMS 12, the most important enhancement is the availability of secondary indexes for DEDBs.

3.3.1 Reduced logging for DEDB changed data capture

Some users want to use asynchronous changed data capture, however they do not want to write log records for before images. Prior to IMS 12, asynchronous changed data captures writes “before” and “after” image log records (x’99’). With IMS 12, you can specify that these before image log records are not to be written.

This is specified with new values on the **EXIT=** parameter of the DBD or SEGM macro of **DBDGEN** (Example 3-10).

Example 3-10 DBDGEN exit parameters

```
EXIT=([exitname],LOG/NOLOG,BEFORE/NOBEFORE,DLET/NODLET)
```

The following values are new:

DLET	Writes the before image log record for DLET calls. This is the default. It is also the action taken by previous versions of IMS.
NODLET	Does not write the before image log record for DLET calls.
BEFORE	Writes the before image log record for REPL calls. This is the default. It is also the action taken by previous versions of IMS.
NOBEFORE	Does not write the before image log record for REPL calls.

3.3.2 Full segment logging option

ISRT always logs the entire segment. DLET logs the data which cleared out the data. REPL logs the changed data.

IMS 12 provides new options to log entire DEDB segments when a REPL call replaces some of the data in a segment. Previously, only the changed data was logged in the x'5950' log record. The option to log the entire segment is specified for either the DEDB database or the area.

Example 3-11 shows the new keywords for the **INIT.DB**, **CHANGE.DB**, **INIT.AREA**, and **CHANGE.AREA** DBRC commands.

Example 3-11 DBRC commands for full REPL segment logging

```
INIT.DB DBD(name) NOFULLSEG|FULLSEG …
CHANGE.DB DBD(name) NOFULLSEG|FULLSEG …
INIT.DB DBD(name) AREA(aname) NOFULLSEG|FULLSEG …
CHANGE.DB DBD(name) AREA(aname) NOFULLSEG|FULLSEG …
```

- **FULLSEG** indicates that the entire segment is to be logged.
- **NOFULLSEG** indicates that only changed data is logged. The default is to log only the changed data.

If **FULLSEG** is specified on the **INIT.DB** or **CHANGE.DB** command without the **AREA(aname**) specified, the entire segment will be logged for all segments in the database unless **NOFULLSEG** is specified for an area with either the **INIT.DB** or **CHANGE.DB** command with **AREA(aname)** specified.

AREA FULLSEG takes precedence over **DB FULLSEG**.

The new option is especially useful for users of the Log Archive exit who want access to the entire segment for REPL calls. Without this enhancement, users must invoke Asynchronous Changed Data Capture. It writes x'99' log records in addition to the x'5950' log records.

3.3.3 Improved diagnostic message for DEDB data sharing

IMS 12 includes a new diagnostic message for data sharing. The new DFSO066I message is issued when a data sharing system responds to a notify message.

Notify messages are used to send messages between data sharing IMS systems. For example, they are sent to synchronize the initialization of the use of unit of work (UOW) locks. These messages are sent by one IMS system to all of its data sharing partners. All partners must respond before the processing can continue. IMS sends a DFS3770W message if all partners do not respond within a time limit. The DFS3770W tells the user that the timeout situation has occurred but does not identify which IMS system has not responded.

IMS 12 uses the new DFSO066I message to assist the user (Example 3-12). This message is sent by all systems responding to the notify message.

Example 3-12 Acknowledgement from other data sharing IMS

```
DFSO066I A NOTIFY RESPONSE HAS COME BACK FROM imsname
```

If a DFS3770W message is issued, the user can identify the system that has not responded by determining for which system the DFSO066I message has not been sent.

All DFSO066I messages are issued by the IMS system that sent the original notify message. This new message makes it easier for users to identify the failing system and to resolve the problem more quickly. You might need to cancel the IMS that has not issued this message.

3.3.4 Fast Path DEDB secondary index support

Secondary indexing provides a way to meet the various processing requirements of various applications. With secondary indexing, you can have an index based on any field in the database, not simply the key field in the root segment. Secondary indices were previously only available for full-function and HALDB databases.

In IMS 12, you can have a secondary index on a primary DEDB database to process a segment type in a sequence other than the one defined by the segment's key. A DEDB database can be composed of 1 (optional) sequential dependent segment (SDEP) and up to 127 direct dependent (DDEP) segments, spread over up to 15 levels.

You can have a maximum of 32 secondary indexes per segment and 255 secondary indexes per DEDB. Secondary indexes are only supported for DDEPs, and not for the SDEP. The secondary index databases must be “root-only” VSAM-based HISAM or SHISAM databases. HISAM databases must be used if you are confronted with duplicate secondary index values. A SHISAM database is composed of 1 KSDS data set. A HISAM database can have overflow in an ESDS data set.

Having duplicate secondary index values, if too many, can provoke performance problems. Techniques can be used to avoid the creation of duplicate keys by concatenating the logical key value with generic /CK values, thereby making the real stored physical key value unique.

Creation of the secondary index pointers can be suppressed by using an exit routine or a **NULLVAL** parameter; this is known as “sparse” secondary indexing.

When designing a secondary index on a database, you must deal with three segments:

Target segment This is a segment in the primary DEDB, regardless of whether it is the root, that you try to access by using the secondary key.

Source segment This is a segment in the primary DEDB that is the source for building the search (secondary) key. The source segment can be the target, or it can be a dependent of the target.

Index (pointer) segment
This is the root segment of the secondary index; the starting point for the alternative processing access.

Figure 3-4 illustrates these aspects.

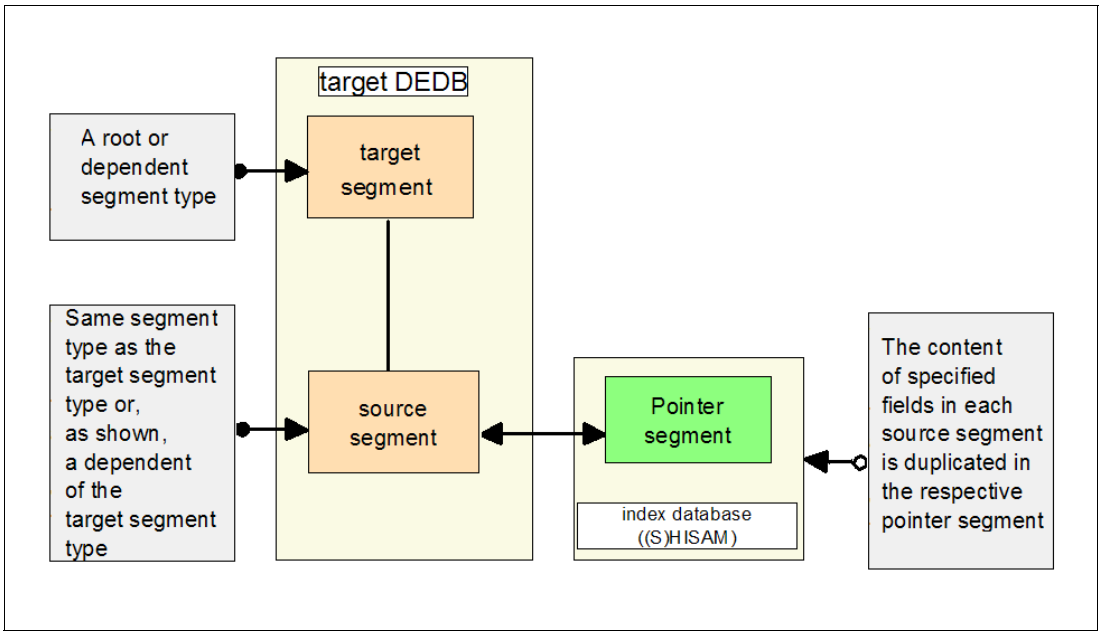

Figure 3-4 Target, source, and pointer segment

The secondary index relationship must be described by **LCHILD/XDFLD** macro statements in the database descriptors of the primary and the index databases. The secondary index key is built from up to five fields in the source segment. These fields do not have to be adjacent in the source segment. They can be placed in any order in the secondary index key.

The pointer from the secondary index to the DEDB is a symbolic pointer. That is, it is the concatenated key of the target segment. By using a symbolic key the secondary index is not affected by reorganizations of the DEDB.

Indices are updated when a source segment is inserted, deleted, or replaced. For the creation of secondary indexes on an existing DEDB, however, a tool (such as IBM IMS Index Builder) or program is required to add a secondary index to an existing database.

Indexing when target is root segment

When the target segment is the root segment, all segments in the DEDB are accessible through the secondary index. This includes SDEP segments.

When accessing a segment through the secondary index, the key feedback area uses the secondary index key for the key of the target segment (the root) and uses the dependent segment keys when they are accessed. The concatenated key in the key feedback area is composed of the secondary index key and the keys of the dependent segments.

Figure 3-5 on page 80 illustrates the physical structure of a database and the structure as viewed when accessing the database through the secondary index. In this case, they are the same because the root segment is also the target segment.

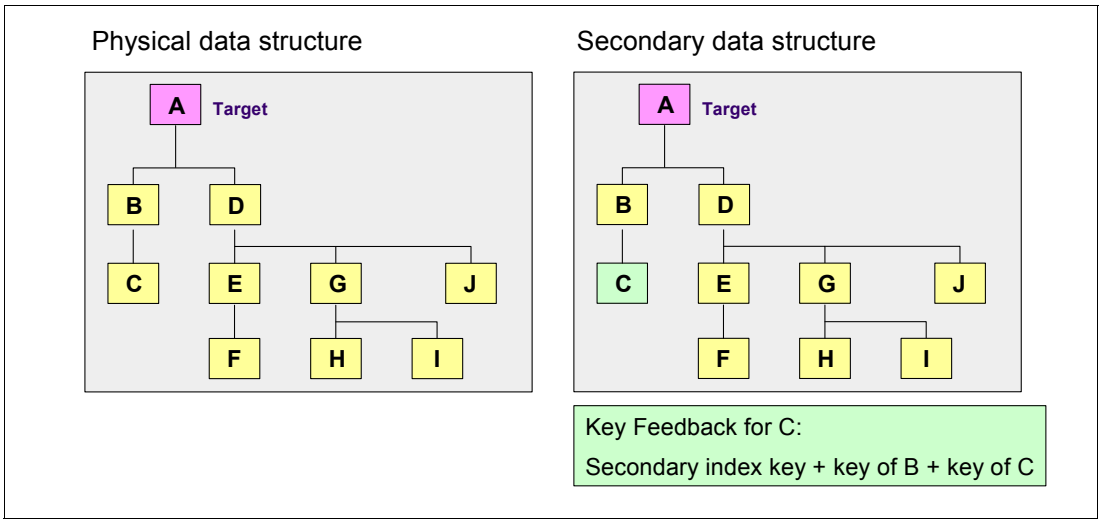

Figure 3-5 Secondary Index where root is target

The key feedback area is composed of the secondary index key and the keys of the dependent segments. The key feedback area for segment C is composed of the secondary index key, the key of segment B and the key of segment C.

Indexing when target is dependent segment

If the target segment is not a root segment in the primary DEDB database, the hierarchy in the database record is conceptually restructured as an inverted structure. The DEDB inverted structure access is limited to a subset of segments.

For DEDB inverted structure access, the target segment, its direct parent segments from the target segment to the root segment, and all its child segments from the target segments are accessible. SDEPs are not accessible through the secondary index. When the target segment is not the root, SDEPs are dependents of the root. They have no children and cannot be source segments. This means that they cannot be target segments.

Important: Fast Path is different from full function. With full function, you have access to all children of the root segment, even those that are not direct parents or dependents of the target segment. The DEDB inverted structure access is limited to a subset of segments.

Figure 3-6 on page 81 illustrates the physical structure of a database and the structure as viewed when accessing the database through the secondary index. In this case, the target is not the root segment. The target is segment G.

The structure as seen from the secondary index path has the target, segment G, as the root. Segment D is the parent of G in the physical structure, so it is the first parent in the secondary structure. Its parent is A, so it is a dependent of D. Segments H and I are the only children of segment G in the physical structure. They are also children in the secondary structure.

The illustration shows the key feedback areas for segments A and H. The key feedback area for A includes the secondary index key, the key of segment D, and the key of segment A. The key feedback area for H includes the secondary index key and the key of segment H.

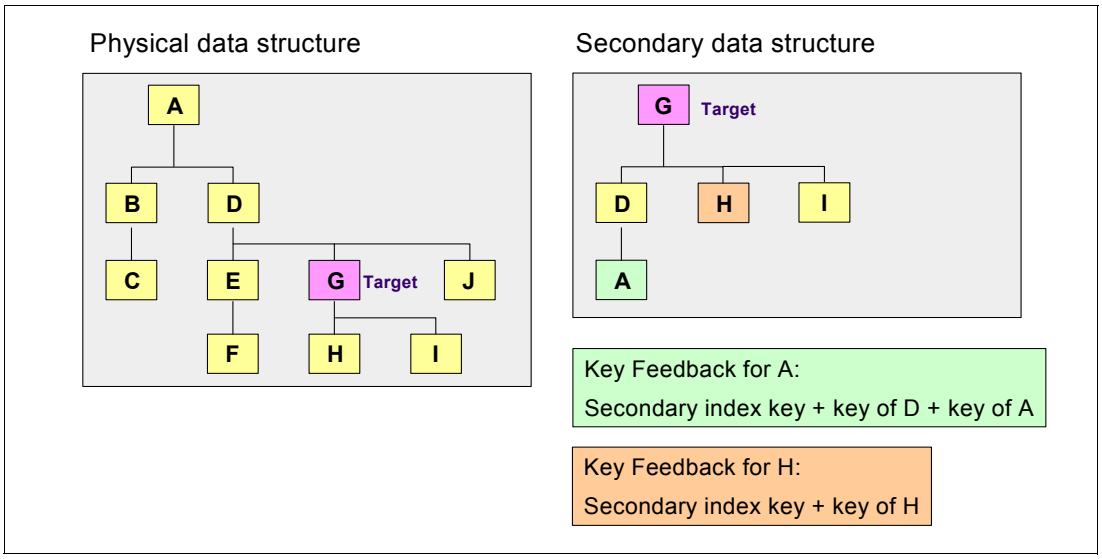

Figure 3-6 Secondary Index where dependent is target

SENSEG statements in program specification block

When accessing a database through the secondary index, the SENSEG statements in program specification block (PSB) must be in the physical structure order. This is different from the requirements for full function databases.

Attention: With full function databases, the SENSEG statements must be in the secondary structure order.

In Figure 3-7, the secondary structure order is G, D, A, H, and I. Nevertheless, the SENSEG statement order is A, D, G, H, and I. This matches the physical structure order for these segments.

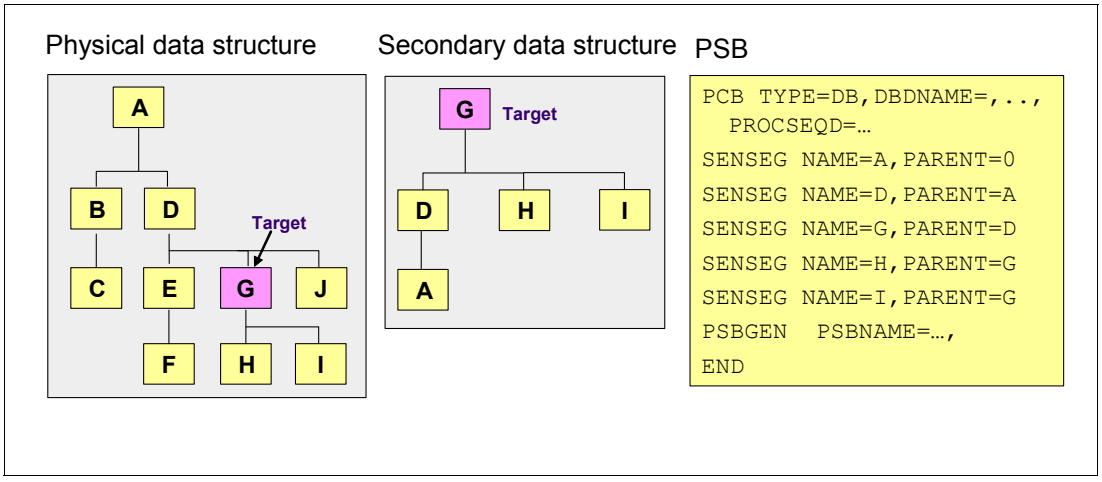

Figure 3-7 SENSEG sequence different from full function, but not processing sequence

When accessing a database through the secondary index, the SENSEG statements in PSB must be in the physical structure order of the DEDB.

This is different from the requirements for full function databases. With full function databases, the SENSEG statements must be in the secondary structure order. In this

illustration the secondary structure order is G, D, A, H, and I. Nevertheless, the SENSEG statement order is A, D, G, H, and I. This matches the physical structure order for these segments.

Attention: Even though the SENSEG statements in the PSB are in physical structure order, the segments are accessed in the secondary structure order when accessing the database through the secondary index. For example, a program using unqualified GN calls accesses segments in the order G, D, A, H, and I, which does not match the order of the SENSEG statements of A, D, G, H, and I.

The order of the segments in the PCB is different, and the order in which the programmer accesses them is unique with DEDB secondary indexes.

DBDGEN for DEDB with secondary index

To include secondary indexes for a DEDB you must specify an LCHILD and XDFLD statement for each secondary index (Example 3-13).

Example 3-13 Secondary indexes for a DEDB

```
LCHILD NAME=(sisegname,sidbname),PTR=SYMB
XDFLD  NAME=searchname,SEGMENT=segmname,                    x
       SRCH=(fldname1,fldname2,),                           x
       DDATA=(fldnamea,fldnameb,),                          x
       SUBSEQ=(fldnamex,fldnamey,),                         x
       NULLVAL=value,EXTRTN=rtnname
```

- The LCHILD statement follows the SEGM statement for the segment that is the target of the secondary index. The **NAME=** parameter specifies the segment in the secondary index and the secondary index database name. The **PTR=** parameter must specify SYMB. This indicates that the pointer is symbolic; the pointer is the concatenated key of the target segment.
- The XDFLD statement follows the LCHILD statement. The XDFLD statement defines the field or fields on which the secondary index is built.

  If the source segment is not the target segment, it is specified in the **SEGMENT=** parameter.

  The source segment can be either the target segment or one of its dependents. If **SEGMENT=** is not included, the source segment is the target segment.

  The field or fields on which the secondary index is built are defined in the **SRCH=** parameter. Up to five fields can be specified. All fields must be in the same segment. The **DDATA=**, **SUBSEQ=**, and **NULVAL=** parameters are optional.

  - **DDATA=** defines duplicate data fields. These are fields in the source segment that are also included in the secondary index segment. They are available to programs that process the secondary index as a database.
  - **SUBSEQ=** defines subsequence fields. These fields are used to sequence secondary index segments that have the same secondary index key. Concatenated key fields (/CKxxxxx) fields can be specified as **SUBSEQ=** fields, which is explained in the following section.
  - Index suppression is optional. It can be specified in two ways, with the **NULLVAL=** parameter and with the **EXTRTN=** parameter. Either, neither, or both can be specified. **NULLVAL=** is a one-byte field. If it is specified, a **SRCH=** value that has this value in all of its bytes will cause index suppression. Index suppression causes no index entry to be created for the source segment. If multiple fields are specified in **SRCH=**, all must have this value for index suppression to be invoked.

EXTRTN= specifies an Secondary Index Database Maintenance exit routine. The exit routine is passed the source segment and determines if an index entry should be built for the segment.

- The **NAME=** parameter specifies the name that can be used to segment search arguments (SSAs) to qualify calls on the value of the secondary index.

DBDGEN for secondary index

The DBD for the secondary index requires **ACCESS=(INDEX,VSAM)** for a HISAM secondary index or **ACCESS=(INDEX,SHISAM)** for a SHISAM secondary index (Example 3-14).

Example 3-14 Secondary index DBDGEN input

```
*ACCESS=(INDEX,VSAM) is used when HISAM database is index
   DBD NAME=indexname,ACCESS=(INDEX,VSAM),FPINDEX=YES
*ACCESS=(INDEX,SHISAM) is used when SHISAM database is index
   DBD NAME=indexname,ACCESS=(INDEX,SHISAM),FPINDEX=YES
*Non-unique keys require overflow data set specification on DATASET statement
   DATASET  DD1=ddname1,OVFLW=ddname2
*SHISAM supports only unique index keys
*Overflow data set is never specified on DATASET statement
   DATASET  DD1=ddname1
```

Tip: You do not specify **ACCESS=(HISAM,VSAM)** or **ACCESS=(SHISAM,VSAM)** for HISAM and HISAM secondary indexes.

- The secondary index has only one SEGM statement. This statement specifies the segment name, **PARENT=0**, and the size (**BYTES=**) of the segment. The segment size includes the size of the secondary index key plus the size of the concatenated key of the target segment. It also includes the size of any subsequence and duplicate data fields. It can be larger than the sum of these fields. If it is larger, the remaining space can be used for user data.
- One or more FIELD statements must be included. The secondary index key is defined with SEQ included in the **NAME=** parameter. If the key including the subsequence field is unique, specify U. If it is not unique, specify M. The **BYTES=** parameter specifies the size of the sequence field. This includes the search fields and subsequence fields. Always specify **START=1**.
- The LCHILD statement **NAME=** parameter specifies the target segment name and the target database. The **INDEX=** parameter value must match what is specified in the **NAME=** parameter on the XDFLD statement in the target database. **PTR=SYMB** must be specified. See Example 3-15.

Example 3-15 Other secondary index-related statements

```
*
   SEGM NAME=segmname,PARENT=0,BYTES=segsize
*
   FIELD NAME=(fldname,SEQ,U|M),BYTES=fldsize,START=1
*
   LCHILD NAME=(targetsegm,targetdb),INDEX=xdfldname,PTR=SYMB
```

Secondary indexes can have either unique or non-unique keys.

- HISAM supports both unique and non-unique keys.
- SHISAM requires unique keys.

Subsequence fields (**SUBSEQ=** on the XDFLD statement) can be used to create unique keys. One way to create unique keys is by using the concatenated key of the source segment as a subsequence field. This is done by including a FIELD statement in the DEDB segment whose name begins with /CK and including this field in the **SUBSEQ=** parameter of the XDFLD statement. The /CK field does not guarantee uniqueness if the keys of the source segment and its parents are not unique.

The /SX field: Secondary indexes for full function databases can use a /SX field to create unique keys. The /SX field is either the four-byte relative byte address (RBA) of the source segment or the 8-byte indirect list key (ILK) of the segment. The ILK is used by HALDB. The /SX field cannot be used with DEDBs. DEDB segments do not have an ILK, and they can be changed by a replace (REPL) call.

Duplicate data can be included in a secondary index by including **DDATA=** on the XDFLD statement. Duplicate data is only available to application programs when they process the secondary index as a *database*. It is not available to them when they use the secondary index to process the DEDB.

SHISAM does not support CI reclaim with data sharing. Therefore, when all index entries from a large range of keys are deleted, data sharing users might prefer to choose HISAM even when the secondary index has unique keys.

- HISAM secondary indexes support non-unique keys. They require an overflow data set. When using non-unique keys, the DATASET statement includes both the **DD1=** parameter and the **OVFLW=** parameter. They specify the DD names for these data sets. If unique keys are used, the DATASET statement specifies only the **DD1=** parameter. Unique keys are supported with both HISAM and SHISAM.

When accessing a segment through the secondary index, the key feedback area uses the secondary index key for the key of the target segment. The key feedback area uses the keys of the other segments when they are accessed. The concatenated key in the key feedback area is composed of the secondary index key and the keys of the other segments in the path from the secondary index.

Figure 3-8 illustrates this concept.

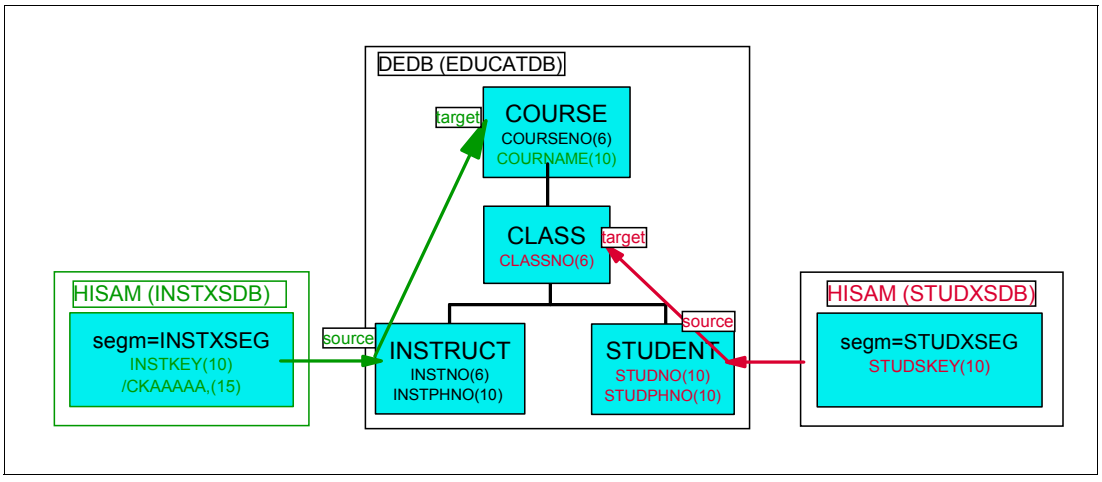

Figure 3-8 Secondary indexes on DEDB

COURSE is the root segment of a DEDB, and course number is a unique key for this segment. This is the primary access. Consider a scenario where we want to add two secondary entries:

- On the root segment, COURSE, we want a secondary entry by using the INSTRUCT segment as entry point with a phonetic search key INSTPHNO. The COURSE segment is the target and segment INSTRUCT is the source. We eliminate duplicates in the secondary index built by including the concatenated key of INSTRUCT, by using a /CK field.
- We implement an access to the CLASS segment, which is the target segment, by using the student segment, which is the source segment. The student key is used to access the courses, taken by a student. In this case, we accept duplicates. Therefore, we must use an HISAM database with overflow.

DBDGEN example A: Root is target with a dependent as source

The example in Figure 3-9 shows a secondary index where the root is the target with a dependent as the source segment:

- The COURSE segment is the target.
- The INSTRUCT segment is the source.

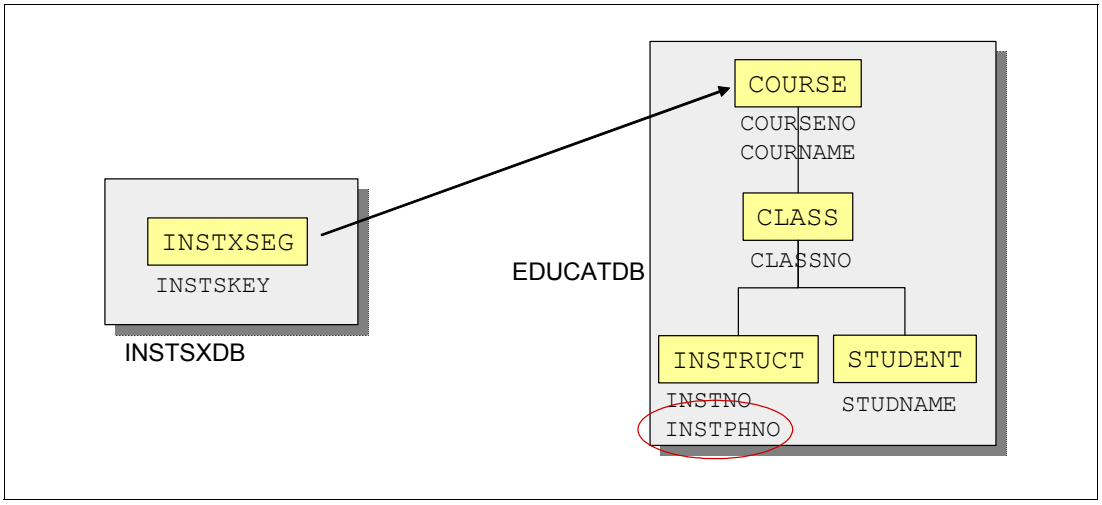

Figure 3-9 ROOT (COURSE) is the target; INSTRUCT is the source

The index is built on the INSTPHNO field. In this example, a /CK field is used to create unique keys.

Figure 3-10 shows the DBD for the DEDB, where:

- Segment COURSE is the target segment.
- Segment INSTRUCT is the source segment.

```
DBD1    DBD  NAME=EDUCATDB,ACCESS=DEDB,RMNAME=RMOD3
AREA    DD1=EDAREA1,SIZE=1024,UOW=(100,10),ROOT=(236,36)
SEGM    NAME=COURSE,PARENT=0,BYTES=100
FIELD   NAME=(COURSENO,SEQ,U),BYTES=5,START=1
FIELD   NAME=COURNAME,BYTES=10,START=6
LCHILD  NAME=(INSTXSEG,INSTSXDB),PTR=SYMB
XDFLD   NAME=XINST,SEGMENT=INSTRUCT,
         SRCH=INSTPHNO,SUBSEQ=/CKAAAAA
SEGM    NAME=CLASS,BYTES=50,PARENT=COURSE
FIELD   NAME=(CLASSNO,SEQ,U),BYTES=6,START=1
SEGM    NAME=INSTRUCT,BYTES=50,PARENT=CLASS
FIELD   NAME=(INSTNO,SEQ,U),BYTES=6,START=1
FIELD   NAME=INSTPHNO,BYTES=10,START=7
FIELD   NAME=/CKAAAAA,BYTES=15,START=1
SEGM    NAME=STUDENT,BYTES=50,PARENT=CLASS
FIELD   NAME=(STUDNO,SEQ,U),BYTES=10,START=1
FIELD   NAME=STUDPHNO,BYTES=10,START=11
FIELD   NAME=STUDNAME,BYTES=20,START=21
DBDGEN
```

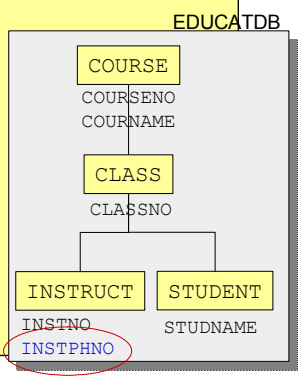

Figure 3-10 DBD for DEDB with target ROOT, source INSTRUCT

The LCHILD and XDFLD statements follow the SEGM statement for COURSE. The LCHILD segment specifies the secondary index segment, INSTXSEG, and database, INSTSXDB. **PTR=SYMB** is specified, as required.

The XDFLD statement specifies the name of the search field, XINST, for use with the secondary index. Because the source segment is not the target segment, the following parameters are used:

- **SEGMENT=INSTRUCT** is specified to indicate that INSTRUCT is the source segment.
- **SRCH=INSTPHNO** specifies that field INSTPHNO is used to build the search field.
- **SUBSEQ=/CKAAAAA** is used to create a unique key.

A FIELD statement with **NAME=/CKAAAAA** is included so that the XDFLD **SUBSEQ=** parameter can reference it (Figure 3-11).

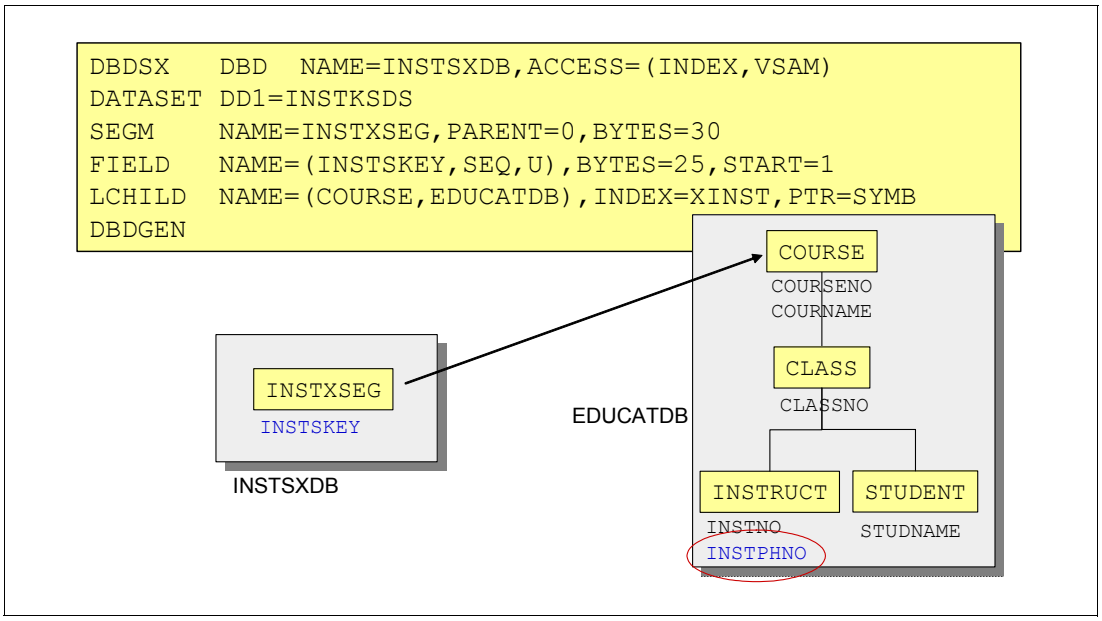

Figure 3-11 DBD for index with target ROOT, source INSTRUCT

Figure 3-11 shows the DBD for the secondary index database, which is HISAM. Therefore, **ACCESS=(INDEX,VSAM)** is specified.

- **DD1=** on the DATASET statement specifies the DD name of the secondary index data set. Because the key is unique, the **OVFLW=** parameter is not specified on the DATASET statement.
- The SEGM statement defines the segment in the secondary index. Its size is 30 bytes. It is composed of the secondary index key (10 bytes), the concatenated key of the INSTRUCT segment (/CKAAAAA field which is 15 bytes), and the symbolic pointer to the target (5 bytes).
- The FIELD statement defines the sequence field in the secondary index. Because the keys are unique, U is specified in the **NAME=** parameter. The size of the sequence field is 25 bytes. This is the size of the INSTPHNO field (10 bytes) in the INSTRUCT segment and the /CKAAAAA field (15 bytes).
- The LCHILD statement specifies the target segment, INSTRUCT, and database, EDUCATDB, in the **NAME=** parameter. The **INDEX=** parameter specifies the **NAME=** value on the XDFLD statement of the target database. This is XINST. **PTR=SYMB** is required for Fast Path secondary index databases.

DBDGEN example B: Target and source are two dependent segments

Figure 3-12 shows a secondary index where the target segment is a dependent segment, and another dependent segment is the source:

- The CLASS dependent segment is the target.
- The STUDENT segment is the source.

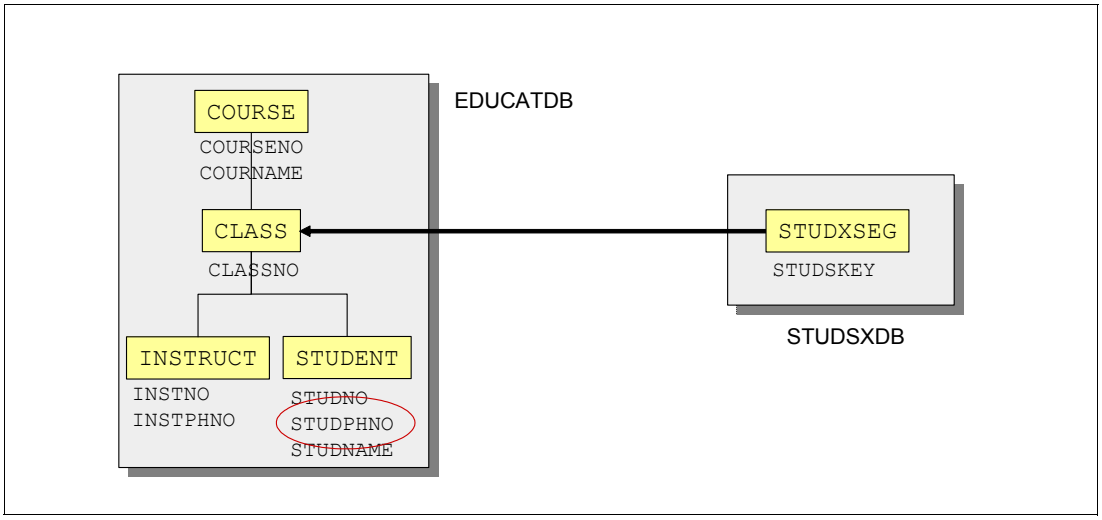

Figure 3-12 CLASS is target, STUDENT is source

The index is built on the STUDPHNO field. We do not use a /CK field, so we can have synonyms for the key.

Figure 3-13 shows the DBD for the DEDB.

```
DBD1    DBD   NAME=EDUCATDB,ACCESS=DEDB,RMNAME=RMOD3
AREA    DD1=EDAREA1,SIZE=1024,UOW=(100,10),ROOT=(236,36)
SEGM    NAME=COURSE,PARENT=0,BYTES=100
FIELD   NAME=(COURSENO,SEQ,U),BYTES=5,START=1
FIELD   NAME=COURNAME,BYTES=10,START=6
SEGM    NAME=CLASS,BYTES=50,PARENT=COURSE
FIELD   NAME=(CLASSNO,SEQ,U),BYTES=6,START=1
LCHILD  NAME=(STUDXSEG,STUDSXDB),MULTISEG=YES,
         PTR=SYMB
XDFLD   NAME=XSTUD,SEGMENT=STUDENT,SRCH=STUDPHNO
SEGM    NAME=INSTRUCT,BYTES=50,PARENT=CLASS
FIELD   NAME=(INSTNO,SEQ,U),BYTES=6,START=1
SEGM    NAME=STUDENT,BYTES=50,PARENT=CLASS
FIELD   NAME=(STUDNO,SEQ,U),BYTES=10,START=1
FIELD   NAME=STUDPHNO,BYTES=10,START=11
FIELD   NAME=STUDNAME,BYTES=20,START=21
DBDGEN
```

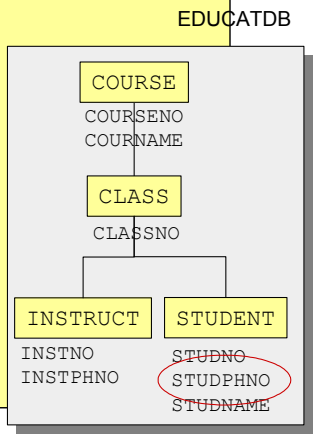

Figure 3-13 DBD for DEDB with target CLASS, source STUDENT

- Segment CLASS is the target segment.
- STUDENT is the source segment.

  The LCHILD and XDFLD statements follow the SEGM statement for CLASS.

The LCHILD segment specifies the secondary index segment, STUDXSEG, and database, STUDSXDB. **PTR=SYMB** is specified, as required.

The XDFLD statement specifies the name of the search field, XSTUD, for use with the secondary index.

- Because the source segment is not the target segment, **SEGMENT=STUDENT** is specified to indicate that STUDENT is the source segment.
- **SRCH=STUDPHNO** specifies that field STUDPHNO is used to build the search field.
- A =/CK field is *not* used to make the STUDENT key unique. Therefore, we have to specify **MULTISEG=YES** in LCHILD.

Figure 3-14 shows the DBD for the secondary index database. It must be HISAM because of the duplicated secondary index keys, therefore, **ACCESS=(INDEX,VSAM)** is specified.

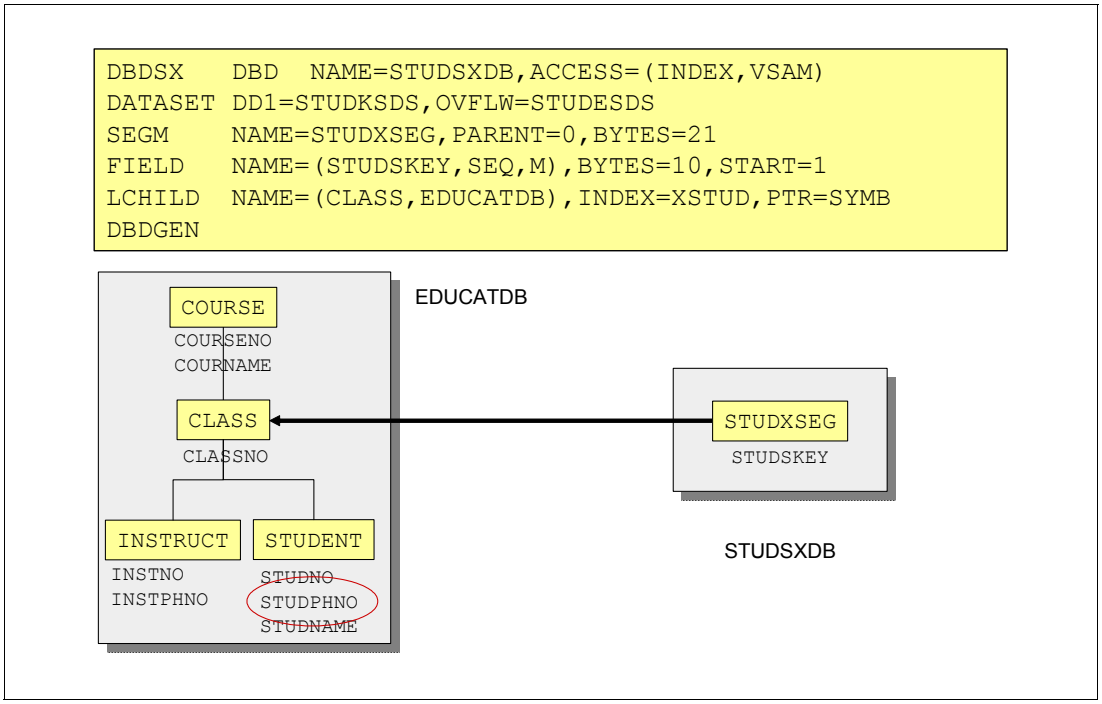

Figure 3-14 DBD for index with target CLASS, source STUDENT

- **DD1=** on the DATASET statement specifies the DD name of the secondary index data set. Because the key is *not* unique, the **OVFLW=** parameter must be specified on the DATASET statement.
- The SEGM statement defines the segment in the secondary index. Its size is 21 bytes. It is composed of the secondary index key (10 bytes) and the symbolic pointer to the target (11) bytes).
- The FIELD statement defines the sequence field in the secondary index. Because the keys are *not* unique, M is specified in the **NAME=** parameter.
- The LCHILD statement specifies the target segment CLASS and database EDUCATDB in the **NAME=** parameter. The **INDEX=** parameter specifies the **NAME=** value on the XDFLD statement of the target database. This is XSTUD. **PTR=SYMB** is required for Fast Path secondary index databases

Secondary indexes for Fast Path databases are invisible to the application program. When a DEDB database needs to be accessed using its Fast Path secondary index, the **PROCSEQD=**

parameter in the PCB is used to specify the name of the Fast Path secondary index database to use to access the primary DEDB database. The **PROCSEQD=** parameter has the same function as the full-function **PROCSEQ=** parameter. The **PROCSEQD=** parameter stands for PROCSEQ for DEDB databases.

When a primary DEDB database is accessed through its secondary index using the PCB with the **PROCSEQD=** parameter, the primary DEDB database is processed in an alternate sequence. The way in which the application program perceives the database record changes. If the target segment is a root segment in the primary DEDB database, the inverted structure in the primary DEDB database that is using the secondary index is the same as the physical structure of the primary DEDB database.

If the target segment is not a root segment in the primary DEDB database, the hierarchy in the database record is conceptually restructured as an inverted structure. The DEDB inverted structure access is limited to a subset of segments. For DEDB inverted structure access, the target segment, its direct parent segments from the target segment to the root segment, and all its child segments from the target segments are accessible.

Figure 3-15 shows the inverted sequence for target segment CLASS.

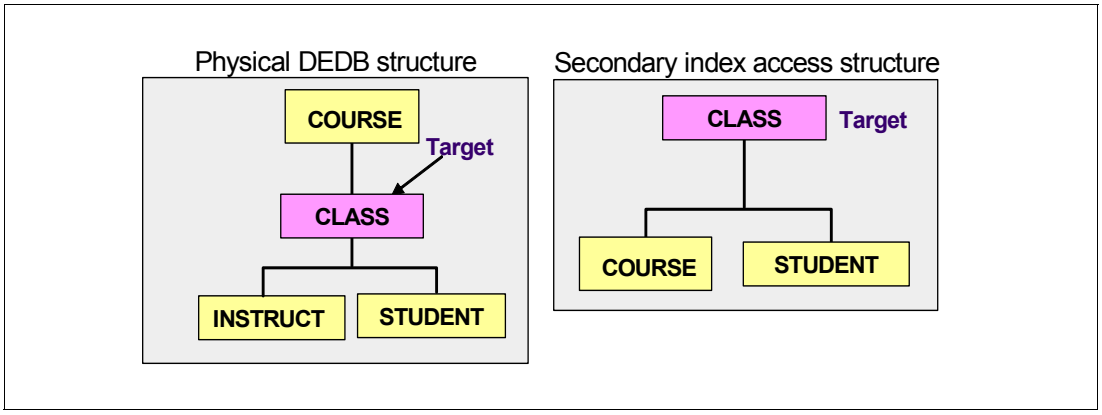

Figure 3-15 Processing sequence with target class

Nevertheless, the SENSEG statements in the PCB must be specified in the hierarchical sequence of the main DEDB (Example 3-16).

Example 3-16 PCB for processing by using the secondary index STUDXSEG

```
PCB TYPE=DB,DBDNAME=EDUCATDB,PROCOPT=G,KEYLEN=30,PROCSEQD=STUDXSEG
SENSEG NAME=COURSE,PARENT=0
SENSEG NAME=CLASS,PARENT=COURSE
SENSEG NAME=STUDENT,PARENT=CLASS
PSBGEN LANG=ASSEM,PSBNAME=CLASSTUD
END
```

When you use a Fast Path secondary index, you must specify the **PROCSEQD=** parameter on the PCB statement in the PSB. Notice that you must specify **PROCSEQD**, and not **PROCSEQ**. The D is added to indicate that the index is for a DEDB.

- The order of the SENSEG statements is the physical order in the indexed database, not the secondary index processing order. In this example, the SENSEG statements appear in the order COURSE, CLASS, and STUDENT.
- The secondary index processing order is CLASS, COURSE, and STUDENT.

The KEYLEN value on the PCB statement must be the larger of:

- The largest concatenated key in the physical structure for any segment which might be accessed by the secondary index. In this case, it is the larger of the concatenated keys for segment STUDENT (5+6+10).
- The largest concatenated key in the secondary structure. The key of the target segment in the secondary structure is the secondary index key. In this case, the target is segment CLASS. The largest concatenated key is the secondary index key plus the largest of the keys for segments COURSE and STUDENT (6+10).

Secondary indexes for Fast Path databases have e capabilities that are not available with secondary indexes for full function databases.

The first of these capabilities is user data partitioning (Figure 3-16) so that a secondary index can be spread across multiple physical databases. This supports large indexes.

Each index database contains a range of keys. Either HISAM or SHISAM can be used, but all “partitions” in an index must be the same type. Index keys are assigned to an index database by a user partition selection exit routine. The index that is passed is the secondary index key.

Each database in an index must have the same structure and attributes. The databases might have different sizes to accommodate the number of entries that can exist in the different key ranges.

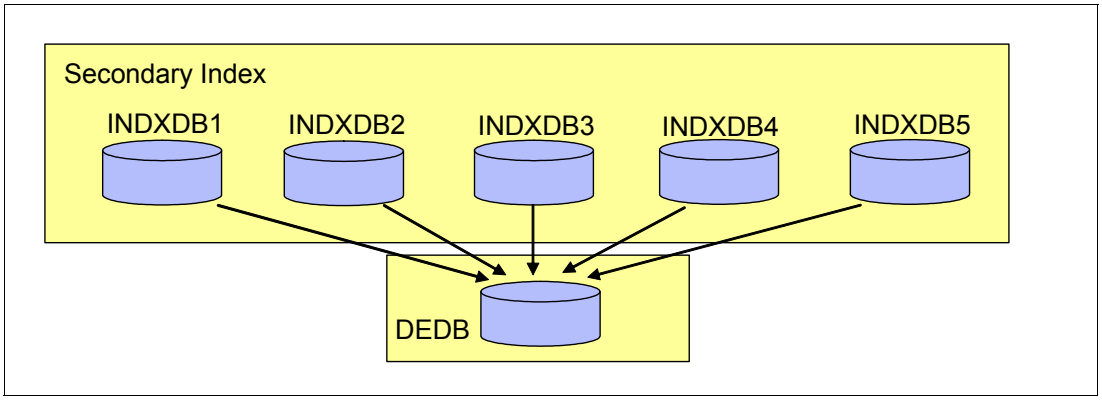

Figure 3-16 User partitioning for secondary indexes

To use this facility, you must use special keywords in the DBD definition of the DEDB (Example 3-17).

Example 3-17 DBD additional keywords for user partitioning

```
* Specify multiple index databases on DEDB LCHILD statement
   LCHILD NAME=(segname,(db1name,db2name,…)),PTR=SYMB
* Specify PSELRTN= on DEDB XDFLD statement
* Optionally specify PSELOPT= on DEDB XDFLD statement
   XDFLD NAME=searchname,SRCH=fldname,PSELRTN=rtnname,PSELOPT=MULT|SNGL,…
```

User data partitioning is defined by specifying multiple database names on the LCHILD statement in the indexed database. The order of the databases in the LCHILD statement determines the order in which the index partitions are processed by get next calls. This means that a get next call that reaches the end of an index database will continue to the next database defined in the LCHILD statement.

User data partitioning also requires the specification of **PSELRTN=** on the XDFLD statement in the indexed database. This parameter specifies the user partition selection exit routine.

The partition selection routine is called when an insert or qualified get call is issued. The routine determines which secondary index database is used for the call. That is, it is used to specify in which database a secondary index key is stored. The routine can be shared by multiple secondary indexes. These indexes might be on different databases.

A sample partition selection routine, DBFPSE00, is supplied by IMS.

You can specify the **PSELOPT=** parameter on the XDFLD statement.

The partition selection option controls whether only one secondary index user partition is used for a call. It is only used with secondary index processing. This means that **PROCSEQD=** must be specified in the PCB used for the call.

The value specified for **PROCSEQD=** must be the first partition.

- **PSELOPT=MULT** indicates that all partitions are used. A “GB” (end of database) status code is returned when the end of the last secondary index partition is reached.
- **PSELOPT=SNG**L indicates that only one partition is used. A “GB” status code is returned if the call reaches the end of the current partition. The **PSELOPT=** parameter can be specified in two places, the DBD and the PCB. The specification in the PCB overrides the specification in the DBD. If neither is specified, the **PSELOPT=MULT** parameter is used.

The second of these capabilities is support for multiple secondary index segments. This is one index created from different fields in the same source segments.

Because the index has one key size, the search fields must be the same size. With this capability, you can build one index from similar data that is stored in different fields. An example is an index based on telephone numbers. Multiple phone numbers, such as home phone, work phone, and cell phone can be stored in different fields, but only one index is used. The index might have an entry for each phone number.

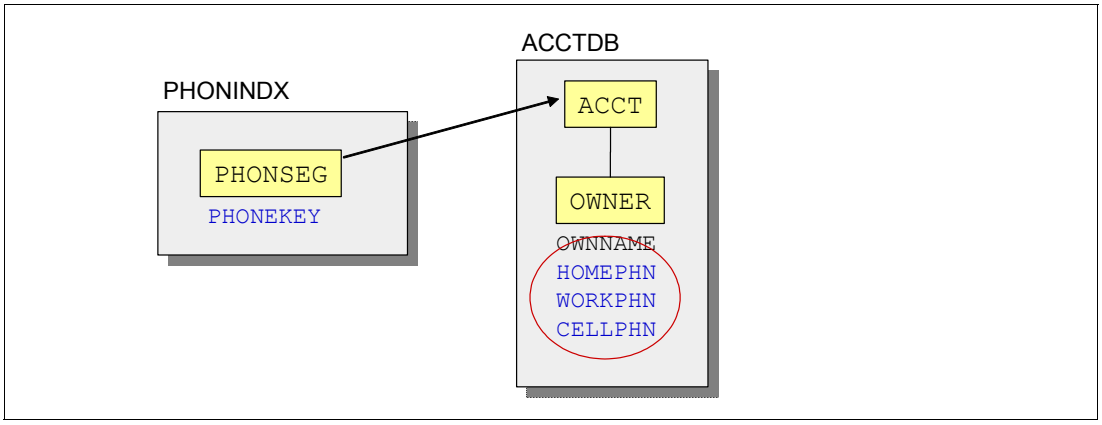

Figure 3-17 Multiple secondary index segments

Multiple secondary index segments is the support for one index created from different fields in the same source segments. Each search field (or set of search fields) is used to create an entry in the secondary index. These fields or sets of fields must be the same size. In this example, telephone numbers in the OWNER segment have three fields. The index might contain an entry for each phone number.

Example 3-18 DBDGEN statements for multi secondary index segments

```
LCHILD NAME=(sisegname,sidbname),PTR=SYMB,MULTISEG=YES
XDFLD ..................NULLVAL=value1
```

Multiple secondary index segments are defined by including multiple LCHILD and XDFLD statement pairs in the indexed database (Figure 3-18).

The LCHILD segment must include the **MULTISEG=YES** parameter. **MULTISEG=NO** is the default for this parameter.

The **NULLVAL=** parameter is useful for avoiding the creation of secondary indices without a value. With this parameter, you suppress the creation of index pointer segments when the index source segment data used in the search field of an index pointer segment contains the specified value.

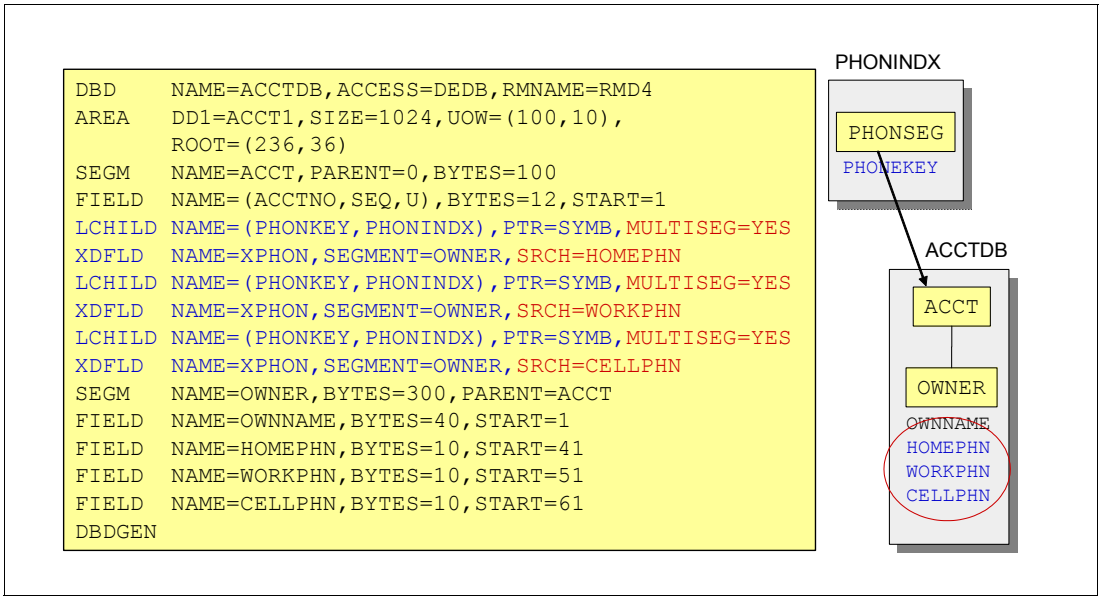

Figure 3-18 DBD for DEDB with multiple secondary indexes

Multiple LCHILD and XDFLD statements refer to the same secondary index. The LCHILD statements are the same. The XDFLD statements have the same **NAME=** and **SEGMENT=** parameters. The **SRCH=** parameters point to the various fields that are used for indexing.

Example 3-19 DBD for index database with multiple secondary indices

```
DBDSX   DBD  NAME=PHONINDX,ACCESS=(INDEX,VSAM)
        DATASET DD1=PHONKSDS,OVFLW=PHONOVFL
        SEGM    NAME=PHONSEG,PARENT=0,BYTES=22
        FIELD   NAME=(PHONEKEY,SEQ,U),BYTES=10,START=1
        LCHILD  NAME=(OWNER,ACCTDB),INDEX=XPHON,PTR=SYMB
        DBDGEN
        END
```

In this example, the XDFLD statements in the DEDB DBD might include the **NULLVAL= ' '** parameters to specify that a secondary index entry is not built when the phone field contains blanks.

Creating DEDBs with secondary indexes

The following two scenarios are considered:

- Adding a secondary index to an existing DEDB
- Creating a new DEDB with a secondary index

Adding a secondary index to an existing DEDB

To add a secondary index on an existing DEDB, complete these steps:

1. Modify the DEDB DBD.
2. Add the LCHILD and XDFLD statements.
3. Create a secondary index DBD.
4. Allocate secondary index data sets.
5. Create a PSB with the **PROCSEQD=** parameter in PCB.
6. Run the **DBDGEN** and **PSBGEN** utilities, and then run the **ACBGEN** utility.
7. Take DEDB offline.
8. Run tool or user program to create the secondary index.
9. Add a secondary index to the system definition.
10. Run the **CREATE DB** command or system definition and online change.
11. Add any new programs and transactions that use the secondary index.
12. Run the **CREATE** commands or system definition and online change.
13. Make an online change for application control blocks library (ACBLIB).
14. Start DEDB.

You need to write a program to load the secondary index databases or use a tool. This program or tool must fill the segments of the secondary indices. Several fields must be filled depending on the XDFLD description of the contents of the SI.

Figure 3-19 shows an overview of the different segment layouts that are possible, depending on the index organization (HISAM, SHISAM), or whether we have duplicate (only with HISAM) SI values.

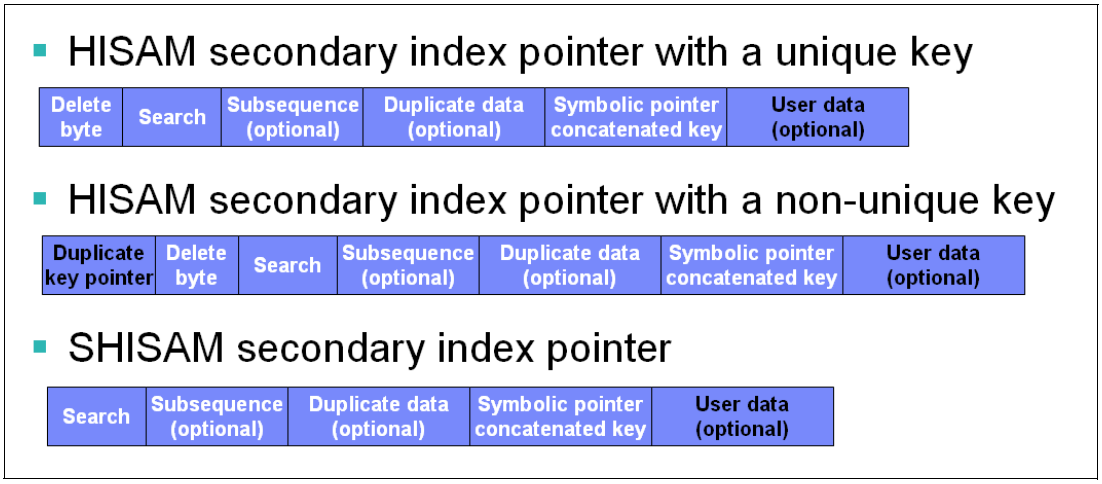

Figure 3-19 Secondary index segment layouts

If the secondary index key is not unique then an additional pointer field of length 4 is added in front of the segment. This is the duplicate key pointer, pointing to extensions in the ESDS data set. In Figure 3-19 on page 94, we recognize the following fields:

- Prefix

  Delete byte: one byte

- Data fields:

  Search This is the key of the secondary index. It contains variable-length bytes, made up of up to 5 fields from the source.

  Subsequence This is used to make the secondary index key unique. It contains variable-length bytes, made up of up to 5 fields from the source or IMS-generated values (optional). It is used to make the secondary index key unique. It can be used to order segments in a secondary index database. The search field and the subsequence field together make up the key of the secondary index.

  Duplicate data This is only used when processing the secondary index as a database. It contains variable-length bytes, made up of up to 5 fields from the source (optional). It is only used when processing the secondary index as a database.

  Symbolic pointer concatenated key
  This contains variable-length bytes. It is the concatenated key to the target.

  User data This contains variable-length bytes, made up of any user data fields (optional). It is only used when processing the secondary index as a database.

  Duplicate key pointer
  This is the pointer to chain duplicated segments. It points into the overflow data set of the index, which is a VSAM ESDS.

The IMS High Performance Fast Path Utilities offering is used for validating and building secondary indexes on Fast Path databases. Although this tool is described in Chapter 10, “Tools for IMS 12” on page 385, a brief overview is provided here.

FPA Secondary Index (FPSI) support provides build and analyze capabilities for the Fast Path secondary index databases that are supported in IMS 12 with the following features:

- HISAM/SHISAM secondary index databases
- Unique Key/Non-Unique Key
- Sparse Indexing
- Symbolic Pointer
- Multiple Secondary Index Segments
- Partition Selection

For more information, see *IBM Fast Path Solution Pack for z/OS V1R1, IMS High Performance Fast Path Utilities User’s Guide*, SC19-2914.

The HPFPU Build Index function (INDEXBLD) is related to Fast Path secondary indexes. This function (Figure 3-20 on page 96) builds all FPSI databases of DEDB areas when the secondary indexes are defined against the existing DEDB. It can build multiple secondary index databases in one job step, and can rebuild the specific secondary index databases in case of system failures. APAR PM37894 has enabled the new INDEXBLD function for users of the IMS Database Recovery Facility under IMS 12.

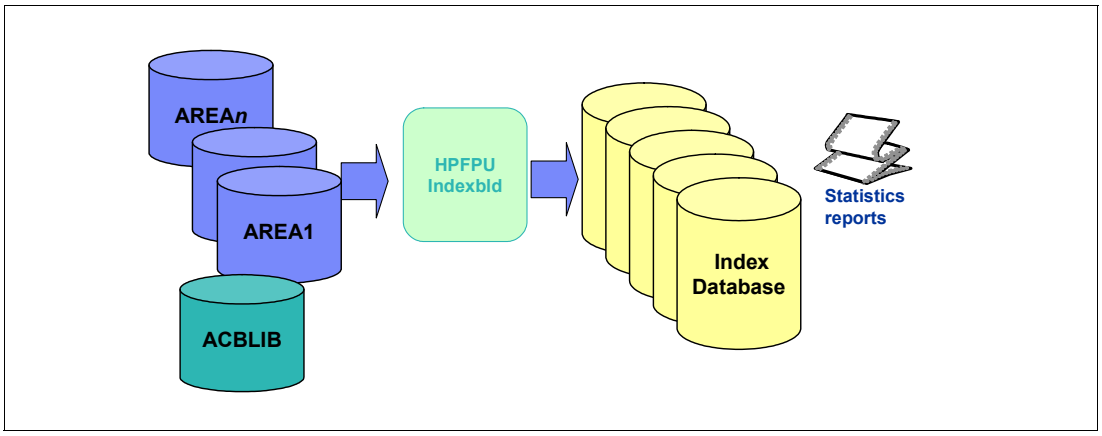

Figure 3-20 Building Fast Path index with HPFPU

This function reduces the amount of time that it takes to build multiple secondary index databases using both parallel sorting and parallel loading. It also provides the following new reports:

- Secondary Index Definition Report
- Secondary Index Processing Report

FPSI data set names are identified with the member in the DFSMDA library. You can also specify in the JCL DD statements. The **NOTIFY.REORG** command is issued for FPSI databases when the **DBRC=YES** parameter is specified (Example 3-20).

Example 3-20 JCL and control information for INDEXBLD function

```
//HFP      EXEC PGM=HFPMAINO
//STEPLIB  DD DISP=SHR,DSN=HPFP.SHFPLMDO
//         DD DISP=SHR,DSN=IMSVS.SDFSRESL
//         DD DISP=SHR,DSN=IMSVS.PGMLIB
//IMSACB   DD DISP=SHR,DSN=IMSVS.ACBLIB
//IMSDALIB DD DISP=SHR,DSN=IMSVS.MDALIB
//IMS      DD DISP=SHR,DSN=IMSVS.DBDLIB
//HFPSYSIN DD *
  GLOBAL DBRC=YES
  INDEXBLD DBD=DEDBJN22,ITASKCTL=4,IAREA=ALL,INDEXDBD=ALL
/*
```

Creating a new DEDB with a secondary Index

In this case, a tool or user-written program is not required to build the secondary index. Instead, the insertion of source segments in the DEDB causes the secondary index entries to be created.

To create a new DEDB with a secondary index and to create entries in the secondary index, complete these steps:

1. Create a DEDB DBD with the LCHILD and XDFLD statements.
2. Create a secondary index DBD.
3. Allocate the DEDB and secondary index data sets.
4. Create a PSB with the **PROCSEQD=** parameter in PCB.
5. Run the **DBDGEN** and **PSBGEN** utilities, and then run the **ACBGEN** utility.

6. Add the DEDB and secondary index to the system definition.
7. Run the **CREATE DB** commands or system definition and online change.
8. Add any new programs and transactions to the system definition.
9. Run the **CREATE** commands or system definition and online change.
10. Make an online change for ACBLIB.
11. Run the DEDB Initialization utility.
12. Load the DEDB.

An alternative method for adding a secondary index to an existing DEDB without requiring tool is to unload the DEDB database, and then use the same steps as documented here.

3.3.5 DEDB buffer pool enhancements

The DEDB buffer pool enhancements capability applies to DEDBs for both DBCTL and IMS Transaction Manager (TM) or database environment support. It was introduced in IMS 11 and has been enhanced in IMS 12.

IMS 11

In any IMS with the database manager, buffers are needed to fulfill requests from database calls are obtained from a global pool called the *Fast Path buffer pool*.

If you are using the Fast Path 64-bit buffer manager, IMS creates and manages the Fast Path buffer pools for you and places DEDB buffers in 64-bit storage. The buffers are placed in virtual storage above 2G, above the bar. The 64-bit buffer manager creates multiple subpools with different buffer sizes. The 64-bit buffer manager creates an initial allocation of subpools based on the number of areas of each CI size. It automatically created more buffers in a subpool when they were needed. This is only possible when you have the Z/architecture enabled. When the Fast Path 64-bit buffer manager is enabled, you do not need to design DEDB buffer pools or specify the **DBBF**, **DBFX**, and **BSIZ** parameters that define Fast Path buffer pools.

In IMS 11, you can enable the Fast Path 64-bit buffer manager by specifying **FPBP64=Y** in the Fast Path section of DFSDFxxx PROCLIB member (Example 3-21).

Example 3-21 IMS 11 Fast Path specifications in DFSDFXXX

```
<SECTION=FASTPATH>
FPBP64=Y,FPBP64M=xxxxxx (set maximum storage used)
```

When the Fast Path 64-bit buffer manager is enabled, IMS ignores the **DBBF**, **DBFX**, and **BSIZ** parameters, if specified.

IMS 12

IMS 12 enhances the Fast Path 64-bit buffer manager, which was introduced in IMS 11. With IMS 12, you can specify the initial amount of 64-bit storage used for the buffer pool. Buffer pools are pre-expanded, that is, expanded in anticipation of future needs. They are compressed when the use of a subpool drops. IMS 12 moves some buffers that were still in extended common service area (ECSA) to 64-bit storage. Finally, IMS 12 enhances the **QUERY POOL TYPE(FPBP64)** command output.

The keywords FPBP64D, FPBP64C, FPBP64E, and FPBP64SR are introduced in IMS 12 and are described here:

- **FPBP64D=N** is the default. This default leaves the initial allocation as it was in IMS 11.
- If **FPBP64D=Y** is specified in the FASTPATH section of the DFSDFxxx PROCLIB member, the **DBBF=** execution parameter is used to determine the initial number of buffers. The initial number of buffers is 25% of the DBBF specification. These buffers are allocated among different buffer sizes based on the number of areas with different CI sizes.

  For example, if a DBBF specification is 8000, then 2000 (25% of 8000) buffers will be used for the initial allocation:

  – 100 areas with a 1 K CI size
  – 200 areas with a 2 K CI size
  – 700 areas with a 4 K CI size.

  The sum of 100+200+700 is a total of 1000 areas.

  10% of the areas have a 1 K CI size, 200 (10% of 2000) 1 K buffers are initially allocated.

  20% areas have 2 K CI size, 400 (20% of 2000) 2 K buffers are initially allocated.

  70% areas have 4 K CI size, 1400 (70% of 2000) 4 K buffers are initially allocated.
- If **FPBP64D=Y** is specified but there is no DBBF specification, the initial allocation is the same as it was in IMS 11.
- With **FPBP64E**, you can disable the pre-extension code in a way that is similar to how you can disable the compression code with FPBP64C.

IMS 11 expands a 64-bit subpool when a DL/I call requires a buffer but none is available. IMS 12 has an option to expand subpools in anticipation of the need for more buffers. When a subpool is almost out of available buffers, the extension process is initiated asynchronously. As the volume of buffer requests increase, the subpool extension process will increase the pace at which subpools are extended. By the time the additional buffers are required, the subpool should have been extended, avoiding wait-for-buffer conditions.

IMS 12 also adds the capability to compress subpools when there are substantial unused buffers. IMS resizes the subpool after 24 hours if it is grossly overallocated in size. Subpools are compressed by reducing the number of buffers in the subpool, which is the default.

Subpools can also be deleted. That is, all of the buffers of a certain size can be deleted. This will only be done when none of the buffers of this size have been used for more than 24 hours. If buffers of this size are needed again, the subpool will be rebuilt. The compression and deletion actions are the default. They can be disabled by specifying **FPBP64C=N** in the FASTPATH section of the DFSDFxxx PROCLIB member.

The use of the 64-bit Fast Path buffer manager in IMS 11 did not put all buffers in 64-bit storage. Buffers in ECSA were used for MSDBs, SDEP inserts and FLD calls by IMS 11. Additionally, ECSA storage was used for buffer headers and control blocks.

- IMS 11 emergency restart uses ECSA buffers for all SDEP processing.
- IMS 12 uses 64-bit buffers for FLD calls.
- IMS 12 emergency restart uses 64-bit buffers for SDEPs unless FPBP64SR=N is specified.

IMS 12 increases the size of the extents if too many extents exist, which keeps the number of extents to a minimum.

IMS 12 enhances the **QUERY POOL TYPE(FPBP64)** command from IMS 11. The new **SHOW(STATISTICS)** option provides a subset of the data returned with the **SHOW(ALL)** option,

which was the only **SHOW** option available in IMS 11. The **SHOW(ALL)** option provided so much information that, at times, it was difficult to find the most interesting data. The **QUERY POOL TYPE(FPBP64) SHOW(ALL)** was also reformatted for easier reading.

The **QUERY** command in IMS 12 also provides data on extended private (EPVT) use. It provides new status information for subpools. The status shows if a pool is being compressed, expanded, or deleted.

If you are not using the Fast Path 64-bit buffer manager, you must specify the characteristics of the pool yourself during IMS system definition and during IMS startup.

3.4 CICS threadsafe support

Release of CICS Transaction Server for z/OS Version 4.2 includes scalability enhancements that allow more work to be done faster in a single CICS system. These enhancements allow increased vertical scaling and can decrease the need to scale horizontally, thus reducing the number of regions that are required to run the production business applications.

The scalability enhancements in CICS Transaction Server Version 4.2 fall into two broad areas: increased exploitation of Open Transaction Environment (OTE) and increased exploitation of 64-bit storage. For more information, see *IBM CICS Scalability: New Features in V4.2*, REDP-4787.

CICS OTE is an architecture that was introduced for the following purposes:

- To allow parallelism in using the mainframe resources, increasing the throughput of work through the system
- To improve the performance of existing applications accessing external resource managers, such as IMS and DB2
- To enrich the CICS application programming interface by providing application interfaces supplied by other software components and allowing CICS applications to use these interfaces

To benefit from OTE, your applications need to be threadsafe. OTE enhancements make more of the CICS API and system programming interface (SPI) threadsafe, including access to IMS databases through the CICS-DBCTL interface. This CICS threadsafe function was added with CICS V4.2 for IMS V12 with APARs PM31420 and PM47327.

With these APARs, IMS 12 provides the coordinator controller (CCTL) database resource adapter (DRA) Open Thread TCB (OTT) enhancement. IMS 12 now provides the option for CCTL exploiters to direct the DRA not to attach dedicated DRA thread task control blocks (TCBs). This option avoids the overhead of TCB switching for IMS database calls and lead to improved parallel processing (Figure 3-21 on page 100).

CICS TS 4.2 extends the threadsafe support to the DBCTL/DRA interface taking advantage of the DRA OTT support. The enhancement applies to both EXEC DLI and CALL DLI.

Without this enhancement, the IMS CCTL DRA attaches dedicated thread TCBs in the CCTL address space. PSB schedule requests are assigned one of these thread TCBs. All subsequent thread-related DL/I requests result in the application's task being suspended, and processing switches onto the DRA thread TCB to complete the DL/I request. Upon returning, the application's task is resumed, switching processing off the DRA thread TCB which is then suspended awaiting the next DL/I request. This sequence of events is repeated for each DL/I

call, sync point requests, and thread termination, at which time the DRA thread TCB becomes available for a new PSB schedule request.

The expected resulting benefits are lower CPU usage and increased throughput.

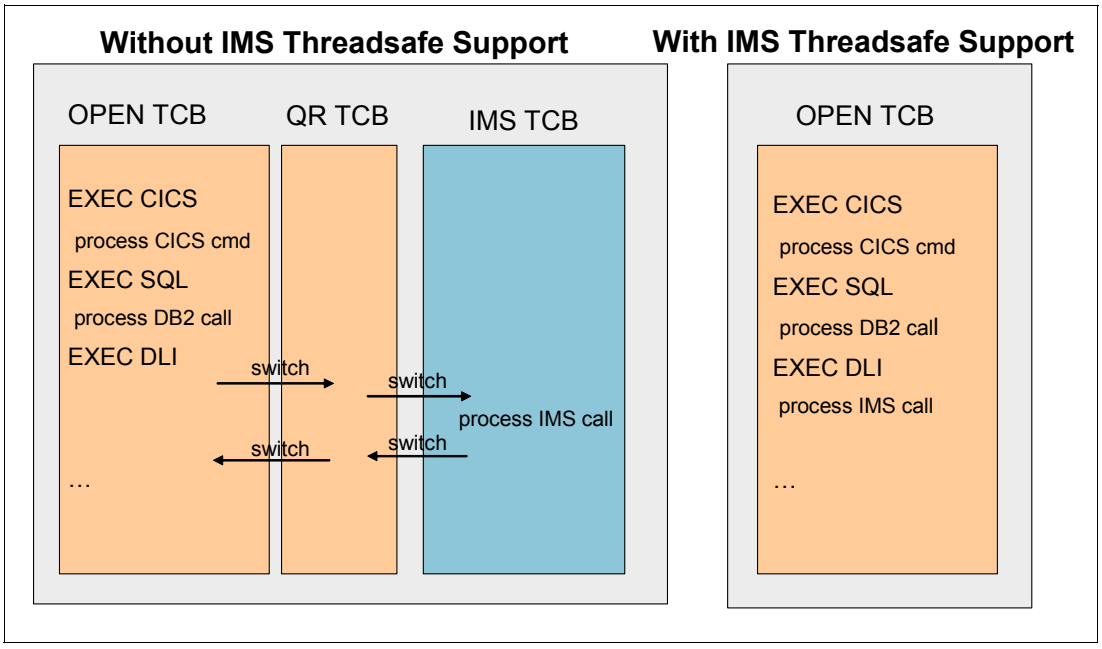

Figure 3-21 TCB switching with threadsafe support for CICS accessing IMS database

3.5 Miscellaneous enhancements

IMS 12 contains other miscellaneous enhancements. Various changes improve the logging and the locking process, or avoid some abends, or help you to better understand problems by issuing new or enriched messages.

3.5.1 Status messages for DB exit routines

If an HDAM or PHDAM database is opened as the result of an open command of the database, message `DFS2842I` is issued. See Example 3-22. Either `LOADED` or `SHARED` is displayed in the message. The `DFS2842I` message is issued for full function databases as a result of the following commands:

```
/START DB dbname OPEN
UPDATE DB NAME(dbname) START(ACCESS) OPTION(OPEN)
```

Example 3-22 DFS2842I message

```
DFS2842I RANDOMIZER name FOR database IS LOADED|SHARED
```

Where:

- LOADED appears when the routine is loaded as a result of the open of the database.
- SHARED appears when the routine is already in memory due to its use by another database.

When the database is closed as the result of a command, either GONE or SHARED is displayed in message DFS2838I (Example 3-23).

Example 3-23 DFS2838I message

```
DFS2838I RANDOMIZER name FOR database IS DELETED AND GONE|SHARED
```

The DFS2838I message is issued for full function databases as a result of the following commands:

- **/DBR DB dbname**
- **/DBD DB dbname**
- **/STO DB dbname**
- **/STA DB dbname**
- **UPDATE DB NAME(dbname) STOP(ACCESS\UPDATES\SCHD)**
- **UPDATE DB NAME(dbname) START(ACCESS)**

In message DFS2838I:

- GONE appears when the routine is deleted from memory.
- SHARED appears when the routine remains in memory due to its use by another database.

If an HALDB database uses a partition selection exit routine, the DFS2406I message is issued when the database is opened or closed as the result of a command. When the database is opened, either LOADED or SHARED is displayed in the message. The following commands are among those that might cause the DFS2406I message to be issued:

- **/START DB HALDBmaster OPEN**
- **UPDATE DB NAME(HALDBmaster) START(ACCESS) OPTION(OPEN)**
- **UPDATE DB NAME(HALDBmaster) STOP(ACCESS|UPDATES|SCHD)**
- **/DBR DB HALDBmaster**
- **/DBD DB HALDBmaster**

These messages are especially useful when replacing a shared exit routine. They clearly indicate if the old routine has been deleted and if a new routine has been loaded (Example 3-24).

Example 3-24 DFS2406I message

```
DFS2406I THE HALDB PARTITION SELECTION EXIT ROUTINE rname FOR THE HALDB dbname IS
LOADED|GONE|SHARED
```

When the database is opened, either LOADED or SHARED appears in the message.

- LOADED appears when the routine is loaded as a result of the opening of the database.
- SHARED appears when the routine is already in memory due to its use by another database.

When the database is closed, either GONE or SHARED appears in the message.

- GONE appears when the routine is deleted from memory.
- SHARED appears when the routine remains in memory due to its use by another database.

3.5.2 Lock timeout message and logging

IMS 12 adds optional DFS2291I diagnostic messages for lock timeouts (Example 3-25) and writes log record x'67D0' subtype x'1B' for lock timeouts. Both contain the same information.

If the wait for a lock exceeds the IMS LOCKTIME value when using the internal resource lock manager (IRLM), then the lock request is rejected and either the waiter is abended with a U3310 or a BD status code is returned to the program.

Example 3-25 Multiple DFS2291I messages

```
DFS2291I LOCKNAME=090000100480100ID7                      I12A
DFS2291I DBNAME=IVPDB1   LOCKFUNC=GET LCL AND GBL ROOT LOCKS              I12A
DFS2291I BLOCKER PST=0001 TRAN=IMSBLK65 PSB=DFSIVP65 TYPE=BMP I12A
DFS2291I BLOCKER TRANELAPSEDTIME=00:00:35 IMSID=I12B     I12A
DFS2291I BLOCKER RECOVERY TOKEN=I12B    0000002D00000000 I12A
DFS2291I WAITER01 PST=0002 TRAN=IMSDLK65 PSB=DFSIVP65 TYPE=BMP I12A
DFS2291I WAITER01 TRANELAPSEDTIME=00:00:35 IMSID=I12D     I12A
DFS2291I WAITER01 RECOVERY TOKEN=I12D    0000002700000000 I12A
DFS2291I VICTIM PST=0001 TRAN=IMSALK64 PSB=DFSIVP64 TYPE=BMP I12A
DFS2291I VICTIM TRANELAPSEDTIME=00:00:17 IMSID=I12A     I12A
DFS2291I VICTIM RECOVERY TOKEN=I12A    0000000E00000000 I12A
DFS2291I LOCKNAME=090001301480120ID7                      I12A
DFS2291I DBNAME=IVPDB2   LOCKFUNC=GET LCL AND GBL ROOT LOCKS              I12A
DFS2291I BLOCKER PST=0001 TRAN=IMSCLK64 PSB=DFSIVP64 TYPE=BMP I12A
DFS2291I BLOCKER TRANELAPSEDTIME=00:00:38 IMSID=I12C     I12A
DFS2291I BLOCKER RECOVERY TOKEN=I12C    0000000E00000000 I12A
DFS2291I WAITER01 PST=0002 TRAN=IMSDLK65 PSB=DFSIVP65 TYPE=BMP I12A
DFS2291I WAITER01 TRANELAPSEDTIME=00:00:35 IMSID=I12D     I12A
DFS2291I WAITER01 RECOVERY TOKEN=I12D    0000002700000000 I12A
DFS2291I WAITER02 PST=0001 TRAN=IMSDLK64 PSB=DFSIVP64 TYPE=BMP I12A
DFS2291I WAITER02 TRANELAPSEDTIME=00:00:35 IMSID=I12D     I12A
DFS2291I WAITER02 RECOVERY TOKEN=I12D    0000002800000000 I12A
DFS2291I WAITER03 PST=0006 TRAN=IMSBLK64 PSB=DFSIVP64 TYPE=BMP I12A
DFS2291I WAITER03 TRANELAPSEDTIME=00:00:35 IMSID=I12B     I12A
DFS2291I WAITER03 RECOVERY TOKEN=I12B    0000002C00000000 I12A
DFS2291I VICTIM PST=0005 TRAN=IMSALK65 PSB=DFSIVP65 TYPE=BMP I12A
DFS2291I VICTIM TRANELAPSEDTIME=00:00:17 IMSID=I12A     I12A
DFS2291I VICTIM RECOVERY TOKEN=I12A    0000000F00000000 I12A
```

The first example is for the multiple line message. If the same lock has other waiters, they are also listed with the word WAITER where VICTIM appears in this example. The second example is for the single line or "short" message.

In this example, BMP IMSBLK65 using PSB DFSIVP65 on IMS I12B holds a local and global root lock in database IVPDB1. The elapsed time of this update is now 35 seconds. Another BMP IMSDLK65 using the same PSB DFSIVP65 on IMS I12D is waiting on this lock. Its elapsed time is now 35 seconds. The victim on IMS I12A is a BMP IMSALK64 using PSB DFSIVP64 on IMS system I12A.

Example 3-26 shows a similar problem except this time IMS is configured to only issue the short form of the DFS2291I message.

Example 3-26 Short form of the DFS2291 message

```
DFS551I BATCH   REGION IMSCLK64 STARTED ID=00004 TIME=0942  I12C
DFS551I BATCH   REGION IMSCLK65 STARTED ID=00005 TIME=0942  I12C
```

```
DFS2291I BLOCKER PST=0004 TRAN=IMSALK64 PSB=DFSIVP64 TYPE=BMP I12C
DFS2291I BLOCKER PST=0005 TRAN=IMSALK65 PSB=DFSIVP65 TYPE=BMP I12C
DFS2291I BLOCKER PST=0004 TRAN=IMSALK64 PSB=DFSIVP64 TYPE=BMP I12C
DFS2291I BLOCKER PST=0004 TRAN=IMSALK64 PSB=DFSIVP64 TYPE=BMP I12C
DFS552I BATCH   REGION IMSCLK65 STOPPED ID=00005 TIME=0943  I12C
DFS552I BATCH   REGION IMSCLK64 STOPPED ID=00004 TIME=0943  I12C
```

Previous IMS releases provide information only through IBM RMF™ reports. The RMF II ILOCK (IRLM Long Lock Detection) Report includes information about waiters and blockers when a lock request exceeds the IRLM TIMEOUT value. RMF records (type 79.15) can be formatted for more information about the task that is holding (or waiting for) the lock.

By using the IRLM Lock Timeout function, you can interrupt processes that are waiting for locks for longer than a specified number of seconds, with the integer value for the **LOCKTIME** parameter, specified in the DFSVSMxx member of the IMS PROCLIB data set (or DFSVSAMP DD statement for IMS batch procedures). See Example 3-27.

Example 3-27 LOCKTIME definition in DFSVSMxx

```
LOCKTIME=(xxxxx,ABEND/STATUS,[xxxxx,ABEND/STATUS])
```

The number of seconds can also be changed after IMS initialization by issuing the following command:

```
MODIFY irlmproc,SET,TIMEOUT=nn,imsid
```

The DFS2291I messages are only issued if they are requested by specifying **MSG2291=ISSUE** or **MSG2291=SHORT** in the DIAGNOSTIC_STATISTICS section of the DFSDFxxx member (Example 3-28).

Example 3-28 DFSDFxxx DIAGNOSTIC_STATISTICS section

```
<SECTION=DIAGNOSTICS_STATISTICS>
 MSG2291=ISSUE | SHORT | SUPPRESS
```

Consider the following explanation:

- ISSUE causes multiple line messages to be issued.
- SHORT causes one line messages to be issued.
- SUPPRESS is the default.

If the user has chosen the ABEND option for timeouts, IMS TM transactions are retried with three exceptions (IFP regions, CPI-C driven applications, and protected conversations).

3.5.3 Batch data sharing abend elimination

In previous versions of IMS, a batch data sharing job might abend with U3303 when an OSAM or VSAM cache structure access failed. For example, an access attempt while a structure was being rebuilt failed. This problem did not occur with online systems. They survived access failures. They waited for the resolution to the structure access problem.

With IMS 12, batch jobs can survive when these structure accesses fail. Like online systems, they wait for the resolution to the problem. When the problem is resolved, the batch jobs continue processing. For example, when a rebuild of a structure completes, the batch jobs continue.

If the batch job detects the failure, it issues the new DFS2404A message:

```
DFS2404A AN ERROR WAS ENCOUNTERED WHEN ACCESSING THE COUPLING FACILITY. STRUCTURE
xxxxxxxxxxxx RSN yyy
```

The reason code in the message is used to identify the type of failure that occurred when the batch job attempted to access the structure.

With this enhancement, you can rebuild OSAM and VSAM cache structures while your data sharing batch jobs are executing. You might run this task to address coupling facility failures or to move structures between coupling facilities for reconfigurations. In previous versions of IMS, batch jobs did not survive these rebuilds.

3.5.4 RACF user ID in Data Capture batch log records

Data Capture exit routines are compatible with the following physical database structures:

- HDAM
- PHDAM
- HIDAM
- PHIDAM
- HISAM
- SHISAM
- DEDB

LOG is a parameter of the DBD macro in the **DBDGEN** utility (Example 3-29).

Example 3-29 LOG specification in DBD of the DBDGEN utility

```
DBD....,
EXIT=([exitname],LOG/NOLOG)
```

Exitname is optional, and LOG can be specified without exit.

In previous versions of IMS, the IBM Resource Access Control Facility (IBM RACF®) user ID only appears in changed data capture log records (type x'9904') when the log is produced by an online system. IMS 12 adds the RACF user ID to these log records when they are produced by batch (DLI or DBB) jobs. Changed data capture writes log records when the LOG (asynchronous) option is chosen in the **DBDGEN**.

The RACF user ID is specified by including the **USER=** parameter on the JOB statement of the batch job.

3.5.5 Increased VSAM pools

Previous versions of IMS allowed only 16 VSAM full function database buffer pools to be defined for an IMS online system, batch job, or utility. IMS 12 expands this number to 255. Each buffer pool can have separate subpools for different buffer sizes and for data and index components.

VSAM buffer pools are defined with POOLID statements in the DFSVSMxx member or DFSVSAMP data set. With IMS 12, you can specify up to 255 of these POOLID statements.

3.5.6 Elimination of OSAM U0080 Open, Close, or EOV abends

Previous versions of IMS had rare problems in OSAM open, close, or end-of-volume processing. When they occurred, the entire IMS system terminated with the U0080 abend.

IMS 12 has changed this processing. When such problems occur, the database is closed and marked `recovery needed`. The abend does not occur. Additionally, message `DFS0730I` is issued for open or close problems. X is included as the first character in the reason code. The *yy* and *z* values identify the actual problem (Example 3-30).

Example 3-30 DFS0730I message

```
DFS0730I UNABLE TO OPEN|CLOSE DATASET WITH DDNAME ddname FOR REASON X, yy, z
DATABASE dbdname programid
```

In previous versions, the `DFS0730I` message was not issued with the U0080 abend, which made it more difficult to determine the database and data set with the problem.

When the data set cannot be extended as part of EOV processing, message `DFS0842I` is issued:

```
DFS0842I OSAM DATASET CANNOT BE EXTENDED, REASON=x, z dbdname
DFS0842I ddname, dsname
```

This message is enhanced in IMS 12 to include a subcode (z) to further explain the reason for extension failure.

3.5.7 Message DFS993I sent to system console

IMS 12 sends the `DFS993I` message to both the system console and the Master Terminal. Previous versions of IMS sent this message only to the Master Terminal. Because DBCTL systems do not have a Master Terminal, they did not receive the message:

```
DFS993I (CSA PSB|DLS PSB|PSBW) POOL TOO SMALL, UNABLE TO SCHEDULE PSB PSBNAME
```

The `DFS993I` message is issued when the PSB Work, CSA PSB, or DLI PSB pool is too small. With IMS 12, DBCTL users can easily determine why a PSB schedule failure occurs because of insufficient space in one of these pools.

3.5.8 Control Area reclaim support

When IMS database KSDS records are erased with z/OS 1.11 and previous releases, VSAM CI reclaim does not reclaim the empty CI that has the highest key of the Control Area (CA). This otherwise empty CA occupies the index structure as though it was not empty. If an application re-inserts records with the erased keys or keys of nearby values, those empty CAs are reused. However, if the application erases a range of keys and does not reuse those keys or only inserts records with ever-higher keys, VSAM does not reclaim or reuse those empty CAs with lower keys. The failure to reclaim the CAs results in wasted disk space and can cause performance problems in index search because much of the index structure can be populated with those empty index records (Figure 3-22 on page 106).

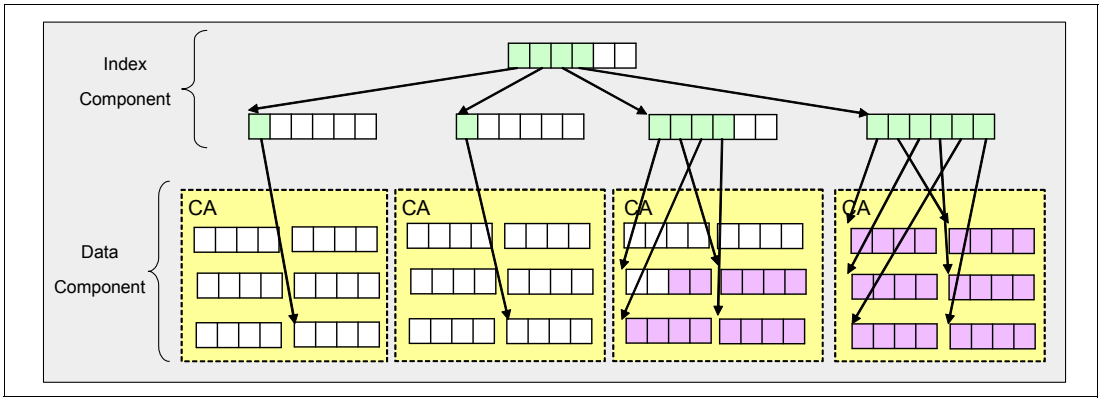

Figure 3-22 Control Area reclaim

By using the CA Reclaim feature in z/OS 1.12, you can reuse the free CA space. With CA Reclaim, space fragmentation caused by erasing records from a KSDS will be minimized to reduce the need to reorganize the data set. When the freed CAs are placed in a free chain to be reused, the index structure can be shrunk to facilitate faster data accesses. When space is needed for a new CA, a CA from the free chain is reused so there will be fewer calls to EOV to extend the KSDS.

There is no requirement for all of the systems in a sysplex to be at the same z/OS release level. z/OS 1.10 and z/OS 1.11 have compatibility maintenance so that they can process data sets for which CA reclaim is being used with z/OS 1.12. However, CA reclaim is only processed on systems that have z/OS 1.12.

3.5.9 New command codes for sequential search

A small programming enhancement (SPE) for IMS 11 adds two new command codes for use with GN and GHN calls for root segments. These new command codes are also included in IMS 12.

- Command code A clears positioning and causes the GN or GHN call to start at the beginning of the database.
- Command code G is used with GN and GHN calls qualified on the root segment key. It prevents the use of the randomizer routine for DEDB, HDAM, and PHDAM databases. It also prevents the use of the partition selection exit routine for PHDAM or PHIDAM databases. Instead of using these routines, the call processes the next records in the database until one satisfying the SSAs is found or the end of the database is reached.

These codes change the actions that might otherwise occur for calls qualified on the key of the root segment. Consider a call qualified with key >= 1000 and key <=2000. Without the A or G command codes, the call randomizes using key=1000. It returns the first segment found if it satisfies the SSAs. Otherwise, it returns a GE (not found) status code. If a segment is returned, successive calls using the same SSAs move forward in the database. If a segment not satisfying the call is encountered, a GE status code is returned. However, the use of the A command code causes the call to begin at the beginning of the database. The G command code causes the call to ignore roots which do not satisfy the SSAs and continue to following roots until one is found that satisfies the SSAs.

If you use these new command codes, use the A command code on the first GN or GHN call and do not use it on successive calls, because if A is used on every call, the calls always start at the beginning of the database and return the same segment.

These command codes should not be used with DL/I calls. They are used by JDBC with Open Database to provide results comparable to relational.

The JDBC driver uses the new command codes when converting a JDBC call to a DL/I call. This is done so that the JDBC call returns the same results with an IMS database that it returns with a relational database. Without these command codes, a search on a range of root segment keys is done with logic that assumes the roots are in key sequence. A call qualified on a range of root segment keys attempts to begin the search with the key at the bottom of the range.

For example, a search for roots with keys >= 1000 and <= 2000 begins by using the partition selection exit routine or the randomizer with key 1000. Subsequent GN or GHN calls with the same qualification move forward in the database. If a root segment with key>2000 is found, the search ends. The JDBC driver uses the new command codes to change the logic of the search. With the new command codes all root segments in the database are examined. This provides the expected results from the JDBC call.

Searching the entire database comes with a performance cost. The performance cost for the search can be eliminated by using an alternative. If many of these calls are issued by a program, you can create a secondary index on this key. Then you can use the secondary index for the calls by specifying **PROCSEQ=**, referencing the secondary index for full function databases or **PROCSEQD=**, referencing the secondary index for DEDBs. This way, the search can be performed without examining root segments that are not in the key range. It avoids the sequential scan of the database. This approach is analogous to placing an index on a column in a relational database. In fact, with a relational database, create the index when this type of JDBC call is made.

3.5.10 IRLM 2.3

Both IRLM 2.2 and IRLM 2.3 are delivered with IMS 12. Both of these IRLMs can be used with any supported version of IMS.

IRLM 2.3 is required by DB2 10 for z/OS. However, IRLM 2.2 can be used by the IMS database manager when DB2 is using IRLM 2.3. IRLM 2.3 supplies a 64-bit caller interface that is required by DB2 Version 10. IMS does not use this interface.

IRLM 2.3 must run under z/OS 1.10 or later. IRLM 2.3 provides some improved performance.

3.5.11 ACB library enhancements

The ACB library enhancements are also in IMS 11. With the ACBLIB usability enhancements, you can cache the ACB members into 64-bit storage, separately. You have to create DFSMDA members for the dynamic allocation of the ACBLIB data sets.

An ACB is built for each DBD and each PSB. Each ACB is stored as an ACB library member in the IMS.ACBLIB data set. ACBs are loaded into storage for online use either when the IMS control region is initialized or when an application program that requires the ACB is scheduled, depending on whether the ACB is resident or non-resident.

In online storage, the ACBs for PSBs and the ACBs for DBDs are stored separately in a PSB pool and DMB pool, respectively. IMS loads the non-resident ACB into 31-bit storage only when an application program that requires it is scheduled. Non-resident ACB members persist in storage only until the storage allocated for the non-resident ACBs is exhausted, at which time IMS frees storage by removing the ACBs that have remained unused for the longest period of time.

Non-resident ACB members can also be cached in a 64-bit storage pool to potentially improve the performance of program scheduling and reduce the usage of 31-bit storage. When 64-bit caching is enabled, when a non-resident ACB is first loaded into the 31-bit storage pool, it is also cached in the 64-bit storage pool. Later, if any non-resident ACBs that have been removed from online storage are required by a scheduled application program, the ACBs are retrieved from 64-bit storage instead of from the IMS.ACBLIB data set on DASD.

To enable your ACBs to use 64-bit storage, specify a **ACBIN64=ggg** parameter in the <DATABASE> section of the DFSDFxxx PROCLIB member. The value specified (ggg) is the amount of 64-bit storage (in GB) to be allocated for PSB and DMB ACB members. Because PSBs and DMBs are stored together in 64-bit storage pools, the size of a 64-bit storage pool must be large enough to contain all of the non-resident PSBs and DMBs combined. The size of an ACB member is reported by the ACB Maintenance utility when the ACB members are built.

To migrate ACB libraries to use dynamic allocation, you create DFSMDA members for the ACBLIBA and ACBLIBB data sets. Remove the IMSACBA and IMSACBB DD statements from the IMS and DL/I JCL procedures. IMS must be stopped and restarted with the new **ACBIN64** parameter in DFSDFxxx and with the DFSMDA members.

You can display information about the ACBs cached in 64-bit storage by using the type-2 **QUERY POOL TYPE(ACBIN64)** command.

For batch application programs, IMS does not support 64-bit caching of ACBs.

3.5.12 Reuse of local DMB numbers

The local database number (DMB number) is an internal value assigned by IMS when a database is defined to an IMS online system. The DMB is an IMS control block in main storage that describes and controls a physical database. A DMB is constructed from information that is obtained from the ACBLIB.

Before IMS 12, this local database number is never reused when its database is deleted by online change or DRD. A cold start is required when the local database number reaches the limit of 32 K-1. In IMS 12, the local database numbers deleted by online change or DRD can be reused when databases are added by online change or DRD. This change affects only local DMB numbers.

DBRC RECON data set: Concurrent access to databases by systems in one or more z/OS operating systems is controlled with the shared Database Recovery Control (DBRC) RECON data set.

IMS systems automatically sign on to DBRC, ensuring that DBRC knows which IMS systems and utilities are currently participating in shared access. A given database must have a DMB number that uniquely identifies it to all the sharing IMS systems. Global DMB numbers are reused in previous versions of IMS. A global DMB numbers is assigned to a database when it is registered with DBRC. The reuse of global DMB numbers was introduced in IMS 9. The DMB number that DBRC records in its RECON data set is related to the order in which databases are registered to DBRC.

4

Transaction Manager enhancements

This chapter describes the benefits of the Transaction Manager (TM) enhancements of IBM Information Management System (IMS) 12, including:

- APPC and OTMA shared queues enhancement
- OTMA ACEE reduction for multiple OTMA clients
- OTMA DFS2082 for Commit Mode 0
- Other Transaction Manager enhancements such as the following examples:
  - OTMA performance improvements
  - DFSMSCE0 exit modified for shared queue
  - LU 6.2 Input/Output Edit Exit (DFSLUEE0) Enhancement
  - Timer expiration enhancement and WebSphere MQ V7.0.1 Support for Message Expiry

4.1 APPC and OTMA shared queues enhancement

The target market of this enhancement is Advanced Program-to-Program Communication (APPC) and OTMA clients who use synchronous shared queues transactions. This is a major enhancement and has the potential for reducing CPU cost.

The capability to use shared queue for synchronous messages was introduced with IMS 8 and was based on Resource Recovery Services (RRS) to support the cascaded transactions between front-end and back-end IMS systems. However, RRS has a CPU cost and complicates the diagnostic in case of problem. Various clients had implemented pseudo wait for input (WFI) regions for a part of the workload to privilege a front-end IMS, and to reduce cascading in transaction processing and lower RRS consumption.

Synchronous or asynchronous APPC transactions: APPC transactions can be synchronous or asynchronous.

OTMA requests from remote clients can be either Send-Receive or Send-Only. The Send-Receive interaction supports the use of both Commit Mode 1 and Commit Mode 0. Send-Only interactions only support Commit Mode 0. Commit Mode 1 is considered to be a synchronous transaction request and Commit Mode 0 is asynchronous.

All synchronous transactions have a synchronization level (synclvl):

- NONE or Synchronization Level 0 (SL0)
- CONFIRM or Synchronization Level 1 (SL1)
- SYNCPT or Synchronization Level 2 (SL2)

IMS 12 removes the RRS dependency for the synchronous transactions with a synchronization level NONE or CONFIRM. IMS 12 uses cross-system coupling facility (XCF) communication between shared queue's front-end and back-end systems instead of RRS. The benefit of this enhancement is a performance improvement and a simplification of the syncpoint process.

Important: Transactions with synchronization level SYNCPT still require RRS.

As mentioned, the synchronous APPC and OTMA shared queues enhancement was introduced with IMS 8. Before IMS 12, APPC and OTMA shared message queue enablement used RRS Multisystem Cascaded Transaction support to synchronize IMS systems in a sysplex.

RRS had to be turned on with the DFSPBxxx RRS parameter. Then, the control of this enablement was done through the DFSDCxxx AOS parameter. It had three possible values for this sharing:

Y Activate
N Not activate
F Force

The values Y, N, and F are still available with IMS 12, and three new parameters offer the possibility to use XCF communications for transactions using SL0 and SL1.

Shared queues environments that are set with IMS versions before IMS 12 can still run with the new IMS 12 members with no new settings. You can plan the synchronous shared queues migration to XCF as a separate project.

The following sections describe the new values of the AOS parameter, various migration and setup considerations, and basics about operations and performance:

- Understanding the DFSDCxxx proclib parameters
- Setup and migration considerations
- Operations
- Performance considerations

4.1.1 Understanding the DFSDCxxx proclib parameters

You use the **AOS=** parameter of DFSDCxxx proclib member to enable IMSplex users to execute transactions that are originated by APPC or OTMA on a back-end system. AOS stands for APPC OTMA Synchronous.

The **AOS=** parameter includes the options listed in Figure 4-1 to manage the synchronous APPC/OTMA shared message queue (SMQ) support.

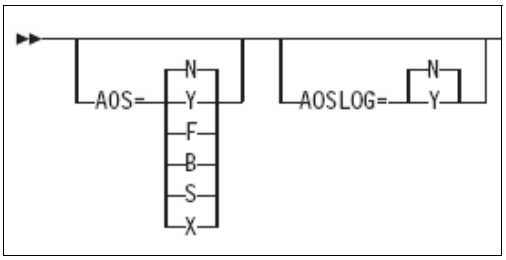

Figure 4-1 SMQ parameters in DFSDCxxx proclib member

With IMS 12, the AOS parameter has new values to indicate that XCF will be used rather than RRS to process APPC and OTMA synchronous transactions.

The front-end designates an IMS system that receives a message, sets the XCF indicator according to the DFSDCxxx settings, sets or unsets affinity, and then puts the message in the shared queue.

The back-end designates an IMS system that gets a message from the shared queue, schedules this message in a region, and then sends the response back. In some cases, the back-end is the same as the front-end.

The result of the AOS setting depends on the registration of IMS to RRS, which is controlled with the RRS parameter in the DFSPBxxx proclib member. It can be set to Yes or No.

Table 4-1 explains the meaning of the combination of setting the two parameters.

Table 4-1 Meaning of the combinations of AOS and RRS values

AOS	RRS	Description
N	Y/N	APPC/OTMA SMQ local status is INACTIVE (default) Transactions are queued with affinity and processed by the front-end.
F	N	APPC/OTMA SMQ local status INACTIVE ► If front-end, IMS enqueues messages with affinity. (Front-end, in this case, needs RRS to create the parent UR and suppress the affinity.) ► If back-end, IMS schedules messages having no affinity from the queue: – If the message has no XCF indicator (it from a front-end with RRS), the transaction abends with U0711. – If the XCF indicator on, the message is scheduled normally.

AOS	RRS	Description
F	Y	APPC/OTMA SMQ local status FORCE-RRS and Multisystem Cascaded Transaction using RRS: ► If front-end, IMS enqueues messages with no affinity and creates a parent UR using RRS. ► If back-end, IMS schedules messages having no affinity, regardless of whether the XCF indicator is set on. If such a system loses RRS, the other systems with **AOS=F** continue to work with this function active.
Y	N	APPC/OTMA SMQ local status INACTIVE: ► If front-end, IMS enqueues messages with affinity and schedules them. ► If back-end, IMS schedules any message having no affinity.
Y	Y	APPC/OTMA SMQ local status ACTIVE-RRS and Multi-System Cascaded Transaction using RRS: ► If front-end, IMS enqueues messages with no affinity and creates a parent UR using RRS. ► If back-end, IMS schedules messages with no affinity, whether the XCF indicator is set on or off. If such a system loses RRS, all systems with **AOS=Y** from the shared queue group stop working with this function.
B, S, X	Y	APPC/OTMA SMQ local status ACTIVE-XCF: ► If front-end, IMS enqueues messages with no affinity and sets the XCF indicator on. ► If back-end, IMS schedules messages having no affinity, regardless of whether the XCF indicator is set. B, S, and X are equivalent for SL0 and SL1 processing: ► B is equivalent for SL2 processing to **AOS=Y**. ► S is equivalent for SL2 processing to **AOS=F**. ► X is equivalent for SL2 processing to **AOS=N**.
B, S, X	N	APPC/OTMA SMQ local status ACTIVE-XCF: ► If front-end, IMS enqueues messages with no affinity and sets the XCF indicator on. ► If back-end, IMS schedules messages having no affinity, but if the XCF indicator is set off, the transaction abends with U0711. SL2 processing not possible because RRS not there.

For APPC and OTMA transactions, the new DFSDCxxx AOSLOG parameter specifies whether the front-end system writes an X'6701' log record for the following cases (using a value of Y or N as appropriate):

- A response message is returned from the back-end system by XCF for transactions with all synchronization levels.
- An error message is returned from the back-end system by XCF for transactions with all synchronization levels of NONE, CONFIRM, and SYNCPT.

AOSLOG=N is the default.

Important: Do not mix **RRS=Y** and **RRS=N** in a shared queue group with members having **AOS=Y** or **AOS=F**.

SL2 messages always need RRS. If RRS is not present, SL2 messages cannot be processed.

For more information about DFSDCxxx and DFSPBxxx settings, see *IMS Version 12 System Definition*, GC19-3021.

Color guide for Figure 4-2: Figure 4-2 uses the following color scheme:

- IMS members in blue have **RRS=N**, and IMS members in purple have **RRS=Y**.
- The upper blue dash-dotted lines represent how a member enqueues the message to the shared queue, with affinity or not, with the XCF bit set or unset. In such cases, the member is front-end.
- The lower green dotted lines represent all the kinds of messages a member can schedule from the shared queue.
- The red dashed lines are two cases where you get abendU0711. In such cases, it is back-end.

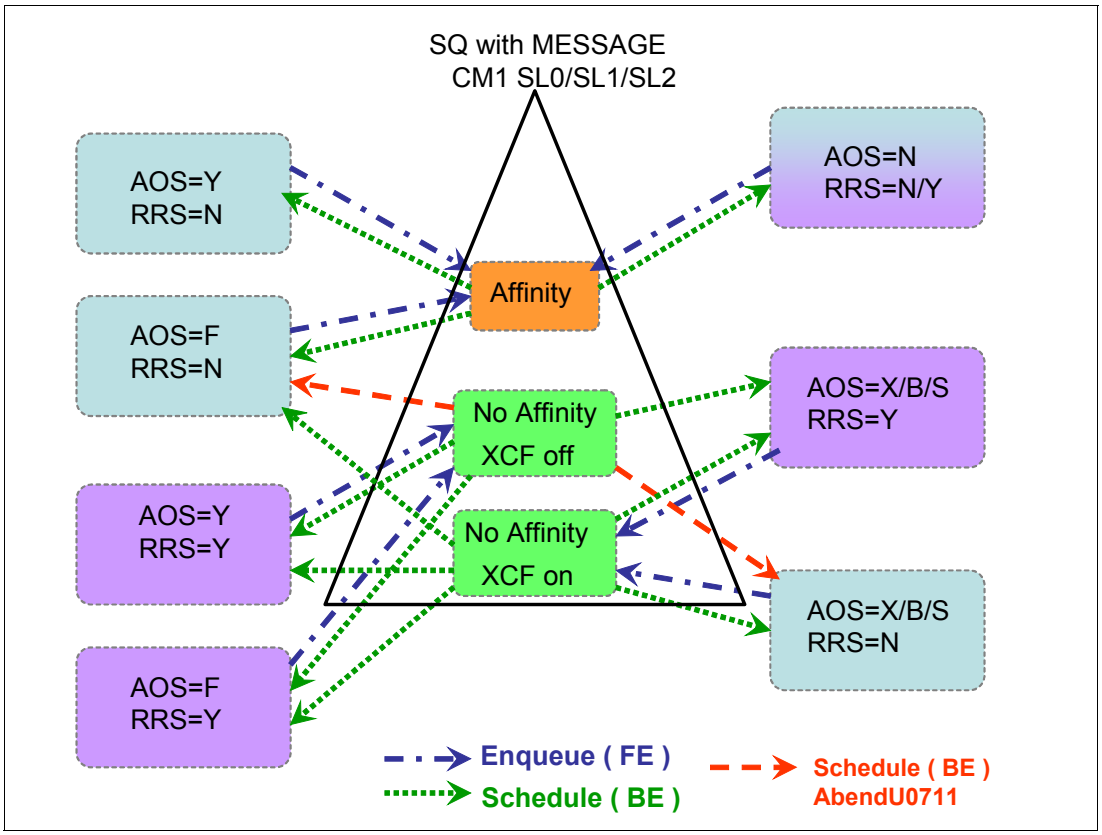

Figure 4-2 AOS and RRS combinations at a glance

IMS log records indication

The XCF indicator is set in Log Record 01. When **LUY_FLAGS=x'40'** at offset x'B4', **LUY_XCF_INDICATOR** is set on and a system with AOS=X, B, or S has enqueued this message.

4.1.2 Setup and migration considerations

If you have the APPC and OTMA synchronous shared queue function already activated using an IMS version other than IMS 12, keep in mind the considerations we discuss in the following sections when you plan a migration to use XCF.

RECON minimum version consideration

Important: IMS systems in a shared queues group must be at MINVERS 12.1 to enable this enhancement.

If MINVERS is not at version 12.1, message `DFS2088I RSN40` might be sent, depending on the AOS/RRS combination.

Table 4-2 outlines the steps.

Table 4-2 MINVERS influence on APPC/OTMA SMQ enablement

Member version	RECON MINVERS	Result
< v12	< 12.1	AOS=N, Y, or F available. AOS=X, B, and S not supported.
<12	=12.1	Recovery control (RECON) access not allowed.
=12	<12.1	If AOS=B and RRS=Y/N, or AOS=S and RRS=N, the `DFS2088I RSN40 APPC/OTMA SMQ support not activated` message is sent. If AOS=S and RRS=Y, AOS=S is changed to AOS=F and the message `DFS2089I APPC/OTMA SMQ Enablement active. RRS is used` is sent.
=12	=12.1	AOS=X, B, and S full support.

You can check RECON MINVERS by using the **`LIST.RECON STATUS`** command (Example 4-1).

Example 4-1 LIST RECON STATUS and MINVERS V12

```
11.215 04:12:08.141311              LISTING OF RECON                   PAGE 0003
-------------------------------------------------------------------------------
 RECON
  RECOVERY CONTROL DATA SET, IMS V12R1
  DMB£=23                             INIT TOKEN=11192F0745595F
  FORCER    LOG DSN CHECK=CHECK44     STARTNEW=NO
  TAPE UNIT=          DASD UNIT=SYSALLDA  TRACEOFF   SSID=I12A
  LIST DLOG=YES                CA/IC/LOG DATA SETS CATALOGED=YES
  MINIMUM VERSION = 12.1       CROSS DBRC SERVICE LEVEL ID= 00001
  REORG NUMBER VERIFICATION=NO
  LOG RETENTION PERIOD=00.001 00:00:00.0
```

Activating the proclib new setting

Important: New proclib AOS parameter values need /NRE or /ERE to be activated.

Mixed environment RRS/XCF considerations

If the workload includes only SL0/SL1 messages, migrate any **`AOS=Y`** or **`F`** environment to **`AOS=X`**. In that way, all messages are placed in queue with no affinity. Those messages from an XCF front-end will have the XCF indicator on. As soon as RRS is active everywhere, all the RRS or XCF messages are scheduled on every back-end.

Keep the setting **`RRS=Y`** until all members in the shared queue group are **`AOS=X`**. At that point, and *only* if there are no applications or functions working with RRS or SL2 messages, there is no reason to keep it active. However, if the workload includes SL2 messages, use **`AOS=B`** for

an equivalent to **AOS=Y**, and use **AOS=S** for an equivalent to **AOS=F**. In such cases, keep RRS active because SL2 always needs RRS.

4.1.3 Operations

This section illustrates the old process flow using RRS and the new branded process flow using XCF and how it is seen through the OLDS using the interactive IMS Problem Investigator IBM tool. For more information about this tool, see “IMS Problem Investigator” on page 402.

Assume that tests have been run on a two-way shared queue. IMSplex and IVP transactions have been sent from an IMS Connect client using a REXX program, sending a message including an IRM with CM1 and SL0.

Operation using RRS

The IMSPLEX supports synchronous APPC and OTMA messages when the following conditions are true:

- All IMS systems in the shared queues group are Version 9 or higher.
- RRS is active.
- The IMS control region parameter **RRS=Y** is defined for all IMS systems in the IMSplex.
- **AOS=Y** or **AOS=F** is specified in the DFSDCxxx PROCLIB member data set.

For more considerations about processing in this environment, see “Managing APPC and OTMA messages in a sysplex environment” in *IMS Version 12 System Administration*, SC19-3020.

High level flow using RRS

Figure 4-3 shows the high level flow of a synchronous message. (Therefore, it does not show all possible interactions.) The flow works the same in IMS 12 as it worked in the previous releases since IMS 8.

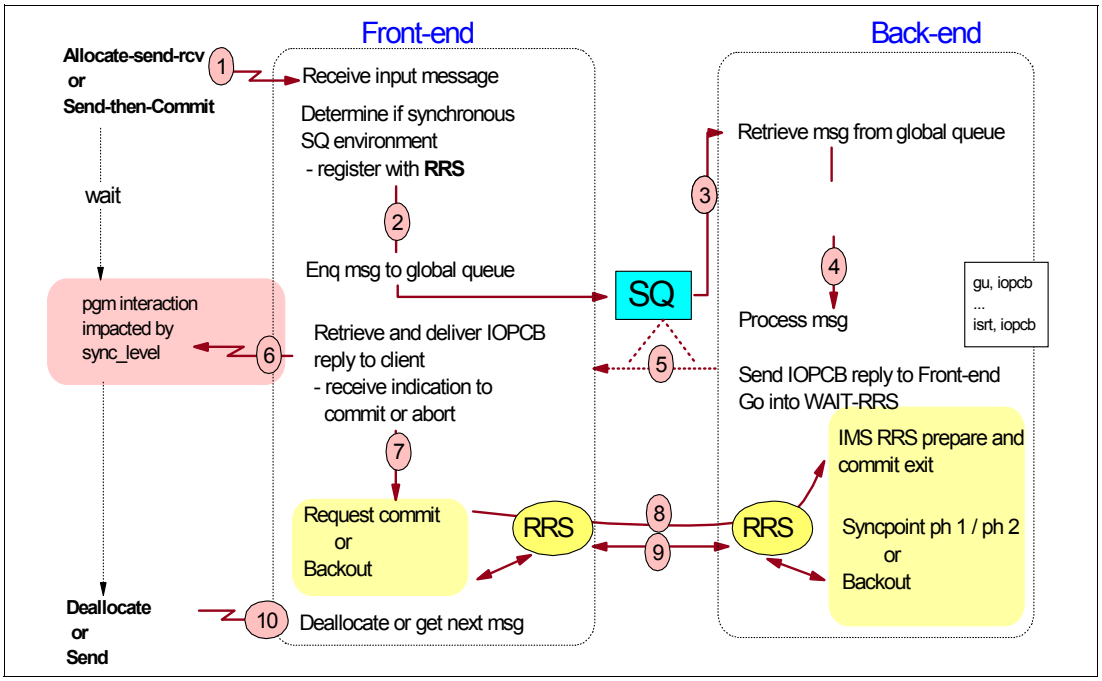

Figure 4-3 General flow of a synchronous message using RRS

A synchronous message passes through the following flow as illustrated in Figure 4-3 on page 115:

1. When an input message is received, IMS determines if the message is synchronous, checks to see if the shared queues capability is enabled, and invokes RRS callable services to establish the RRS working environment.
2. The input message is placed on the global shared queues to be processed by an available IMS, that is, an IMS where the transaction is defined and has an available message region. In this example, the back-end system is immediately available to process the transaction.
3. The back-end IMS invokes RRS callable services to establish the RRS environment and perform message synchronization.
4. The message is processed in the back-end and the IOPCB reply sent to the front-end. All IMS resources are held pending syncpoint processing until either a commit or backout.
5. Depending on the size of the IOPCB reply and whether this is a conversational transaction, the message is either sent by using XCF services or routed through shared queues. An indicator is received.
6. The front-end IMS sends the message and interfaces with the partner client following the rules of synclvl processing (None, Confirm, or Syncpoint).
7. Based on the success or failure of the partner interaction, the front-end IMS invokes RRS to either commit or back out.
8. The RRS commit or backout is communicated to the back-end IMS for the corresponding commit or backout.
9. RRS on both sides provides the support for the synchronization of commit or backout.
10. At the completion of the commit or backout, the front-end IMS interacts with the partner program to either terminate the connection or get the next message.

Setting up and monitoring by using RRS

Set DFSDCxxx AOS to Y or F, and set DFSPBxxx RRS to Y. Example 4-2 shows the messages and command output during a normal startup with **AOS=F**, **RRS=Y** on two IMS members named I12A and I12C.

Example 4-2 Startup messages and OTMA CM1 SL0 transaction monitoring messages with RRS

First IMS Startup messages:

```
05.36.04 STC02823  DFS0653I PROTECTED CONVERSATION PROCESSING WITH RRS/MVS ENABLED  I12A
05.36.04 STC02823 DFS2089I APPC/OTMA SMQ Enablement active. RRS is used I12A
```

/DIS A DC shows:

```
05:40:24.77 STC02823 00000090  DFS000I    APPC/OTMA SHARED QUEUE STATUS - LOCAL=FORCE-RRS
                             GLOBAL=ACTIVE-RRS       I12A
05:40:24.78 STC02823 00000090 DFS000I     APPC/OTMA SHARED QUEUES LOGGING=N   I12A
```

Second IMS Startup messages:

```
05.42.20 STC02834  DFS0653I PROTECTED CONVERSATION PROCESSING WITH RRS/MVS ENABLED  I12C
05.42.20 STC02834  DFS2089I APPC/OTMA SMQ Enablement active. RRS is used I12C
```

/DIS A DC shows:

```
999             +    APPC/OTMA SHARED QUEUE STATUS - LOCAL=FORCE-RRS      GLOBAL=ACTIV
999              E-RRS
999                  APPC/OTMA SHARED QUEUES LOGGING=N
```

/DIS UOR shows:

```
RESPONSE=SC63
 DFS4444I DISPLAY FROM ID=I12C
```

```
      ST P-TOKEN  PSBNAME  RRS-URID                          IMS-RECTOKN
+A    DFSIVP1 C82811C07E76AF400000004801010000 I12C 0000002700000002
       WID=206401F8NATIVE CASCADED TRAN
      *11213/083557*
               650 00000090   /192454
                 650 00000090       *11213/083250*
```

Example 4-3 shows the log records that you can find at the front-end.

Example 4-3 Message flow on the front-end of I12A for an RRS scenario

```
---- ------------------------------------------------- ----------------
01   Input Message                                     11.45.04.859413
     UTC=11.45.04.859406 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8324BB4B3CEA546 Port=7100
     LogToken=C8324BA78ABD2D04 SSN=07 Socket=TRAN CM=1 SL=0 Source=Connect
                  Message associated with CQSPUT MSGUFLG1=x'80'
-------------------------------------------------------------------------
35   Input Message Enqueue                             11.45.04.859425
     UTC=11.45.04.859406 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8324BB4B3CEA546 Port=7100
     LogToken=C8324BA78ABD2D04 SSN=07 Socket=TRAN CM=1 SL=0
                 Message enqueued to the shared queue
-------------------------------------------------------------------------
33   Free Message                                      11.45.04.859694
     OrgUOWID=I12A/C8324BB4B3CEA546
-------------------------------------------------------------------------
```

Example 4-4 shows the log records you can get at the back-end.

Example 4-4 Message flow on back-end I12C for an RRS scenario

```
08   Application Start                                 11.45.04.860883
     UTC=11.45.04.860878 TranCode=IVTNO Region=0001
     RecToken=I12C/0000000600000000 RegTyp=MPP TClass=01 TPrty=01
Application Program scheduled
-------------------------------------------------------------------------
5607 Start of UOR                                      11.45.04.860884
     UTC=11.43.23.069649 Program=DFSIVP1 Region=0001 IMSID=I12C
     RecToken=I12C/0000000600000000 UOR processing on back-end I12C
-------------------------------------------------------------------------
01   Input Message                                     11.45.04.861068
     UTC=11.45.04.859406 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8324BB4B3CEA546 Port=7100
     LogToken=C8324BA78ABD2D04 SSN=07 Socket=TRAN CM=1 SL=0 Source=Connect
-------------------------------------------------------------------------
31   DLI GU                                            11.45.04.861082
     UTC=11.45.04.861080 TranCode=IVTNO Region=0001
     OrgUOWID=I12A/C8324BB4B3CEA546 RecToken=I12C/0000000600000000
Message picked up from the shared queue / front-end = I12A
-------------------------------------------------------------------------
5616 Start of protected UOW                            11.45.04.862476
     Region=0001 IMSID=I12C RecToken=I12C/0000000600000000
Interest has been registered with RRS for this UOW
TPCPDATA shows NATIVE CASCADED
-------------------------------------------------------------------------
```

```
50   Database Update                                          11.45.04.901939
     UTC=11.45.04.901938 Program=DFSIVP1 Userid=IMSR6 Database=IVPDB1
     RBA=00000002 Region=0001 RecToken=I12C/0000000600000000
-------------------------------------------------------------------------------
03   Output Message Response                                  11.45.04.924985
     UTC=11.45.04.859406 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8324BB4B3CEA546 Port=7100
     LogToken=C8324BA78ABD2D04 SSN=07 Socket=TRAN CM=1 SL=0 Source=Connect
Data response put in a message queue buffer
MSGORGID=I12A (origin)  and  MSGPROID=I12C(process)
MSGU1PUT=x'80'   Message associated with CQSPUT
-------------------------------------------------------------------------------
31   Message GU for APPC                                      11.45.04.924995
     UTC=11.45.04.924988 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8324BB4B3CEA546
     RecToken=I12C/0000000600000000 Port=7100 LogToken=C8324BA78ABD2D04
     SSN=07 Socket=TRAN CM=1 SL=0
QLGUORID=I12A (origin)    QLGUPRID=I12C (process)
QLGUUFLG1=x'80' Message associated with CQSPUT
-------------------------------------------------------------------------------
33   Free Message                                             11.45.04.925073
     OrgUOWID=I12A/C8324BB4B3CEA546
-------------------------------------------------------------------------------
5610 Start Phase 1 Syncpoint                                  11.45.04.927274
     Region=0001 IMSID=I12C RecToken=I12C/0000000600000000
-------------------------------------------------------------------------------
5611 End of Phase 1 Syncpoint                                 11.45.04.929268
     Region=0001 IMSID=I12C RecToken=I12C/0000000600000000
Shows in TPCPDATA.: *........NATIVE CASCADED
-------------------------------------------------------------------------------
37   Syncpoint                                                11.45.04.930028
     Region=0001 RecToken=I12C/0000000600000000
-------------------------------------------------------------------------------
33   Free Message                                             11.45.04.930680
     OrgUOWID=I12A/C8324BB4B3CEA546
-------------------------------------------------------------------------------
5612 End of Phase 2 Syncpoint                                 11.45.04.930776
     Program=DFSIVP1 Userid=IMSR6 Region=0001 IMSID=I12C
     RecToken=I12C/0000000600000000
```

Error condition

When an output IOPCB reply is sent, it is always sent before sync point. If the client partner is unavailable or the output reply cannot be sent, the following actions occur:

- If the transaction that replies to the IOPCB executes on the front-end, the default action is to abend the transaction with a U0119 and discard the output reply. User exit DFSCMUX0 (Message Control/Error Exit Routine) can be implemented to change the default action. The exit can change the default abort action (except for sync-level of sync point, which must continue with the abort). This is how errors with synchronous message replies have been processed for several releases of IMS.
- If the transaction that replies to the IOPCB executes in a back-end IMS and the front-end IMS cannot deliver the message, an RRS Take Backout command is issued which forces backout processing to occur on the back-end. The back-end aborts the transaction with U0711-1E.

For any RRS error occurring before sending the output, abend U0711 is sent and the transaction is stopped.

For more information about coding DFSCMUX0, see *IMS Version 12 Communications and Connections*, SC19-3012, and *IMS Version 12 Exit Routines*, SC19-3016.

Operation using XCF

XCF communications for synchronous SL0 and SL1 transactions can be used if the following statements are true:

- **AOS=B** or **S** is specified in the DFSDCxxx PROCLIB member data set.
- All IMS systems in a shared queue group must be at MINVERS (see 4.1.2, “Setup and migration considerations” on page 113).
- /ERE or /NRE after the DFSDCxxx PROCLIB modification.

High level flow for synchronous transactions using XCF

Figure 4-4 shows the general process flow of a synchronous SL0 transaction.

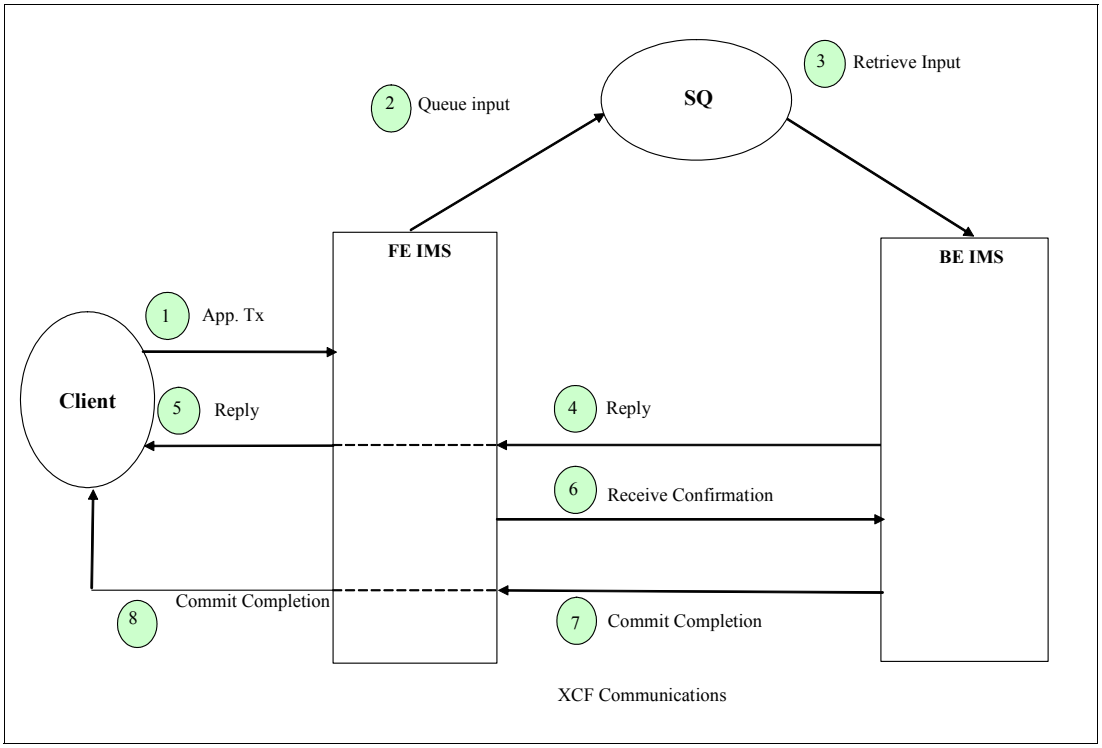

Figure 4-4 Synchronous SL0 processing with XCF communication

A synchronous SL0 transaction follows this flow as illustrated in Figure 4-4:

1. A client application enters OTMA CM1 or APPC synchronous conversation transaction with SL0 from the front-end IMS system.
2. The input transaction message with the XCF indicator is put on the SQ.
3. A dependent region on the back-end IMS system retrieves and processes the input message.
4. The back-end IMS system sends the transaction response to the FE and waits for confirmation.
5. The front-end forwards the transaction response to the client application.

6. The front-end sends the receive-confirmation to the back-end and waits for the commit completion.
7. The back-end receives the receive-confirmation, completes the commit process, and sends back the commit completion message to the front-end.
8. The front-end forwards the commit completion message to the client application.

Figure 4-5 illustrates the general process flow for a synchronous SL1 transaction.

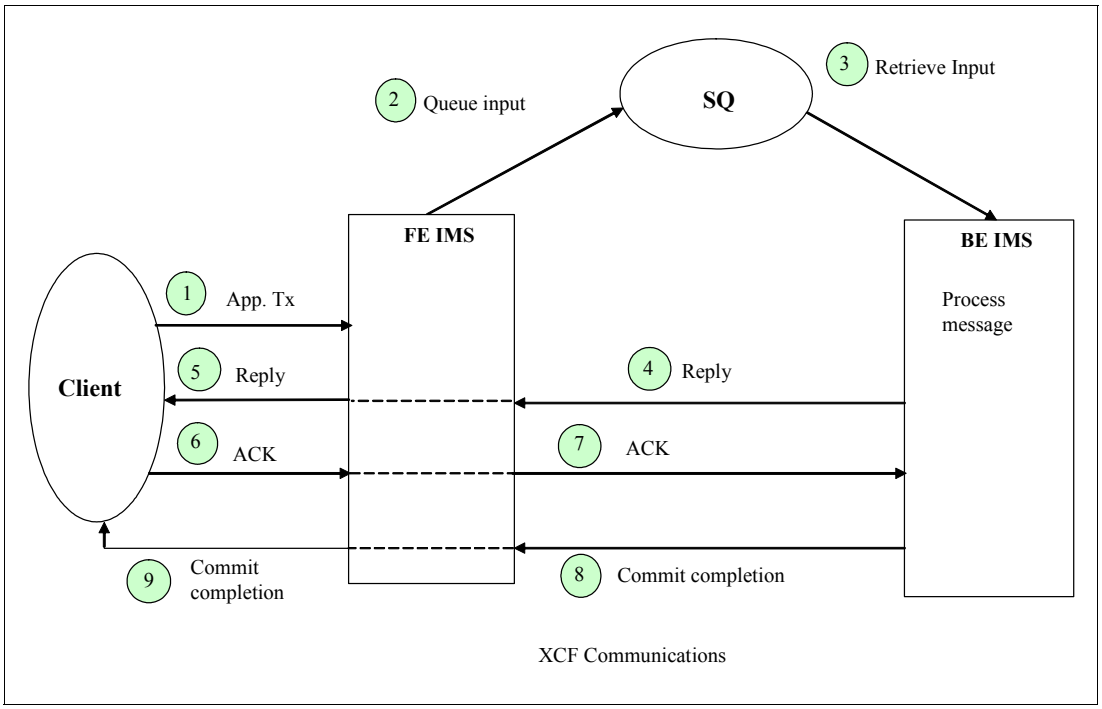

Figure 4-5 Synchronous SL1 processing with XCF communication

A synchronous SL1 transaction follows this flow as illustrated in Figure 4-5:

1. A client application enters an OTMA CM1 or APPC synchronous conversation transaction with SL1 from the FE IMS system.
2. The input transaction message with the XCF indicator is put on the SQ.
3. A dependent region on the back-end IMS system retrieves and processes the input message.
4. The back-end IMS system sends the transaction response to the front end and waits for an acknowledgement (ACK).
5. The front-end forwards the transaction response to the client application.
6. The client application returns an ACK.
7. The front-end forwards the ACK to the back end and waits for a commit completion.
8. The back-end receives the ACK, completes the commit process, and sends back the commit completion message to the front-end.
9. The front-end forwards the commit completion message to the client application.

Set up and monitoring using XCF

Set DFSDCxxx AOS to B or S. Then decide whether you want the front-end IMS to write 6701 log record by setting **AOSLOG=Y**. See Example 4-5.

Example 4-5 Startup messages and OTMA CM1 SL0 transaction monitoring messages with XCF

First IMS Startup messages I12A AOS=S RRS=Y

```
09.54.28 STC03112  DFS0653I PROTECTED CONVERSATION PROCESSING WITH RRS/MVS ENABLED  I12A
09.54.28 STC03112  DFS2089I APPC/OTMA SMQ Enablement active. XCF and RRS are used I12A
```

/DIS A DC shows:

```
09.57.46 STC03112  DFS4444I DISPLAY FROM ID=I12A  924
   924                  VTAM STATUS AND ACTIVE DC COUNTS
   924                  VTAM ACB OPEN          -LOGONS ENABLED
   924                  IMSLU=N/A.N/A            APPC STATUS=DISABLED  TIMEOUT=   0
   924                  OTMA GROUP=I12XOTMA  STATUS=ACTIVE
   924             +    APPC/OTMA SHARED QUEUE STATUS - LOCAL=FORCE-RRS/XCF  GLOBAL=ACTIV
   924              E-RRS/XCF
   924                  APPC/OTMA SHARED QUEUES LOGGING=Y
   924             +    APPC/OTMA RRS MAX TCBS -   40 ATTACHED TCBS -    2 QUEUED RRSWKS-
   924                    0
   924                  APPLID=APPLI12A  GRSNAME=IMS12XCF STATUS=ACTIVE
```

Second IMS Startup messages I12C AOS=S RRS=N

```
09.58.55 STC03125  DFS0698W PROTECTED CONVERSATION PROCESSING NOT ENABLED - RRS=Y NOT
SPECIFIED  I12C
09.58.56 STC03125  DFS2089I APPC/OTMA SMQ Enablement active. XCF is used I12C
```

/DIS A DC shows:

```
10:52:58.00 STC03125 00000090  DFS4444I DISPLAY FROM ID=I12C 598
598 00000090       VTAM STATUS AND ACTIVE DC COUNTS
598 00000090       VTAM ACB OPEN          -LOGONS ENABLED
598 00000090       IMSLU=N/A.N/A            APPC STATUS=DISABLED  TIMEOUT=   0
598 00000090       OTMA GROUP=I12XOTMA  STATUS=ACTIVE
598 00000090  +    APPC/OTMA SHARED QUEUE STATUS - LOCAL=ACTIVE-XCF     GLOBAL=ACTIV
598 00000090   E-RRS/XCF
598 00000090       APPC/OTMA SHARED QUEUES LOGGING=Y
598 00000090  +    APPC/OTMA RRS MAX TCBS -   40 ATTACHED TCBS -    2 QUEUED RRSWKS-
598 00000090         0
598 00000090       APPLID=APPLI12C  GRSNAME=IMS12XCF STATUS=ACTIVE
```

I12A message when I12C joins:

```
09.58.54 STC03112  DFS0778I I12A, MSC SUBSYSTEM I12C HAS JOINED THE SHARED QUEUES GROUP,
I12A
```

Example 4-6 and Example 4-7 show the log records for a message processing where XCF is used between front-end and back-end. Example 4-6 shows the message flow on the front end.

Example 4-6 Message flow on front-end I12A for an XCF scenario

```
01   Input Message                                          09.07.25.206790
     UTC=09.07.25.206782 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8322877464D5E0C Port=7100
     LogToken=C83228699B0A680C SSN=06 Socket=TRAN CM=1 SL=0 Source=Connect
Message associated with CQSPUT MSGUFLG1=x'80'
LUY_FLAGS=x'40' LUY_XCF_INDICATOR ON
------------------------------------------------------------------------
35   Input Message Enqueue                                  09.07.25.206801
```

```
     UTC=09.07.25.206782 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8322877464D5E0C Port=7100
     LogToken=C83228699B0A680C SSN=06 Socket=TRAN CM=1 SL=0
Message enqueued to the shared queue
--------------------------------------------------------------------------------
33   Free Message                                              09.07.25.207141
     OrgUOWID=I12A/C8322877464D5E0C
--------------------------------------------------------------------------------
```

Example 4-7 shows the message flow on the back-end.

Example 4-7 Message flow on back-end I12C for an XCF scenario

```
08   Application Start                                         09.07.02.876952
     UTC=09.07.02.876946 TranCode=IVTNO Region=0003
     RecToken=I12C/0000000500000000 RegTyp=MPP TClass=01 TPrty=01
Application Program is scheduled
--------------------------------------------------------------------------------
5607 Start of UOR                                              09.07.02.890783
     UTC=19.35.27.208423 Program=DFSIVP1 Region=0003 IMSID=I12C
     RecToken=I12C/0000000500000001
UOR processing on back-end I12C
--------------------------------------------------------------------------------
01   Input Message                                             09.07.25.207425
     UTC=09.07.25.206782 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8322877464D5E0C Port=7100
     LogToken=C83228699B0A680C SSN=06 Socket=TRAN CM=1 SL=0 Source=Connect
--------------------------------------------------------------------------------
31   DLI GU                                                    09.07.25.207440
     UTC=09.07.25.207438 TranCode=IVTNO Region=0003
     OrgUOWID=I12A/C8322877464D5E0C RecToken=I12C/0000000500000001
Message picked up from the shared queue / front-end = I12A
--------------------------------------------------------------------------------
50   Database Update                                           09.07.25.227814
     UTC=09.07.25.227813 Program=DFSIVP1 Userid=IMSR6 Database=IVPDB1
     RBA=00000002 Region=0003 RecToken=I12C/0000000500000001
--------------------------------------------------------------------------------
03   Output Message Response                                   09.07.25.244638
     UTC=09.07.25.206782 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8322877464D5E0C Port=7100
     LogToken=C83228699B0A680C SSN=06 Socket=TRAN CM=1 SL=0 Source=Connect
Data response put in a message queue buffer
MSGORGID=I12A (origin)  and  MSGPROID=I12C(process)
MSGU1PUT=x'80'   Message associated with CQSPUT
--------------------------------------------------------------------------------
31   Message GU for APPC                                       09.07.25.244648
     UTC=09.07.25.244642 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8322877464D5E0C
     RecToken=I12C/0000000500000001 Port=7100 LogToken=C83228699B0A680C
     SSN=06 Socket=TRAN CM=1 SL=0
QLGUORID=I12A (origin)    QLGUPRID=I12C (process)
QLGUUFLG1=x'80' Message associated with CQSPUT
--------------------------------------------------------------------------------
33   Free Message                                              09.07.25.246293
     OrgUOWID=I12A/C8322877464D5E0C
--------------------------------------------------------------------------------
```

```
5610 Start Phase 1 Syncpoint                                    09.07.25.246305
     Region=0003 IMSID=I12C RecToken=I12C/0000000500000001
-------------------------------------------------------------------------------
37   Syncpoint                                                  09.07.25.247257
     Region=0003 RecToken=I12C/0000000500000001
-------------------------------------------------------------------------------
33   Free Message                                               09.07.25.249519
     OrgUOWID=I12A/C8322877464D5E0C
-------------------------------------------------------------------------------
5612 End of Phase 2 Syncpoint                                   09.07.25.249612
     Program=DFSIVP1 Userid=IMSR6 Region=0003 IMSID=I12C
     RecToken=I12C/0000000500000001
-------------------------------------------------------------------------------
```

Diagnostic improvements

Logging and the **/DISPLAY** command output have been improved, and a new abend has been added to fit with the XCF case.

Front-end logging

When the **AOSLOG=Y** parameter is set on the front-end, or the **/DIAGNOSE SET AOSLOG(ON)** command is run, log record x'6701' is cut when the response messages or error messages are returned from the back-end by using XCF (Example 4-8 on page 123). This is true for all synchronization levels (none, confirm or syncpt).

With **AOSLOG=Y**, IMS also generates a new record of TIB3. APAR PM45923 and PTF UK71520 must be applied to have the log record x'6701' cut properly without setting a trace.

Example 4-8 X'6701' diagnostic log record in a front-end system process flow

```
---- ------------------------------------------------- ----------------
01   Input Message                                     17.26.34.001126
     UTC=17.26.34.001122 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8329808AB82338C Port=7100
     LogToken=C83297F6AD385306 SSN=04 Socket=TRAN CM=1 SL=0 Source=Connect
-------------------------------------------------------------------------------
35   Input Message Enqueue                             17.26.34.001137
     UTC=17.26.34.001122 TranCode=IVTNO Userid=IMSR6 LTerm=7100
     Terminal=7100 OrgUOWID=I12A/C8329808AB82338C Port=7100
     LogToken=C83297F6AD385306 SSN=04 Socket=TRAN CM=1 SL=0
-------------------------------------------------------------------------------
33   Free Message                                      17.26.34.001508
     OrgUOWID=I12A/C8329808AB82338C
-------------------------------------------------------------------------------
6701 YSND XCF message sent to OTMA client              17.26.34.007908
     UTC=17.26.34.007905 Terminal=7100 Port=7100 LogToken=C83297F6AD385306
     SSN=05 ID=YSND
-------------------------------------------------------------------------------
```

For more information about the **/DIAGNOSE** command, see *IMS Version 12 Commands, Volume 1: IMS Commands A-M*, SC19-3009.

This log record retrieves diagnostic information for system resources, such as IMS control blocks, user-defined nodes, or user-defined transactions, at any time without taking a console dump.

If **AOSLOG(ON)** is specified in a non-shared queues environment, or when **AOS=N** is specified in the DFSDCxxx PROCLIB member, the **/DIAGNOSE SET AOSLOG(ON)** command is rejected with a DFS2859I message.

New abend U0109 in the back-end IMS

The U0109 abend means that IMS did not deliver a response for the APPC synchronous or OTMA (CM1) transaction, or that the LU 6.2 device or OTMA client returned a negative acknowledgment (NAK) to the output message of the synclevel(confirm) synchronous CM1 transaction using XCF communications:

- RC=01 means the -end received a NAK from the front-end for the SEND of the output message of a send-then-commt (CM1) transaction with sync level of NONE or CONFIRM (SL0 or SL1) where XCF communication is used.
- RC=02 means the front-end terminated or restarted.

The transaction instance is ended, but the program and transaction are not stopped.

For more information about this abend, see *IMS Version 12 Messages and Codes, Volume 3: IMS Abend Codes*, GC19-9714.

Enhancement to the output of /DISPLAY A DC command

The **/DISPAY A DC** command shows new APPC/OTMA shared queues support statuses:

ACTIVE-RRS	Changed from ACTIVE, where **AOS=Y** and **RRS=Y** are specified.
ACTIVE-XCF	A new status, where **AOS=X** is specified; or **AOS=B** and **RRS=N** are specified.
ACTIVE-RRS/XCF	A new status, where **AOS=B** and **RRS=Y** are specified.
FORCE-RRS	Changed from FORCE, where **AOS=F** is specified.
FORCE-RRS/XCF	A new status, where **AOS=S** is specified.

New statuses are available for **APPC/OTMA SHARED QUEUE STATUS – LOCAL=status1 GLOBAL=status2**:

- Status1 can be one of the following options:
  - ACTIVE-RRS
  - ACTIVE-XCF
  - ACTIVE-RRS/XCF
  - FORCE-RRS
  - FORCE-RRS/XCF
  - INACTIVE
  - UNSUPPORTED
- Status2 can be one of the following options:
  - ACTIVE-RRS
  - ACTIVE-XCF
  - ACTIVE-RRS/XCF
  - CHECK
  - INACTIVE

Enhancement to the output of /DISPLAY A REG command

Two new values, WAIT-XCF and TERM-WAIT-XCF, have been added to describe the MPP status in the output of the **/DISPLAY** command.

WAIT-XCF is a new status that is shown when an application program is the middle of processing a sync point for an APPC or OTMA transaction with a synchronization level of

NONE or CONFIRM. Sync point can continue after the client issues either an ACK or a NAK. XCF is used to communicate between the back-end and the front-end IMS systems.

TERM-WAIT XCF is another new status that is displayed when a dependent region termination is in progress and the application in the region is still processing a sync point for an APPC or OTMA transaction with sync level of NONE or CONFIRM. Sync point can continue after the client issues either an ACK or NAK. When a dependent region is found in this state, a continuation line is inserted into the display, which shows either the transaction member (TMEMBER) and the transaction pipe (TPIPE) for OTMA client or the network ID (NETWORKID) and the logic unit name (LUNAME) for APPC client, in addition to the originating IMS system ID (ORIGIN) that is associated with the transaction processing in the dependent region.

Example 4-9 illustrates the new statuses for the **/DIS A REG** command when using XCF.

Example 4-9 New statuses for the /DIS A REG command when using XCF

```
24,/DIS A REG
DFS000I     REGID JOBNAME     TYPE  TRAN/STEP    PROGRAM  STATUS              CLASS   IMS1
DFS000I           JMPRGN      JMP   NONE   IMS1
DFS000I         1 IMSMPPA     TPI   APOL11 IMS1  APOL1    WAIT-RRS/PC         1,2,3,4
DFS000I     URID:   C2D6B6917DE820000000000001010000 ORIGIN: IMS2
DFS000I         2 IMSMPPB     TPI   APOL12 IMS1  APOL1    TERM-WAIT RRS       1,2,3,4
DFS000I     URID:   C2D6B6917DE830000000000001010000 ORIGIN: IMS2
DFS000I         3 IMSMPPC     TPI   APOL13 IMS1  APOL1    WAIT-XCF            1,2,3,4
DFS000I     TMEM:   HWS1            TPIPE: CLIENT01  ORIGIN: IMS2
DFS000I         4 IMSMPPD     TPI   APOL14 IMS1  APOL1    TERM-WAIT XCF       1,2,3,4
DFS000I     LUNAME: IMSNETWK.LU62IMS1 ORIGIN: IMS2
DFS000I           JBPRGN      JBP    NONE   IMS1
DFS000I           BATCHREG    BMP    NONE   IMS1
DFS000I           FPRGN       FP     NONE   IMS1
DFS000I           DBTRGN      DBT    NONE   IMS1
DFS000I           DBRICTAB    DBRC                                    IMS1
DFS000I           DLISDEP     DLS      IMS1
```

4.1.4 Performance consideration

The IMS 12 OTMA synchronous shared queues enhancement with XCF for Commit Mode 1 (send-then-commit) provides significant CPU efficiency improvements leading to increased throughput compared to RRS for Commit Mode 1 transactions with a sync-level of NONE or CONFIRM.

Important: Based on our performance evaluation, we have seen a transaction rate (external throughput rate (ETR)) improvement of 6–18% and path-length (internal throughput rate (ITR)) improvement of 27–81%.

All measurements were conducted within a stable and isolated environment using a full-function workload.

The ETR is the actual arrival rate of transaction per second. The ITR is a calculated by determining the throughput if the processor is running at 100%.

4.2 OTMA ACEE reduction for multiple OTMA clients

By using the OTMA Access Control Environment Element (ACEE) reduction for multiple OTMA clients capability introduced in IMS 12, you can create, share, and cache a single ACEE associated with a Resource Access Control Facility (RACF) user ID, regardless of the instances of the OTMA member clients (TMEMBER). It also reduces the maximum ACEE aging value, and implements a rule to always take the lowest value when there are multiple clients. This function helps in reducing storage use and improves security.

Important: Do not confuse this capability with the ACEE caching done with the IMS Connect Extensions IBM Tool, which is related to IMS Connect security validation.

4.2.1 Overview of OTMA enhancement

The OTMA enhancement applies to ACEE caching and the modification of the maximum aging value of ACEEs.

ACEE caching

To fully benefit from the availability, scalability, and performance advantages of the z/OS environment, multiple instances of OTMA member clients (TMEMBERs), such as IMS Connect, DB2 Stored Procedures, and WebSphere MQ, can run in parallel on multiple servers or LPARs while still being able to connect to the same IMS.

In previous releases, IMS OTMA isolated the security environment of one member client from another. This meant that an Access Control Environment Element (ACEE) for a user ID had to be created for each OTMA member client instance if the same user ID accessed IMS through more than one path (IMS Connect and WebSphere MQ). Creating multiple copies of the same ACEE resulted in increased storage usage in subpool 249 in Extended Private storage.

Important: In IMS 12, OTMA caches the ACEE so that only one copy exists for the same user even when messages from that user are sent in through different member clients. The cached ACEEs also reside in subpool 249.

New maximum aging value for ACEEs

IMS 12 introduces a new maximum aging value for ACEEs. The ACEE aging value triggers when an ACEE is refreshed. This value is specified by the OTMA member client during the client-bid process. The maximum has been reduced from 68 years to 11.5 days. Each cached OTMA ACEE will have an aging value based on the OTMA member client using it that has specified the lowest number.

For example, if WebSphere MQ sets its ACEE aging value to 5 days while IMS Connect sets its ACEE aging value to 1 day, any ACEEs that only WebSphere MQ uses have an aging value of 5 days and any ACEEs that are only invoked through IMS Connect have an aging value of 1 day. After the ACEE, which was previous only used through WebSphere MQ, is invoked on behalf of the same user sending a message through IMS Connect, the aging value is set to 1 day, the lower of the 5 days versus the 1 day value.

This enhancement is important because some OTMA clients, such as the DB2 Stored Procedure DSNAIMS, set the '7FFFFFFF'X seconds (68 years) as the ACEE aging value for users sending IMS transactions and commands. The enhancement also detects obsolete ACEEs, improving security.

To enable ACEE refreshes, the OTMA member client needs to request a minimum ACEE aging value of 300 seconds during the client-bid process. If the aging value specified by an OTMA member client is less than 300 then OTMA resets the value to 0, meaning that ACEEs will not be refreshed. When an aging value OAAV value is sent to IMS 12 that is greater than 999999 seconds (11.5 days), OTMA resets that value to 999999 seconds. IMS 10 and IMS 11 allowed the value to be up to 2147483647 or 68 years.

4.2.2 OTMA enhancement implementation

This section explains how environments can benefit from this enhancement and illustrates how it works through an example.

Challenge addressed

The scenario illustrated in Figure 4-6 that references IMS 11 describes the issue when a user accesses IMS using several paths. With sysplex distributor and multiple servers, a connection can be routed through more than one IMS Connect for the same IMS system.

Creating multiple ACEEs occupies storage in subpool 249 and requires calls to RACF to create each instance of an ACEE. For example, we have two IMS Connect member clients connected to IMS and each one submitted IMS transactions on behalf of the same 10,000 RACF user IDs. In this case, IMS OTMA creates 20,000 RACF ACEEs. Because the same user sends in messages through WebSphere MQ, a third ACEE is created for that user. The system storage for multiple copies of ACEEs on behalf of the same user can keep growing.

Additionally, a potential security exposure is introduced if a security change is made to the user profile but not all copies of the ACEE are refreshed.

For example, an IMS input transaction for a user ID by using an instance of an OTMA member client application can be rejected by OTMA. However, the same user ID sending in a message through a different path can be accepted by OTMA because the ACEE was created before the profile change and before a refresh of the ACEE is requested.

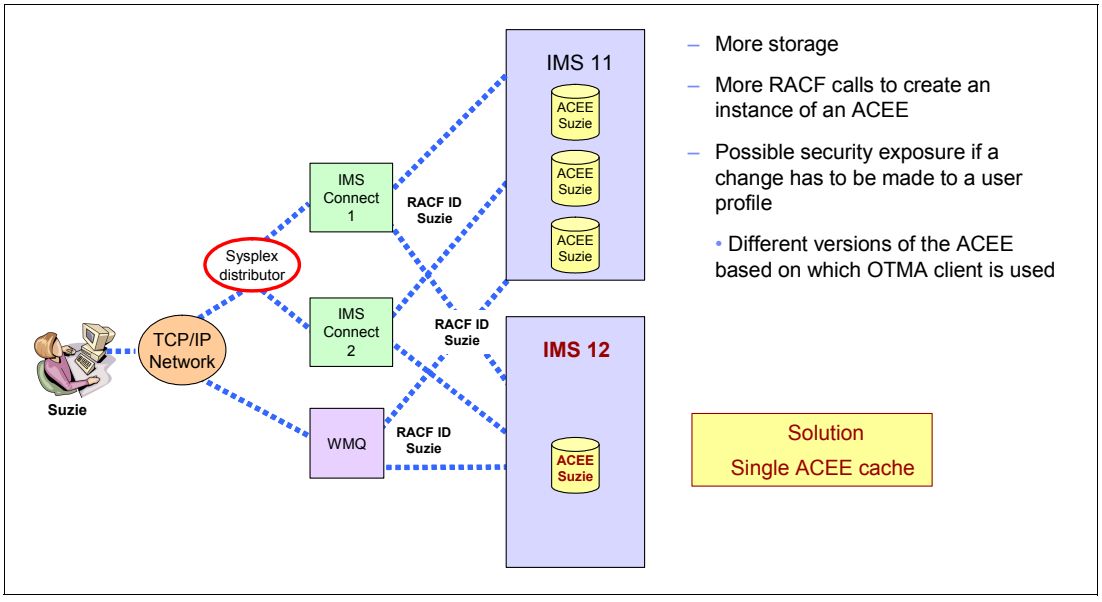

Figure 4-6 OTMA ACEE reduction

However, as shown with the connections to IMS 12, the issues described previously no longer apply to this environment. The ACEE is created when a transaction message on behalf of a

specific user ID first comes in from an OTMA member client and then is cached for reuse for subsequent transaction requests from the same user regardless of the communication path used.

How the OTMA enhancement works

Consider three IMS Connect users accessing the same data store I12A with different OTMA Aging Value settings in the IMS Connect Configuration Member (Figure 4-7).

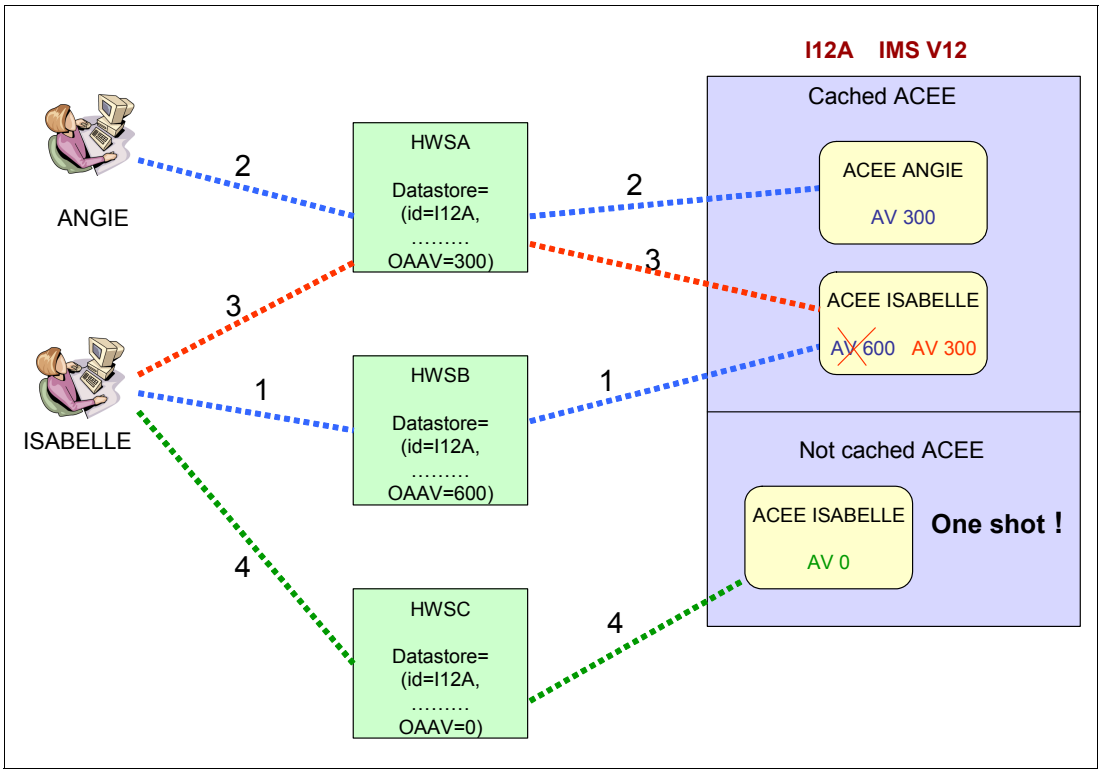

Figure 4-7 OTMA ACEE aging value

Figure 4-7 illustrates the following process flow:

1. User Isabelle sends a transaction to data store I12A through HWSB. An ACEE is created for user ID Isabelle in I12A SP229 with an aging value set to 600.
2. User Angie sends a transaction to data store I12A through HWSA. An ACEE is created for user ANGIE with an aging value of 300.
3. User Isabelle sends a transaction to I12A through HWSA. An ACEE is already created for that user with a separate aging value than the one specified in HWSA. Therefore, IMS chooses the lowest value and will modify it in the ACEE already there. No new ACEE is created for that user, but the aging value is set to 300.
4. User Isabelle sends a transaction through HWSC where an aging value of 0 is specified. An aging value of 0 means that no cached ACEE will be used. A new ACEE is created and is used only one time.

The **/DISPLAY OTMA** command has been modified to show the ACEE aging value for each OTMA client; see Example 4-10.

Example 4-10 /DISPLAY OTMA output

```
/I12ADIS OTMA

 GROUP/MEMBER      XCF-STATUS   USER-STATUS    SECURITY  TIB INPT  SMEM   DRUEXIT  T/O   ACEEAGE
 I12XOTMA
 -I12AOTMA         ACTIVE       SERVER         FULL        0 8000         N/A       0
 -HWBI12A1         ACTIVE       ACCEPT TRAFFIC FULL        0 5000  I12S             120      300
 -HWBI12A3         ACTIVE       ACCEPT TRAFFIC FULL        0 5000                   120      600
 -HWBI12A2         ACTIVE       ACCEPT TRAFFIC FULL        0 5000  I12S             120        0
 -HWBI12C3         NOT DEFINED  SMQ BACKEND    FULL        0    0                     0        0
 -I12S                          SUPER MEMBER                       I12S
```

4.2.3 Considerations and benefits

The OTMA enhancement has some impact on performance and security.

Performance

Because cached ACEEs are applicable to all OTMA TMEMBER clients, the requirement to issue the **RACROUTE REQUEST=VERIFY** command requests to create ACEEs for user IDs for a new OTMA client instance is reduced, also reducing possible RACF I/Os.

When an input transaction message carries a user ID whose ACEE has expired, OTMA uses an asynchronous request to create a new ACEE for this user ID, which will be kept in the cache for subsequent transaction requests. For the current transaction request, an ACEE is created for the authorization process and deleted when the authorization is complete.

From an operational perspective, the **/SECURE OTMA REFRESH TMEMBER membername** and **/SECURE OTMA REFRESH** commands have an identical impact because both commands work on the single OTMA ACEE table for all users.

Security

OTMA detects obsolete RACF ACEEs by using an internal IMS timer. Every two minutes, OTMA performs an ACEE cleanup operation for 10 expired user IDs.

IMS 12 changes the input ACEE aging value to 999999 seconds (11.5 days). This can increase the number of RACF I/Os and impact performance if more refreshes are done based on the aging value.

Mixed environments

In a mixed version environment, the difference in maximum aging value can cause an ACEE to be refreshed in an IMS 12 system but not in the IMS 10 or IMS 11 environments. (It can be 999999 seconds in IMS 12 and 2147483647 seconds in IMS 10 or 11.)

Benefits

Cached ACEEs reduce system storage requirements while providing better security and performance, as explained here:

- Having only one copy of the ACEE instead of multiples per OTMA client helps to reduce storage usage, security exposures, and improve performance.
- The same security result, regardless of which OTMA client is used, provides consistency.

By lowering the maximum ACEE aging value, you can trigger faster cache refresh. Security exposures are reduced because a user ID is revoked or permissions are changed.

4.3 OTMA DFS2082 for Commit Mode 0

The DFS2082 IMS message is sent instead of the application output reply to prevent the terminal from being hung in response mode. An OTMA send-then-commit (CM1) or APPC synchronous input message receives a DFS2082 message when the IMS application did not reply to the IOPCB or does a message switch to another transaction.

This section explains why the DFS2082 message has been implemented for Commit Mode 0 OTMA transaction and how it is requested.

4.3.1 Problem addressed

IMS commit modes: OTMA can control how IMS commits transactions: They can be either commit-then-send (Commit Mode 0) or send-then-commit (Commit Mode 1).

- For CM0 transactions, IMS processes the transaction and commits the data before sending a response to the OTMA client. It commits the transaction output as part of sync-point processing, and then delivers the output to the client later.
- For CM1 transactions, IMS processes the transaction and sends a response to the OTMA client before committing the data. It delivers the transaction output first, receives an acknowledgment from the client, and then completes the syncpoint processing.

The DFS2082 (Response Mode transactions terminated without reply) message is a mechanism to release an outstanding wait for CM1 (Send-then-Commit) transactions when the IMS application flow across program-to-program switches terminates without inserting a reply to the IOPCB.

When converting remote programs that use CM1 to CM0 (Commit-the-Send), a problem can arise. Before IMS 12, a remote program that sends a CM0 transaction message and then waits for a reply can possibly wait a long time until a timeout occurs, if the IMS application does not send any reply to the IOPCB.

IMS OTMA in Version 12 resolves this potential problem by introducing a new commit-then-send (CM0) optional flag to request the DFS2082 message. When this new flag is specified for an input commit-then-send transaction and the IMS application either does not reply to the IOPCB or performs a message switch to another transaction, OTMA will send a DFS2082 message to the client regardless of the IMS transaction response mode.

This DFS2082 message for a commit-then-send transaction only occurs for the original input transaction and does not support the program-to-program switch. This restriction means that there is no DFS2082 message for a switched-to transaction, even if the switched-to transaction fails to reply and the original transaction does not reply either.

This function eases the CM1-to-CM0 application conversion by reducing the necessary timeout in remote applications.

4.3.2 Implementation

Figure 4-8 shows how this message is requested from various OTMA clients.

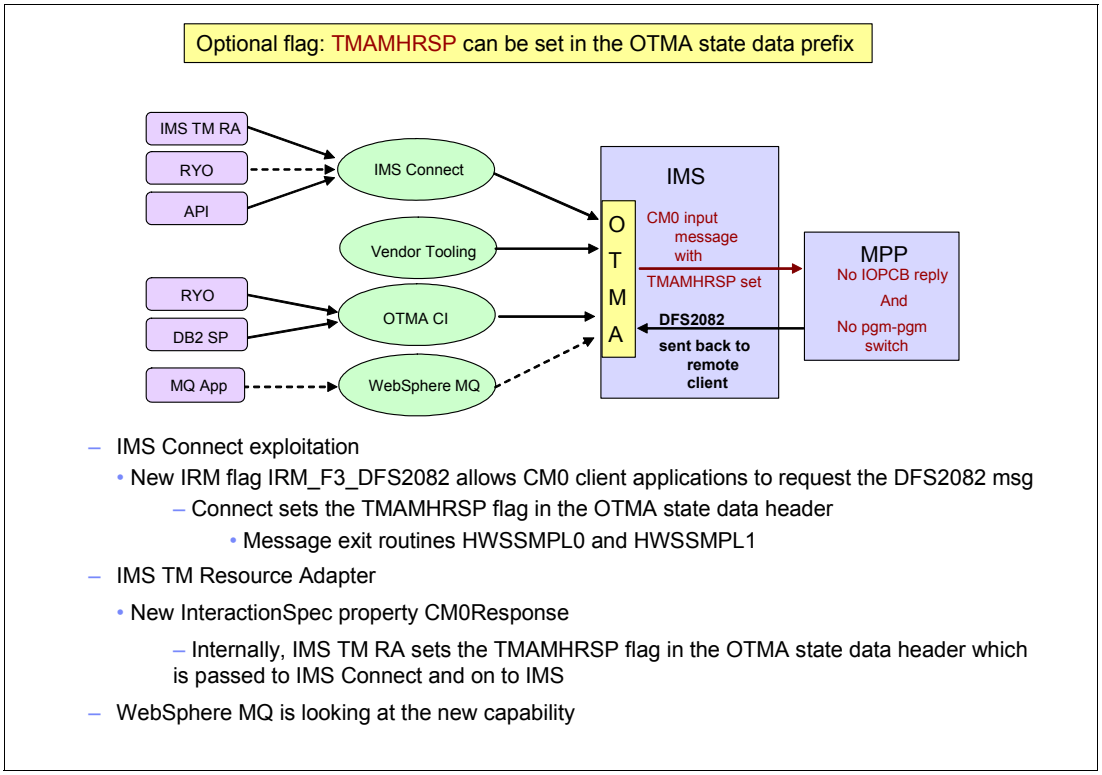

Figure 4-8 DFS2082 CM0 implementation

The new optional flag TMAMHRSP is for OTMA input commit-then-send transactions (CM0) only. When TMAMHRSP is specified for an input send-then-commit (CM1) transaction, IMS OTMA ignores it. The DFS2082 message has been supported for OTMA send-then-commit messages without the need of setting any OTMA message prefix flag.

IMS Connect uses this function by introducing a new IRM flag, IRM_F3_DFS2082. With this flag, the client applications can request the DFS2082 message for a CM0 input transaction. After the flag is set and the IMS application either does not reply to the IOPCB or message-switch to another transaction, OTMA sends a `DFS2082` message to the client regardless of the IMS transaction response mode so that the client's application does not need to wait for the timeout. This `DFS2082` message for a CM0 input only occurs for the original input transaction and does not support IMS program-to-program switches.

IMS TM RA also uses this function by introducing a new InteractionSpec property, CM0Response. With this property, clients can request the DFS2082 message for a CM0 input transaction. After the flag is set and the IMS application either does not reply to the IOPCB or message switch to another transaction, OTMA sends a `DFS2082` message to the client regardless of the IMS transaction response mode so that the client's application does not need to wait for the timeout. This `DFS2082` message for a CM0 input will only occur for the original input transaction and does not support IMS program-to-program switches.

4.4 Other Transaction Manager enhancements

The following additional enhancements have been set:

- In OTMA, to boost OTMA performance
- To let the DFSMSCE0 exit support the new shared queues enhancement with XCF
- To allow the DFSLUEE0 exit to dequeue an undeliverable asynchronous message
- To expand the transaction expiration function to WebSphere MQ

4.4.1 OTMA performance

The path length for OTMA transaction processing has been reduced by simplifying the logic when validating a tpipe name. Before this performance enhancement, OTMA experiences unnecessary CPU overhead because it always validates a tpipe name against keyword names when each message is received.

With the enhancement, OTMA performs tpipe validation only when a new tpipe name is received. For the subsequent transactions using the same tpipe name, OTMA no longer does tpipe name validation checking. Even for OTMA tmember clients like IMS Connect that only use 1 port tpipe for CM1 messages, validation checking will only be invoked one time instead of for every message from that port tpipe.

This enhancement is also available for IMS 10 and IMS 11 with the APARs PM20292 (V10) and PM20293 (V11).

4.4.2 TM and MSC Message Routing and Control exit routine (DFSMSCE0) exit modified for shared queues

Users can also use the DFSMSCE0 TM and MSC Message Routing and Control user exit to specify the APPC synchronous conversation or OTMA CM1 transaction with sync level of NONE or CONFIRM to be queued with the RRS or the XCF indicator option.

- On input to the exit, the following indicators are set

  MSCE3XCF EQU X'80'A global XCF enabled IMS system.
  MSCE3RRS EQU X'40'A global RRS enabled IMS system.

- On output, the exit can set the following indicators:

  MSTR2XCF EQU X'02
  Message is to be queued globally to the SQ with the XCF indicator. Only for synclevel of NONE or CONFIRM.
  MSTR2RRS EQU X'01'
  Message is to be queued globally to the SQ with the RRS indicator. Only for synclevel of NONE or CONFIRM.

  If both options are set, IMS uses the XCF indicator option and ignores the RRS indicator option.

If the XCF indicator option is selected, IMS determines whether the message can be queued globally with the XCF indicator. If not, IMS determines whether the message can be queued globally with the RRS indicator. If not, IMS queues the message locally.

If the exit defaults to or sets the XCF indicator, IMS determines input transaction message queuing based on the following order:

1. Queue the input globally to the SQ with the XCF indicator if eligible.
2. Queue the input globally to the SQ with the RRS indicator if eligible.
3. Queue the input locally with the affinity to the FE system where the input is received.

If the exit selects the RRS indicator option, the input transaction message queuing is determined as follows:

1. Queue the input globally to the SQ with the RRS indicator if eligible.
2. Queue the input locally with the affinity to the FE system where the input is received.

4.4.3 LU 6.2 Edit exit routine (DFSLUEE0)

With the LU 6.2 Edit exit routine (DFSLUEE0), you can edit input and output LU 6.2 messages for IMS-managed LU 6.2 conversations. It is also called if a message is inserted from an alternate PCB destined for an LU 6.2 destination.

You can use this exit routine to perform the following tasks:

- Change the APPC local LU name of an asynchronous LU 6.2 outbound conversation.
- Change the synchronization level of an asynchronous LU 6.2 conversation.
- View the contents of a message segment and continue processing.
- Change the contents of a message segment and continue processing.
- Discard a message segment.
- Perform a DEALLOCATE_ABEND of the LU 6.2 conversation.

For input messages, IMS calls the LU 6.2 Edit exit routine for each message segment before the message segment is inserted to the IMS message queue. The exit routine can edit message segments as necessary before the application program processes the input message.

For output messages, IMS calls the LU 6.2 Edit exit routine for each message segment before the message segment is sent to the LU 6.2 program. The exit routine can intercept the data sent by the application program and edit it for the particular destination.

For more information, see *IMS Version 12 Exit Routines*, SC19-3016, and *IMS Version 12 Communications and Connections*, SC19-3012.

In IMS 12, an enhancement to the LU6.2 Input/Output Edit Exit (**DFSLUEE0**) supports a new return code (RC=2) that requests the dequeuing of an undeliverable asynchronous output message. Previously, IMS always requeued the message.

Important: The new return code RC=2 is only valid for asynchronous conversations.

4.4.4 Transaction expiration and WebSphere MQ support

IMS 12 provides an extension of the WebSphere MQ Message Expiry facility to include the IMS transaction expiration function.

Transaction expiration

IMS Connect can adjust the expiration time for IMS transactions to match the timeout value of the socket connection on which the transaction is submitted. If an expiration time is specified

in IMS, transactions can expire and be discarded if IMS does not process them before the expiration time is exceeded.

A client application can submit a transaction request to IMS. IMS receives the transaction, processes it, and sends a reply. If IMS does not have the resources to process the transaction in the allotted time frame, the client application might time out the transaction call.

However, this transaction request might have been received by an IMS, but by the time the transaction is processed and a reply is sent, the client application no longer requires the response message. Processing unwanted transactions in IMS increases processing costs and CPU cycles.

The transaction expiration function has been introduced for the following versions:

- In IMS 10 for OTMA messages with APAR PK74017/UK50901
- In IMS 11 for all messages

Before IMS 12, OTMA checks if a transaction is expired at three points:

- When OTMA first receives a transaction from XCF

  If the expiration time has already passed, OTMA discards the transaction and returns a NAK message to the client.

- When OTMA enqueues a transaction in IMS

  If a transaction expires before OTMA enqueues the transaction, OTMA discards the transaction and returns a NAK message to the client.

- For transactions that are not MSC, Fast Path, or conversational, when an IMS application program issues a GU call to retrieve a transaction from the input queue

  If a transaction expires before an IMS application program retrieves the transaction, OTMA discards the transaction, issues pseudo abend 0243, and issues either message `DFS555I` or, if IMS is running in a shared-queues environment, the back-end system issues message `DFS2224I`.

Important: The purpose of the IMS Transaction Expiration SPE is to issue message `DFS3688I` including tpipe and tmember information instead of `DFS555I` or `DFS2224I` when the transaction expiration time is reached at GU time. See Example 4-11.

Example 4-11 Message DFS3688I sent for expired OTMA message at GU time

```
DFS3688I Transaction aaaaaaaa expired: EXPRTIME=nnnnnn, ELAPSE=ssssss
                      Tmember xxxxx Tpipe xxxx
```

APARs: This enhancement is retrofitted in IMS 11 and IMS 10 with APAR PM05984 and APAR PM05985 respectively.

Expired non-OTMA messages already receive the message `DFS3688I` since APAR PK86426/UK47070 for IMS 11.

For details about how to use the transaction expiration support, see *IMS Version 12 Communications and Connections*, SC19-3012.

WebSphere MQ support

For information about how the message expiry facility is implemented in WebSphere MQ, see the paper *WebSphere MQ for z/OS and IMS Transaction Expiration* in the Techdocs Technical Sales Library at:

`http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD105559`

Important: In WebSphere MQ, the Message Expiry facility provides a new service parameter that indicates whether WebSphere MQ will take advantage of the OTMA message expiry interface. This new service parameter **`SERVICE = 0000000001`** specified in the ZPARM CSQ6SYSP or set by using the **`SET SYSTEM SERVICE`** command.

With this service parameter, WebSphere MQ can tolerate the receipt of an `OTMA NACK_FOR_TRANS_EXPIRED` response when WebSphere MQ passes a message by using OTMA to IMS.

A unique expiration time can also be set at the MQ message level. In this case, the desired expiration interval is passed by the application to MQ using the MQMD.Expiry field and the service parameter should be set. The time is expressed in tenths of a second and can be thought of as a time to live (TTL) for the message.

In Figure 4-9, from the remote application perspective, the MQPUT application is unaware of an expiry unless it specifies a Report option. This option can entail the following actions:

- Include the generation of an expiry report, which is sent to the specified reply-to queue.
- Pass the remaining expiry interval from a request message to a response message.
- Discard the expired message.

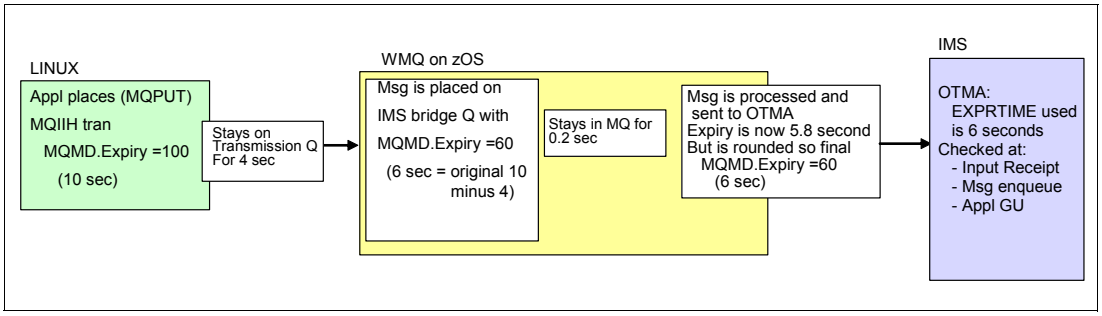

Figure 4-9 Example of expiration time at MQ message level

An attempt to perform an MQGET of a message after the expiration time has expired results in the MQ message being removed from the queue and the execution of expiry processing. As an MQ message flows between queue managers in an MQ network, the “time to live” expiration field is decremented even while the message waits on a transmission queue for movement between queue managers. MQ expiry processing is driven by the Report options specified by the application in the MQMD header of the message. The putting application can request a report on expiration, and will get a message sent to the reply to queues with the expiration information

If the service parameter for OTMA transaction expiration is set, then WebSphere MQ also looks to see if an MQ expiry time has been defined for the message. If an MQ expiry time value exists, then WebSphere MQ calculates the residual value (MQ expiry time minus the time the message has already spent in MQ) and uses that value when building the OTMA interface. If no MQ expiry value has been set, then WebSphere MQ does not send a user-specified value to IMS.

5

Database Recovery Control enhancements

This chapter explores the main Database Recovery Control (DBRC) enhancements that are included in IMS 12. It provides background information to help familiarize or remind you about key aspects of DBRC and its components.

The chapter includes a review the new DBRC functions that you can use to add valuable user information to the recovery control (RECON) data set records, to take advantage of greater flexibility with user written skeletal job control language (JCL) with new keys, to perform a deeper cleanup when removing obsolete information, and to better control change accumulation (CA) records.

In addition, it explains the DBRC commands and functions that have changed to improve serviceability. They now eliminate the need to type unnecessary information, and provide improved information from the some of the **LIST** commands.

Finally, this chapter highlights DBRC migration and coexistence.

It includes the following sections:

- DBRC background information
- New features for managing RECON information
- Changes on RECON
- DBRC with IMS 12

5.1 DBRC background information

The IMS DBRC facility manages information that is required for system and database integrity, database recovery, and databases access by various IMS subsystems. As an integral part of the system, DBRC manages information about many items and stores this information in a set of Virtual Storage Access Method (VSAM) data sets that are collectively called the RECON data set.

More specifically, DBRC offers the following support:

- It helps you ensure IMS system and database integrity by recording and managing information associated with the logging process.
- It assists IMS in the restart process by notifying IMS of which logs to use for restart.
- It assists IMS to allow or prevent access to databases in data-sharing environments by recording and managing database authorization information.
- It facilitates database and log recovery.
- It supports extended recovery facility (XRF) by identifying whether the subsystem is XRF-capable.
- It supports Remote Site Recovery (RSR) by containing the RSR complex definition in the RECON data set and providing other services associated with controlling RSR.
- It supports IMSplexes.

DBRC is not required for IMS batch jobs and for some offline utilities. However, if batch jobs and utilities that access registered databases are allowed to run without DBRC, the recoverability and integrity of the databases can be lost. Even if your configuration does not require the use of DBRC, you can simplify your recovery process by using DBRC to supervise recovery and protect your databases.

DBRC includes the RECON data sets, the DBRC utility (**DSPURX00**), and skeletal job control language (JCL):

- DBRC stores recovery-related information in the RECON data sets. DBRC uses two RECON data sets to increase availability and recoverability. They contain identical information. If you want to continue operations in dual mode after an error occurs on one of the two active RECON data sets, you can define a third RECON data set. DBRC does not use this spare data set unless an error occurs. The RECON data sets are critical resources for both DBRC and IMS.
- The DBRC utility (DSPURX00) is used to issue commands that build and maintain the RECON data set, add information to the RECON data set, and generate jobs for utilities.
- Skeletal JCL are input models or templates stored as members in a partitioned data set (PDS) for generating input for some of the recovery utilities. DBRC uses the skeletal JCL, information from the RECON data set, and instructions from a **GENJCL** command to generate the JCL and control statements that are needed to run some of the recovery utilities.

The RECON data set contains many types of records. Certain records, such as header records, exist primarily to control processing of the RECON data set. Other records exist to define the various data sets used in the recovery of database data sets (DBDSs). Still other records exist to record events related to the use of DBDSs.

Figure 5-1 shows the major relationship among RECON record types.

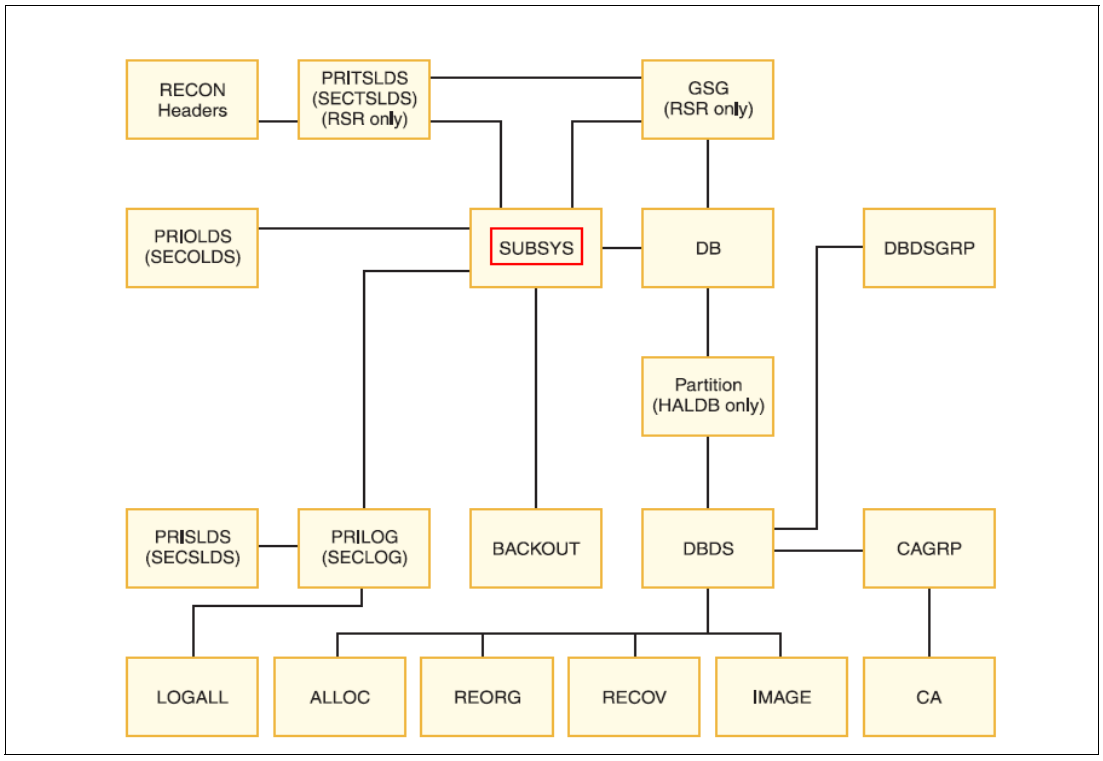

Figure 5-1 RECON records relationship

RECON considerations

Allocate the RECON data sets with different amounts of space so that if one becomes full, the system can continue using the other RECON data set while you provide a replacement. Allocate secondary extents for the RECON data set when you define space for it.

Back up the RECON data sets frequently. They are a critical resource. Always make backup copies of the RECON data set after performing any RECON record maintenance, such as registering databases and adding or deleting CA groups.

You need to reorganize the RECON data sets periodically. Many of the record keys in the RECON data set include the date and time. DBRC recording of IMS log and database activity can cause control interval (CI) and CA splits, which can degrade performance. In addition, deleting unnecessary records might not prevent the RECON data set from filling up because VSAM does not always reuse the space freed.

5.2 New features for managing RECON information

IMS has always featured DBRC as an integral piece of the whole software and relies on the information stored in the RECON data sets to perform several important activities. The following features are new in terms of managing RECON information:

- New user information

  With IMS 12, you can add valuable user information to the RECON records related to some of the most important processes, such as the database image copy, CA, reorganization, and recovery processes, in the database administration role.

- GENJCL new user keys

  IMS 12 adds more possibilities to reflect the system configuration of your installation by increasing the number of user keys in the DBRC skeletal JCL from 32 to 64. This number ultimately provides greater flexibility with user-written skeletal JCL.

- New CLEANUP command parameters

  IMS 12 improves the **CLEANUP.RECON** command by adding the possibility to delete CA execution records that are old or expired. Thus, with IMS 12, the **DELETE.LOG INACTIVE** or **TOTIME** command can be processed when the LOGALL record does not exist.

- New change accumulation retention period

  IMS 12 introduces the retention period keyword into the CA group type of record. The RECOVPD optional keyword is added to **INIT.CAGRP** or **CHANGE.CAGRP** to control DBRC keeping of CA execution records. When GRPMAX is exceeded, CA execution record is kept if the RECOVPD value is not exceeded.

5.2.1 New user information

With IMS 12, to allow clients to add their own control information into some of the important DBRC RECON records related to the database administration role you can add user data into IC, CA, RECOV, and REORG RECON records by using the UDATA optional keyword. The UDATA('string') is an optional keyword you use to specify up to 80 bytes of information about the identified record. You can use the variable field of this keyword to describe how the data set was created. The string value must be enclosed in single quotation marks (‘).

The following DBRC commands can use the UDATA keyword:

- The **CHANGE.CA** and **NOTIFY.CA** commands modify information in a CA record. Figure 5-2 shows the new syntax of the **CHANGE.CA** command.

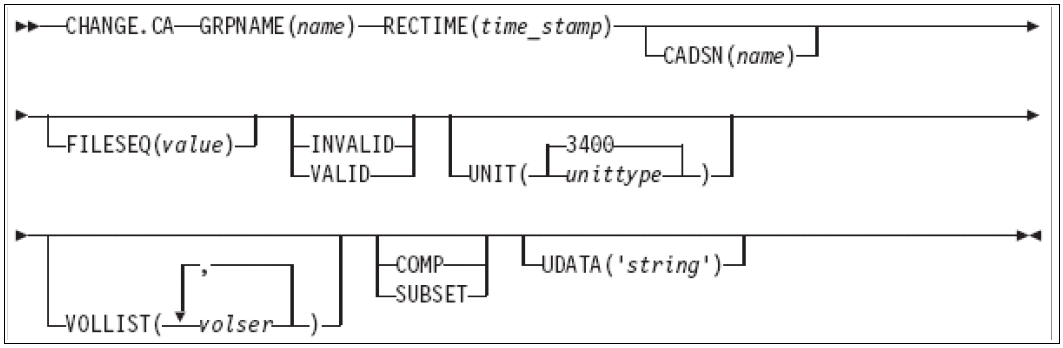

Figure 5-2 The CHANGE.CA command syntax

The **CHANGE.IC** and **NOTIFY.IC** commands modify information contained in an image copy record. Figure 5-3 shows the new syntax of the **NOTIFY.IC** command. For the syntax of all DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

Figure 5-3 The NOTIFY.IC command syntax

- The **NOTIFY.RECOV** command adds information about the recovery of the database.
- The **NOTIFY.REORG** command adds a record about the reorganization of the database.

Using the UDATA keyword

In Example 5-1, the CA record that is identified by the GRPNAME and RECTIME keywords is being changed and valuable user information is included in the **UDATA** parameter.

Example 5-1 The CHANGE.CA command with the UDATA parameter

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
 CHANGE.CA GRPNAME(GRPIVP) -
 RECTIME(11102082132593200) -
 CADSN('IMSVS.IVPDB1.CA0011') -
 UDATA('LAST CA EXECUTED BEFORE CHANGING THE CPU BOX')
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 18:31:21.487046
```

In Example 5-2, DBRC is notified of the successful completion of a image copy for the database description (DBD) specified. The UDATA optional keyword is used to clearly identify that this IC is the first using a new IMS version.

Example 5-2 The NOTIFY.IC command with the UDATA keyword

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
NOTIFY.IC   DBD(IVPDB1) DDN(DFSIVD1) -
RUNTIME(10049211228460952)           -
ICDSN(IMS12B.IVPDB1.DFSIVD1.IC102)   -
UDATA('FIRST CYCLE USING IMS NEW VERSION')
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 15:11:24.404791
```

In Example 5-3, the **LIST.DBS** command shows how the UDATA is displayed in a report.

Example 5-3 LIST.DBS showing UDATA

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
LIST.DBDS  DBD(IVPDB1)
11.208 15:06:22.423389              LISTING OF RECON                  PAGE 0002
------------------------------------------------------------------------------
 DBDS
  DSN=IMS12B.DFSIVD1                                          TYPE=IMS
  DBD=IVPDB1    DDN=DFSIVD1  DSID=001 DBORG=HIDAM  DSORG=OSAM
  CAGRP=**NULL**  GENMAX=3     IC AVAIL=2     IC USED=2     DSSN=00000001
  REUSE           RECOVPD=0
  DEFLTJCL=**NULL**  ICJCL=ICJCL     OICJCL=OICJCL    RECOVJCL=RECOVJCL
  RECVJCL=ICRCVJCL
  FLAGS:                             COUNTERS:
    IC NEEDED      =OFF
    RECOV NEEDED   =OFF
    RECEIVE NEEDED =OFF                EEQE COUNT              =0
------------------------------------------------------------------------------

 ALLOC
  ALLOC   =10.053 19:07:28.472125         *  ALLOC LRID =0000000000000000
  DSSN=0000000001 USID=0000000002 START = 10.053 14:51:54.800000

 IMAGE
  RUN     = 10.049 21:12:28.460952         *  RECORD COUNT =0
  STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000001
  USERDATA= FIRST CYCLE USING IMS NEW VERSION
```

Considerations for the UDATA keyword

User data is always listed when the RECON record is listed. User data is available by using the DBRC API.

The DSPAPQCA, DSPAPQIC, DSPAPQRV, and DSPAPQRR DSECTS are changed for the UDATA enhancement. Therefore, reassemble any of user-written programs that use it.

5.2.2 GENJCL new user keys

DBRC uses, along with other elements, PDS members as templates or skeletal JCL to correctly run recovery utilities. Usually, you modify the skeletal JCL to reflect the system configuration of your installation.

When you issue a **GENJCL** command, the command uses a skeletal JCL execution member, which contains symbolic keywords. You can define your own symbolic keywords and use the symbolic keywords that already exist. DBRC substitutes current information for the symbolic keywords.

IMS 12 increases the number of user keys in skeletal JCL from 32 to 64, keeping the same conventions and restrictions applied to earlier versions. In addition, the existing %DBTYPE key can be used when selecting DBDS allocation.

The following commands are affected:

GENJCL.ARCHIVE	Log Archive utility
GENJCL.CA	Database CA utility
GENJCL.CLOSE	Log Recovery utility
GENJCL.IC	Database Image Copy
GENJCL.OIC	Online Database Image Copy utility
GENJCL.RECEIVE	Database Recovery utility
GENJCL.RECOV	Database Recovery utility
GENJCL.USER	User-defined output

Figure 5-4 shows the new syntax of the **GENJCL.IC** command. For the syntax of all DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

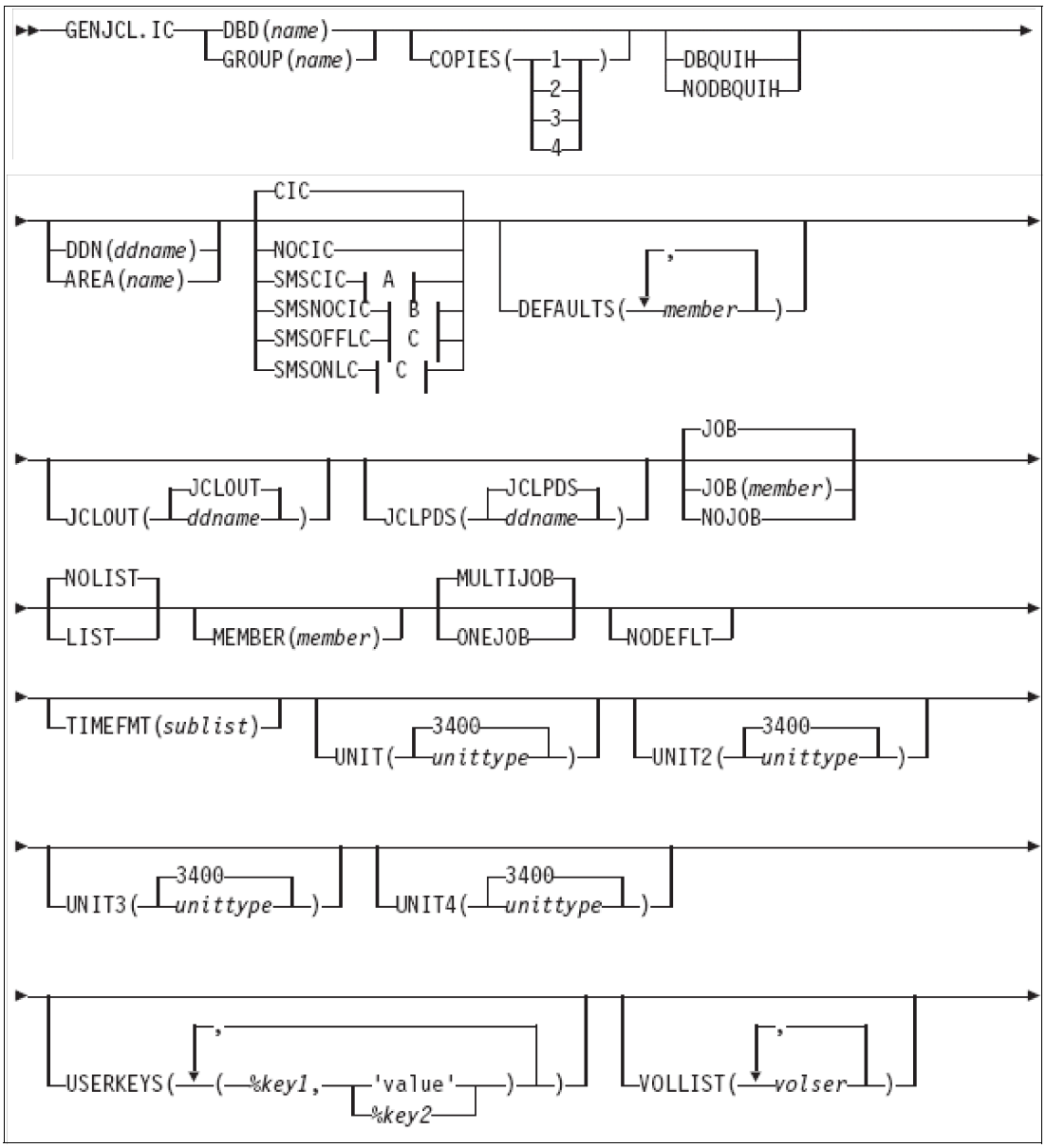

Figure 5-4 The GENJCL.IC Command syntax

The keyword `USERKEYS(%key1,'value' | %key2)` is an optional keyword that you use to set the value of keywords you have defined, where:

%key1 This is a user-defined keyword that is assigned a value. The maximum length of the keyword is 8 characters, including the percent sign (%). The first character after the % must be alphabetic (A–Z). The remaining characters must be alphanumeric (A–Z, 0–9).

'value' This is the value assigned to the user-defined keyword when it is encountered. The value can be any character string enclosed in single quotation marks. The maximum length of the value is 132 characters (excluding the quotation marks). If the value contains a quotation

mark, use two single quotation marks. The value can be a null string (''). If the value is a time stamp, it can be 0.

%key2 This is any simple keyword that was previously assigned a value, including DBRC-defined and user-defined keywords.

Up to 64 keywords can be specified.

Using the USERKEYS keyword

In Example 5-4, the USERKEYS keyword is used to assign a JOB name to the Image Copy process that adheres to the installation standards.

Example 5-4 The GENJCL.IC command with the USERKEYS keyword

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
  GENJCL.IC DBD(IVPDB1) DDN(DFSIVD1) -
               JOB(JOBJCL2)   JCLOUT(JCLOUT) JCLPDS(JCLPDS) -
               USERKEYS((%IVPJOB,'IV2F104J') -
                      (%IVPCIC,'VANAERS'))
DSPO203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSPO220I  COMMAND COMPLETION TIME 11.208 21:02:15.934457

//%IVPJOB   JOB ACTINFO1,
// 'PGMRNAME',
// CLASS=A,
// MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=%IVPCIC,
// REGION=128M
//*
//IV2F104J   JOB ACTINFO1,
// 'PGMRNAME',
// CLASS=A,
// MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=VANAERS,
// REGION=128M
```

Considerations for the user keys

The %DBTYPE key is similar to %SELECT DBDS in previous IMS versions.

5.2.3 New CLEANUP command parameters

IMS 11 introduced the **CLEANUP.RECON** command to delete old or expired recovery-related information from the RECON data set, including image copy, allocation, reorganization, and recovery records and log information.

IMS 12 adds the ability to delete CA execution records information by the new CAGRANGE, CAONLY, and LASTCA keywords. In addition, IMS 12 issues the message DSP0115I instead of setting a fatal return code when a **DELETE.LOG INACTIVE** or **TOTIME** command was issued and a LOGALL record did not exist for the inactive log.

The following commands are affected:

CLEANUP.RECON Deletes obsolete recovery-related CA execution and log records.

DELETE.LOG Deletes LOG records.

Figure 5-5 shows the new syntax of the **CLEANUP.RECON** command. For the syntax of other DBRC commands in *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

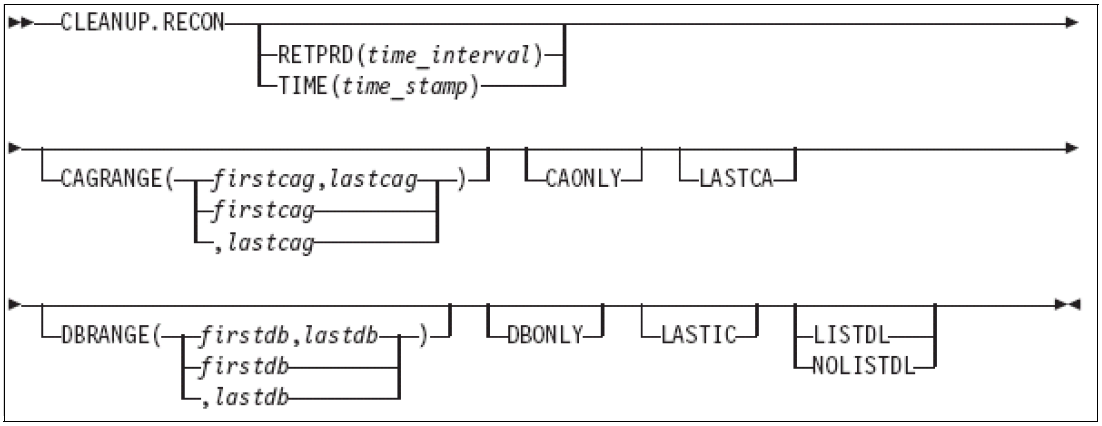

Figure 5-5 The CLEANUP.RECON command syntax

The **CLEANUP.RECON** command has the following options:

CAGRANGE(firstcag,lastcag | firstcag |,lastcag)
This is an optional keyword that specifies that CA data sets for a range of CA groups are to have cleanup done. If this keyword is not specified, all CA groups are processed. Use this keyword to clean up CA data sets for multiple CA groups or to resume cleanup after a **CLEANUP.RECON CAGRANGE** command is stopped.

firstcag,lastcag These are the upper and lower limits of the range of CA groups desired. These parameters do not need to match the name of a CA group in the RECON data set. They are used as the beginning and ending arguments in an alphabetic search.

firstcag This is the name of the CA group from which RECON cleanup begins processing the CA execution data sets. This CA group and all subsequent CA groups are processed until the last group in the RECON data set is reached or until the CA group specified as the lastcag value is reached.

lastcag This is the name of the CA group up to which RECON cleanup continues to process CA groups. RECON cleanup starts with the first CA group defined in the RECON data set and stops after this CA group is processed. If lastcag is specified, it must be preceded by a comma (,).

CAONLY This is an optional keyword you use to specify that you want to delete only CA execution records. (No database recovery-related information or log information is processed.) However, if the DBONLY keyword is also included in the command, database recovery-related information is also processed, and only the log information remain unprocessed.

LASTCA This is an optional keyword you use to specify that the last CA execution record for a CA group can be deleted as part of the RECON cleanup process if it meets the criteria for deletion. If this keyword is not specified, the last CA execution record for a CA group is retained.

Using the CLEANUP and DELETE commands

Example 5-5 shows the output from a **CLEANUP.RECON** command submitted with LASTIC and LASTCA optional keywords. These keywords mean that IC and CA records can be deleted as part of the RECON cleanup process if they meet the criteria for deletion, including the retention period specified.

Example 5-5 The CLEANUP.RECON command

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
CLEANUP.RECON LASTCA LASTIC RETPRD(365)
DSP0123I  NO PREDEFINED IMAGE COPY DATA SETS REMAINING
DSP0123I  DBDNAME=AUTODB    DDNAME=DFSDLR
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=AUTODB    DDN=DFSDLR
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=DI21PART  DDN=DI21PARO
DSP1212W  ALL EXISTING IMAGE COPIES FOR DBNAME=DI21PART  DDN=DI21PARO WERE DELETED
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=DI21PART  DDN=DI21PART
DSP1212W  ALL EXISTING IMAGE COPIES FOR DBNAME=DI21PART  DDN=DI21PART WERE DELETED
DSP0123I  NO PREDEFINED IMAGE COPY DATA SETS REMAINING
DSP0123I  DBDNAME=EMPDB2    DDNAME=DFSEMPL
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=EMPDB2    DDN=DFSEMPL
DSP0123I  NO PREDEFINED IMAGE COPY DATA SETS REMAINING
DSP0123I  DBDNAME=IPODB1    DDNAME=IPODB1A
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=IVPDB1    DDN=DFSIVD1
DSP1212W  ALL EXISTING IMAGE COPIES FOR DBNAME=IVPDB1    DDN=DFSIVD1  WERE DELETED
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=IVPDB1I   DDN=DFSIVD1I
DSP1212W  ALL EXISTING IMAGE COPIES FOR DBNAME=IVPDB1I   DDN=DFSIVD1I WERE DELETED
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=IVPDB2    DDN=DFSIVD2
DSP1212W  ALL EXISTING IMAGE COPIES FOR DBNAME=IVPDB2    DDN=DFSIVD2  WERE DELETED
DSP0123I  NO PREDEFINED IMAGE COPY DATA SETS REMAINING
DSP0123I  DBDNAME=IVPDRD1   DDNAME=DFSDRD1
DSP0123I  NO PREDEFINED IMAGE COPY DATA SETS REMAINING
DSP0123I  DBDNAME=SINDEX11  DDNAME=SINDX1P
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=SINDEX11  DDN=SINDX1P
DSP0123I  NO PREDEFINED IMAGE COPY DATA SETS REMAINING
DSP0123I  DBDNAME=SINDEX22  DDNAME=SINDX2P
DSP1214I  RECON INFORMATION WAS DELETED FOR DBNAME=SINDEX22  DDN=SINDX2P
DSP1228I  NO CHANGE ACCUMULATION INFORMATION WAS DELETED
DSP1216I  THE PRILOG FAMILY WITH TIME=10.053 14:51:54.800000 AND SSID=IMSB WAS DELETED
DSP1216I  THE PRILOG FAMILY WITH TIME=10.060 19:40:46.400000 AND SSID=IMSB WAS DELETED
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0002
DSP1216I  THE PRILOG FAMILY WITH TIME=10.083 11:40:22.500000 AND SSID=IMSB WAS DELETED
DSP1216I  THE PRILOG FAMILY WITH TIME=10.084 21:07:50.300000 AND SSID=IMSB WAS DELETED
DSP1216I  THE PRILOG FAMILY WITH TIME=10.091 07:49:56.400000 AND SSID=IMSB WAS DELETED
DSP1216I  THE PRILOG FAMILY WITH TIME=10.092 08:57:01.300000 AND SSID=IMSB WAS DELETED
DSP0126I  NUMBER OF INACTIVE PRILOG RECORDS DELETED WAS 00006
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
```

For more examples of the **CLEANUP.RECON** command, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

Example 5-6 shows the **DELETE.LOG** command when specifying that the records of all inactive recovery log data sets (RLDSs) and system log data sets (SLDSs) that have a start time older than the time specified with the TOTIME keyword are to be deleted.

Example 5-6 The DELETE.LOG command

```
//SYSIN  DD *
DELETE.LOG TOTIME(10293213950100000)
/*
```

Considerations for the CLEANUP command

After you delete amounts of data, you might want to reorganize your RECONs to ensure that the freed space can be reused. You must issue the **CLEANUP.RECON** command through a batch DBRC job or the DBRC API. This command is not available from IMS through an **/RMx** command.

Evaluate the usage of the **CLEANUP.RECON** command first on a copy of the RECONs, to avoid unintended deletions and to estimate the amount of time to process the command.

The last CA execution record for a CA group is only deleted whenever specifically requested.

5.2.4 New change accumulation retention period

Earlier versions of IMS use the **GRPMAX** parameter to control how many versions of CA execution should be kept in the RECON data sets. When the number of times you run the CA utility for the specified group exceeds the GRPMAX value, the record with the earliest CA stop time for the group is deleted for CA groups.

To improve the control of relevant information stored in the CA group record, IMS 12 provides the RECOVPD optional keyword that can be used to set the recovery period for a specified CA group records. The recovery period is the amount of time before the current date for which DBRC maintains CA information in the RECON data set.

The **CHANGE.CAGRP** and **INIT.CAGRP** commands are affected, which you use to modify information contained in a specified CA group record. Figure 5-6 shows the new syntax of **CHANGE.CAGRP** command. For the syntax of other DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

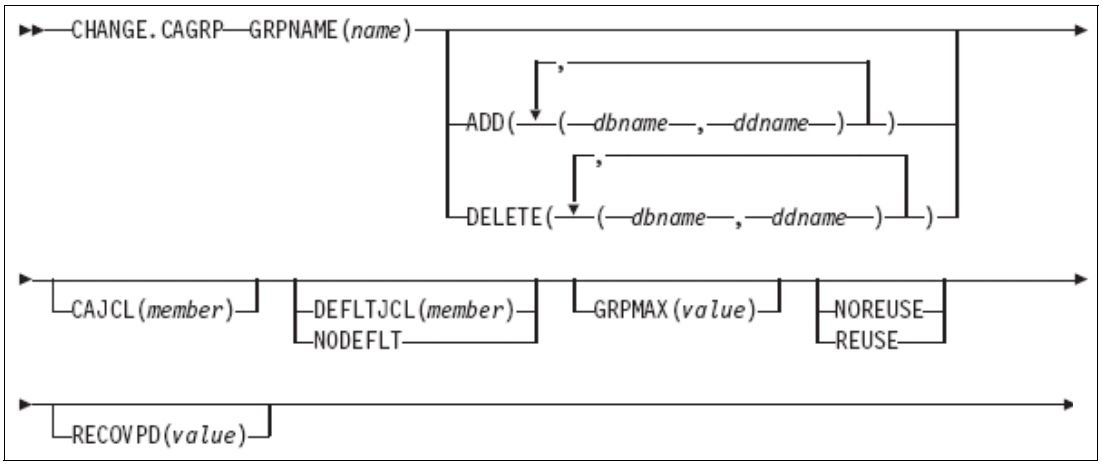

Figure 5-6 Syntax of the CHANGE.CAGRP command

The **CHANGE.CAGRP** command has the `RECOVPD(0 | value)` option. You use this optional keyword to modify the recovery period for a specified CA group. The recovery period is the amount of time before the current date for which DBRC maintains CA information in the RECON data set. For example, if the recovery period of a CA group is 14 days, DBRC maintains sufficient CA execution records for at least 14 days.

To determine whether the CA execution record falls within the recovery period, subtract the RECOVPD value from the current time. Any CA execution records with stop times that are newer than the calculated time is to be kept in the RECON data set.

For `value`, specify a decimal number in the range 0–999 that represents the number of days the CA execution records are to be kept in the RECON data set. If you specify 0 (the default), there is no recovery period.

Using the RECOVPD keyword

In Example 5-7, the retention period for the CA data sets for CA group GRPIVP is being changed to 7 days. This change accommodates new business requirements because the user started doing more than one CA process per day.

Example 5-7 The CHANGE.CAGRP command with the RECOVPD keyword

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
CHANGE.CAGRP GRPNAME(GRPIVP) RECOVPD(7)
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 17:05:49.648625
         IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0002
LIST.CAGRP GRPNAME(GRPIVP)
11.208 17:05:49.408264              LISTING OF RECON                  PAGE 0003
--------------------------------------------------------------------------------
 CAGRP
  GRPNAME=GRPIVP   GRPMAX=7    CA AVAIL=0    CA USED=0
  NOREUSE CAJCL=CAJCL          DEFLTJCL=**NULL**    RECOVPD=7
                               #MEMBERS=1     -DBD-     -DDN-
                                               IVPDB1    DFSIVD1
--------------------------------------------------------------------------------
DSP0180I  NUMBER OF RECORDS LISTED IS        1
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
```

Considerations for the RECOVPD keyword

The recovery period value is a decimal number in the range 0–999 that represents the quantity of days the CA execution records are kept in the RECON data set. If you specify 0 (the default), there is no recovery period. If you specify 7, DBRC maintains sufficient CA execution records for at least 7 days based on the stop time of the CA execution record.

If you issue the **`CHANGE.CAGRP`** command and specify the GRPMAX and RECOVPD values that are less than the existing values, any used CA data sets with stop times that are beyond the recovery period are deleted. These data sets remain deleted until the number of remaining CA data sets equals the specified GRPMAX value.

If you issue the **`DELETE.CA`** command, any specified CA data set record is deleted regardless of the RECOVPD or GRPMAX values.

If the GRPMAX limit is reached, but the RECOVPD for the oldest CA record has not expired, DBRC issues an informational message (`DSP1232I`) and does not discard the record. If the `DSP1232I` message appears frequently, you might need to tune the GRPMAX or RECOVPD values by using the **`CHANGE.CAGRP`** command.

Attention: If the GRPMAX value is lowered by using the **`CHANGE.CAGRP`** command, the GRPMAX value is recorded regardless of whether the oldest CA data sets can be deleted because they are within the recovery period.

5.3 Changes on RECON

IMS uses RECON data set information to perform some of its internal activities and to provide enough information so that you can make informed decisions when issues arise. The following changes have occurred regarding managing RECON information:

- CATDS specification

  IMS 12 makes the **VOLLIST** parameter optional when creating or changing the Image Copy and CA records because the CATDS is in effect for the control record. However, IMS 12 enforces the VOLLIST specification for the **INIT.IC** command when the NOCATDS is in effect.

- LIST command

  IMS 12 modifies some of the output listing from **LIST** commands to tailor better from the user requirement perspective. The online **/RMLIST** command allows an output larger than 32K. An optional suppression of recovery information was introduced on the **LIST.DB** and **LIST.DBDS** commands by the NORCVINF keyword. The use of full precision timestamps is added to the **LIST.HISTORY** command, and the **LIST.RECON** command now reports the number of registered databases at DBRC.

The following sections provide more details.

5.3.1 CATDS specification

Earlier versions of IMS required the VOLLIST keyword to specify the serial numbers of the volumes on which the image copy or the CA data set being defined are to reside. Even the RECON data set was initialized with the CATDS parameter. (CATDS specifies that these data sets are cataloged or SMS-managed.) Most of the time, depending on your installation standards, the FILESEQ and UNIT keywords must also be specified.

To reduce the unnecessary information required to create and manipulate Image copy and CA records, IMS 12 makes the VOLLIST keyword parameter optional if the RECON status record indicates that the data sets are to be treated as cataloged. (CATDS is in effect.)

The following commands are affected:

INIT.CA / NOTIFY.CA This command modifies information in a CA record.

INIT.IC / NOTIFY.IC This command modifies information in an image copy record.

Figure 5-7 shows the new syntax of the **INIT.RECON** command. For the syntax of other DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

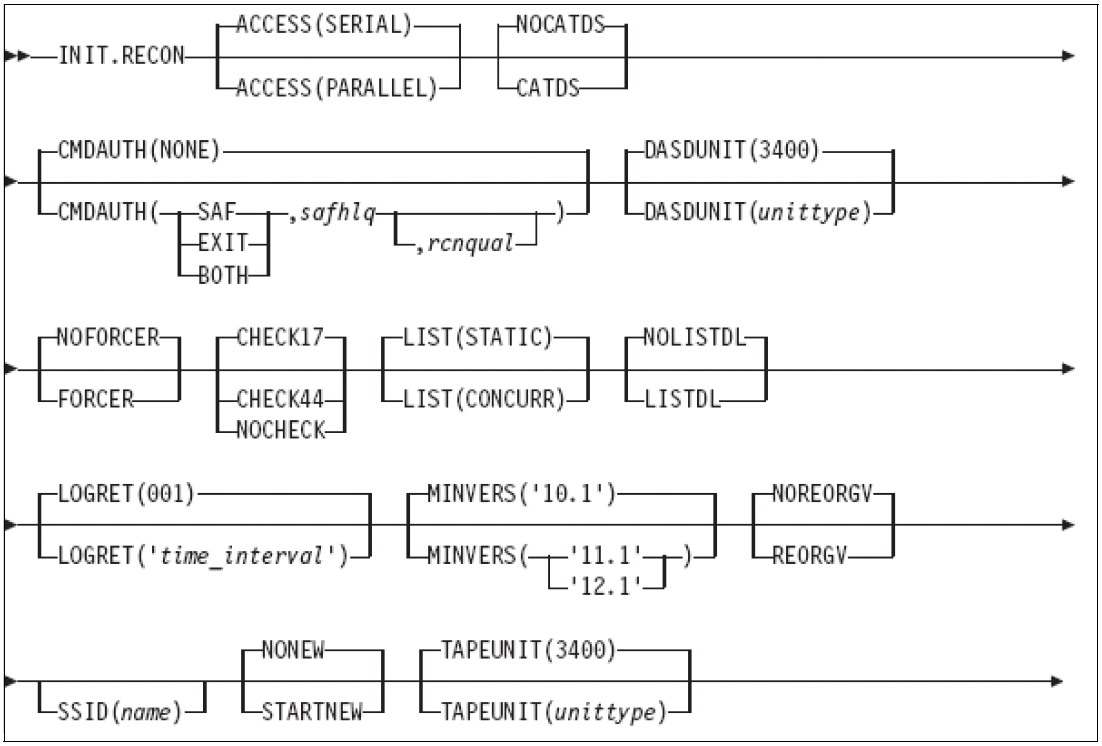

Figure 5-7 The INIT.RECON command

The **INIT.RECON** command has the following mutually exclusive, optional keywords that you use to indicate whether image copy, CA, and log data sets are cataloged:

NOCATDS This keyword specifies that these data sets, regardless of whether they are cataloged, are not to be treated as cataloged. DBRC verifies that the volume serial and file sequence numbers appearing in the job file control block are the same as the information recorded in the RECON data set.

CATDS This keyword specifies that these data sets are cataloged or SMS-managed. If the data set is allocated by the catalog and the CATDS option is used, DBRC bypasses volume serial and file sequence verification for the data set. For the CATDS option to be effective, the data set must be cataloged, and volume serial information for the data set must be omitted from the JCL.

- If the data set is cataloged, CATDS is specified, and volume serial information is included in the JCL. DBRC ignores CATDS and allocates the data set by the JCL. Normal volume serial and file sequence checking occurs.
- If the data set is not cataloged, CATDS is not effective, and DBRC allocates the data set by the JCL, with volume serial and file sequence checking. If log data sets are SMS-managed, select the CATDS option and remove the %LOGVOLS keyword from skeletal JCL member CAJCL.

SLDS: The CATDS option affects restart of IMS from SLDS. Because the CATDS option indicates the SLDSs are under the control of a catalog management system, the VOLSER is not passed back to IMS for data set allocation. If the SLDSs are not cataloged, IMS restart fails.

Using the CATDS specification in effect

In Example 5-8, a record is created in the RECON data set that defines an image copy data set for the specified database. VOLLIST is not needed because CATDS is in effect.

Example 5-8 The NOTIFY.IC command with CATDS in effect

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
 NOTIFY.IC   DBD(IVPDB1) DDN(DFSIVD1) -
 RUNTIME(11052211228460952)           -
 ICDSN(IMS12B.IVPDB1.DFSIVD1.IC105)   -
 UDATA('EXTRA IC DUE TO MASSIVE UPDATE')
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 17:15:21.588069
```

Considerations for the CATDS specification

The **CHANGE.RECON** and **INIT.RECON** commands update the RECON data set header record accordingly if you specify CATDS or NOCATDS.

IMS 12 does not allow usage of the **INIT.IC** command without VOLLIST when NOCATDS is in effect, which is different from earlier versions. In this sense, this command is now more restrictive.

5.3.2 LIST command

The most common usage of the **LIST** command is to produce a formatted printout of all or selected information contained in a RECON data set. Normally, you use the information printed to make an analysis and then take specific action regarding the DBRC controlled resources.

IMS 12 allows an output larger than 32 K for the **/RMLIST** online command, but only when the command is entered through the Operations Manager (OM) API. The output size is restricted by the DBRC private storage available for buffering the output message or OM limitations.

IMS 12 provides the NORCVINF keyword for the **LIST.DB** and **LIST.DBDS** commands, which suppresses recovery-related information. That is, ALLOC, IC, RECOV and REORG records are not listed, which reduces command output.

IMS 12 adds the full precision timestamps and more information about the HALDB type of databases such as active DBDSs, DDNames of inactive DBDSs, and current reorganization number for partition in the **LIST.HISTORY** command output.

In the **LIST.RECON** command output, IMS 12 includes the amount of registered databases, facilitating your control over the DBRC limit of 32,767 registered databases.

Figure 5-8 shows the new syntax of **LIST.DB** command. For the syntax of other DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

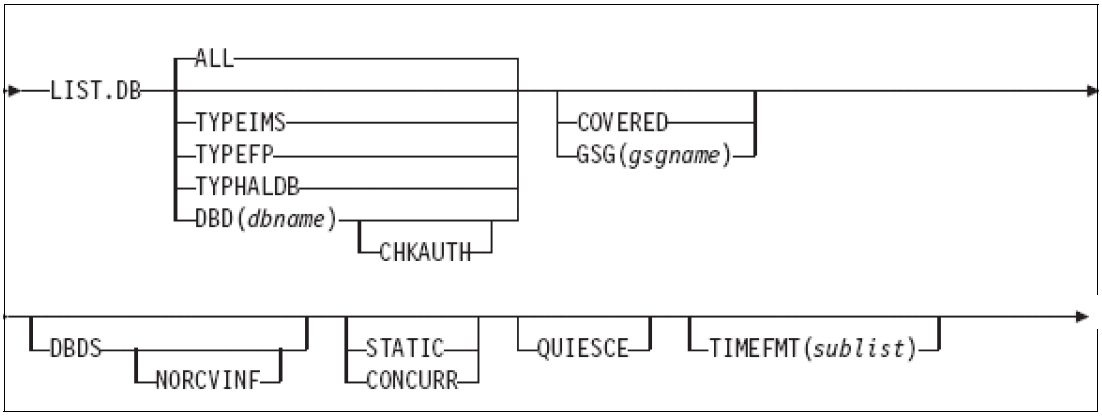

Figure 5-8 The LIST.DB command syntax

The **LIST.DB** command has the NORCVINF option. This option suppresses recovery-related records (ALLOC, IC, RECOV, and REORG) for those DBDSs or areas in the RECON data set that are associated with the specified database. If the **LIST.DB** command output is truncated and message DSP0057I is returned, you can specify the NORCVINF keyword to minimize the size of the output.

Using the LIST command

In Example 5-9, the **LIST.DB** command is used with the NORCVINF information.

Example 5-9 The LIST.DB command with the NORCVINF keyword

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
LIST.DB DBD(IVPDB1) DBDS NORCVINF
11.208 19:04:12.800733              LISTING OF RECON                  PAGE 0002
-------------------------------------------------------------------------------
 DB
  DBD=IVPDB1                    IRLMID=*NULL        DMB#=1       TYPE=IMS
  SHARE LEVEL=3                GSGNAME=**NULL**     USID=0000000002
  AUTHORIZED USID=0000000002  RECEIVE USID=0000000002 HARD USID=0000000002
  RECEIVE NEEDED USID=0000000000
  DBRCVGRP=**NULL**
  FLAGS:                              COUNTERS:
    BACKOUT NEEDED        =OFF          RECOVERY NEEDED COUNT   =0
    READ ONLY             =OFF          IMAGE COPY NEEDED COUNT =1
    PROHIBIT AUTHORIZATION=OFF          AUTHORIZED SUBSYSTEMS   =0
    RECOVERABLE           =YES          HELD AUTHORIZATION STATE=0
                                        EEQE COUNT              =0
    TRACKING SUSPENDED    =NO           RECEIVE REQUIRED COUNT  =0
    OFR REQUIRED          =NO
    REORG INTENT          =NO
    QUIESCE IN PROGRESS   =NO
    QUIESCE HELD          =NO
-------------------------------------------------------------------------------
11.208 19:04:12.800733              LISTING OF RECON                  PAGE 0003
-------------------------------------------------------------------------------
 DBDS
```

```
  DSN=IMS12B.DFSIVD1                                              TYPE=IMS
  DBD=IVPDB1    DDN=DFSIVD1  DSID=001 DBORG=HIDAM  DSORG=OSAM
  CAGRP=**NULL**  GENMAX=3     IC AVAIL=2     IC USED=0     DSSN=00000001
  REUSE           RECOVPD=0
  DEFLTJCL=**NULL**  ICJCL=ICJCL     OICJCL=OICJCL    RECOVJCL=RECOVJCL
  RECVJCL=ICRCVJCL
  FLAGS:                             COUNTERS:
    IC NEEDED      =ON
    RECOV NEEDED   =OFF
    RECEIVE NEEDED =OFF                EEQE COUNT              =0
--------------------------------------------------------------------------------
DSP0180I  NUMBER OF RECORDS LISTED IS        2
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 19:04:13.080011
```

Example 5-10 shows the output of the **LIST.HISTORY** command, which includes full precision timestamps.

Example 5-10 Output of the LIST.HISTORY command

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
LIST.HISTORY DBD(IVPDB1)
11.208 19:16:28.594191              LISTING OF RECON                  PAGE 0002
--------------------------------------------------------------------------------
 DB
  DBD=IVPDB1                    IRLMID=*NULL        DMB#=1       TYPE=IMS
  SHARE LEVEL=3                GSGNAME=**NULL**     USID=0000000002
  AUTHORIZED USID=0000000002  RECEIVE USID=0000000002 HARD USID=0000000002
  RECEIVE NEEDED USID=0000000000
  DBRCVGRP=**NULL**
  FLAGS:                             COUNTERS:
    BACKOUT NEEDED        =OFF         RECOVERY NEEDED COUNT   =0
    READ ONLY             =OFF         IMAGE COPY NEEDED COUNT =0
    PROHIBIT AUTHORIZATION=OFF         AUTHORIZED SUBSYSTEMS   =0
    RECOVERABLE           =YES         HELD AUTHORIZATION STATE=0
                                       EEQE COUNT              =0
    TRACKING SUSPENDED    =NO          RECEIVE REQUIRED COUNT  =0
    OFR REQUIRED          =NO
    REORG INTENT          =NO
    QUIESCE IN PROGRESS   =NO
    QUIESCE HELD          =NO
--------------------------------------------------------------------------------
11.208 19:16:28.594191              LISTING OF RECON                  PAGE 0003
--------------------------------------------------------------------------------
 DBDS
  DSN=IMS12B.DFSIVD1                                              TYPE=IMS
  DBD=IVPDB1    DDN=DFSIVD1  DSID=001 DBORG=HIDAM  DSORG=OSAM
  CAGRP=GRPIVP    GENMAX=3     IC AVAIL=2     IC USED=1     DSSN=00000001
  REUSE           RECOVPD=0
  DEFLTJCL=**NULL**  ICJCL=ICJCL     OICJCL=OICJCL    RECOVJCL=RECOVJCL
  RECVJCL=ICRCVJCL
  FLAGS:                             COUNTERS:
    IC NEEDED      =OFF
    RECOV NEEDED   =OFF
    RECEIVE NEEDED =OFF                EEQE COUNT              =0
--------------------------------------------------------------------------------
```

```
--------------------------------------------------------------------------------
 IMAGE
  RUN     = 10.049 21:12:28.460952         *  RECORD COUNT =0
  STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000002
  USERDATA= FIRST CYCLE USING IMS NEW VERSION

   .
   .
   .
   .
DSP0180I  NUMBER OF RECORDS LISTED IS        4
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 19:16:28.844639
```

Example 5-11 shows the **LIST.RECON STATUS** command to verify how many databases are already registered into the RECON data sets.

Example 5-11 The LIST.RECON STATUS command

```
DSP1123I  IMSR4C5C DBRC REGISTERED WITH IMSPLEX IM12X USING EXIT
         IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0002
LIST.RECON STATUS
11.208 12:45:39.109351              LISTING OF RECON                  PAGE 0003
--------------------------------------------------------------------------------
 RECON
  RECOVERY CONTROL DATA SET, IMS V12R1
  DMB#=23                            INIT TOKEN=11192F0745595F
  FORCER    LOG DSN CHECK=CHECK44    STARTNEW=NO
  TAPE UNIT=          DASD UNIT=SYSALLDA  TRACEOFF   SSID=I12A
  LIST DLOG=YES                CA/IC/LOG DATA SETS CATALOGED=YES
  MINIMUM VERSION = 10.1       CROSS DBRC SERVICE LEVEL ID= 00001
  REORG NUMBER VERIFICATION=NO
  LOG RETENTION PERIOD=00.001 00:00:00.0
  COMMAND AUTH=NONE  HLQ=**NULL**
  RCNQUAL=**NULL**
  ACCESS=SERIAL      LIST=STATIC
  SIZALERT DSNUM=15      VOLNUM=16     PERCENT= 95
  LOGALERT DSNUM=3       VOLNUM=16

   .
   .
   .
   .
  NUMBER OF REGISTERED DATABASES =        8


DSP0180I  NUMBER OF RECORDS LISTED IS        1
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 12:45:39.359739
```

Considerations for the /RMLIST command

When using the **/RMLIST** command, a performance impact might result from reading and reserving the RECONs for an extended amount of information.

5.4 DBRC with IMS 12

IMS 12 DBRC enhancements provide modifications to its internal records and functionality. Therefore, you must keep in mind certain considerations when upgrading from earlier versions. This section explores coexistence and migration from the DBRC point of view. For more and complete information about IMS 12 coexistence and migration, see Chapter 8, “Installation and migration considerations” on page 279.

5.4.1 Coexistence

IMS 12 can coexist with IMS 10 and IMS 11, so that existing applications and data can be used without change. However, coexistence considerations apply to each of the IMS versions.

Coexistence with IMS 10

An IMS 10 system can coexist with IMS 12 in the following situations:

- The RECON has been upgraded to IMS 12.
- APAR PM05243 (PTF UK62970) is applied.
- MINVERS in the RECON data set has not been set higher than 10.1.

Therefore, database quiesce is not available.

Coexistence with IMS 11

An IMS 11 system can coexist with IMS 12 in the following situations:

- The RECON has been upgraded to IMS 12.
- APAR PM05244 (PTF UK62971) is applied.
- MINVERS in the RECON data set has been set to 11.1.

Therefore, cross-system coupling facility (XCF) use by APPC synchronous conversations and OTMA CM1 (send-then-commit) are not available.

Considerations

The MINVERS level must be set to the lowest level of IMS that uses or shares the RECON data sets.

DBRC applications compiled with Version 1.0 DSPAPI macros work without modification or reassembly with Version 2.0 of the DBRC API. However, these applications cannot use any of the newer functions or options that are supported in Version 2.0 macros, which are available only with IMS 10 and later.

5.4.2 Migration

IMS 12 requires you to upgrade the RECON data set before you start a control region. A new CHECKUP keyword was introduced in the **CHANGE.RECON UPGRADE** command to inform you in advance if the RECON data set from earlier version is in a state that allows upgrade. The benefit is that you can react and take the appropriate actions before effectively doing the upgrade, and thereby avoid facing unexpected conditions.

If you have to coexist with earlier versions of IMS, you must apply the DBRC migration or coexistence APARs. You are not required to change the MINVERS value to '12.1' when you migrate to IMS 12. Change this value only after you verify that you do not need to coexist with an earlier version of IMS. When you do not need to fall back to an earlier version and you need to use new functions, the MINVERS value must be set to '12.1'.

The upgrade process begins with a quiesce close and a check for shunted I/O. If there is no shunted I/O, the records in COPY1 and COPY2 are upgraded in parallel RECON access (PRA) mode. After upgrade completes, the quiesce for the RECON data sets is released and other DBRC instances can access the upgraded RECON data sets.

Upgrade processing from IMS 11 to IMS 12 offers the following benefits:

- Reads SSYS records to check for DBRC small programming enhancements (SPEs)
- Reads all database records
- Turns on the high-order bit if it is not on and the database is not authorized
- Fails if the high-order bit is not on and the database is authorized
- Builds a DMB table record
- Updates the RECON header record
- Sets the version indicator and MINVERS value
- Updates the RECON header extension record
- Sets the version indicator
- After COPY1 is upgraded, copies it to COPY2

Upgrade processing from IMS 10 to IMS 12 offers the following benefits:

- Reads SSYS records to check for DBRC SPE
- Reads all database records
- Turns on the high-order bit if it is not on and the database is not authorized; fails if the high-order bit is not on and the database is authorized
- Builds a DMB table record
- Updates the RECON header record
- Expands a record by 44 bytes for the RECON qualifier field used by DBRC Security Override support
- Sets the version indicator and MINVERS value
- Updates the RECON header extension record
- Sets the version indicator
- Updates CA execution records
- Expands records by 16 bytes
- Updates database or area authorization records
- Expands records by 20 bytes to support future enhancements
- After COPY1 is upgraded, copies it to COPY2

Figure 5-9 shows the new syntax of **LIST.DB** command. For the syntax of other DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

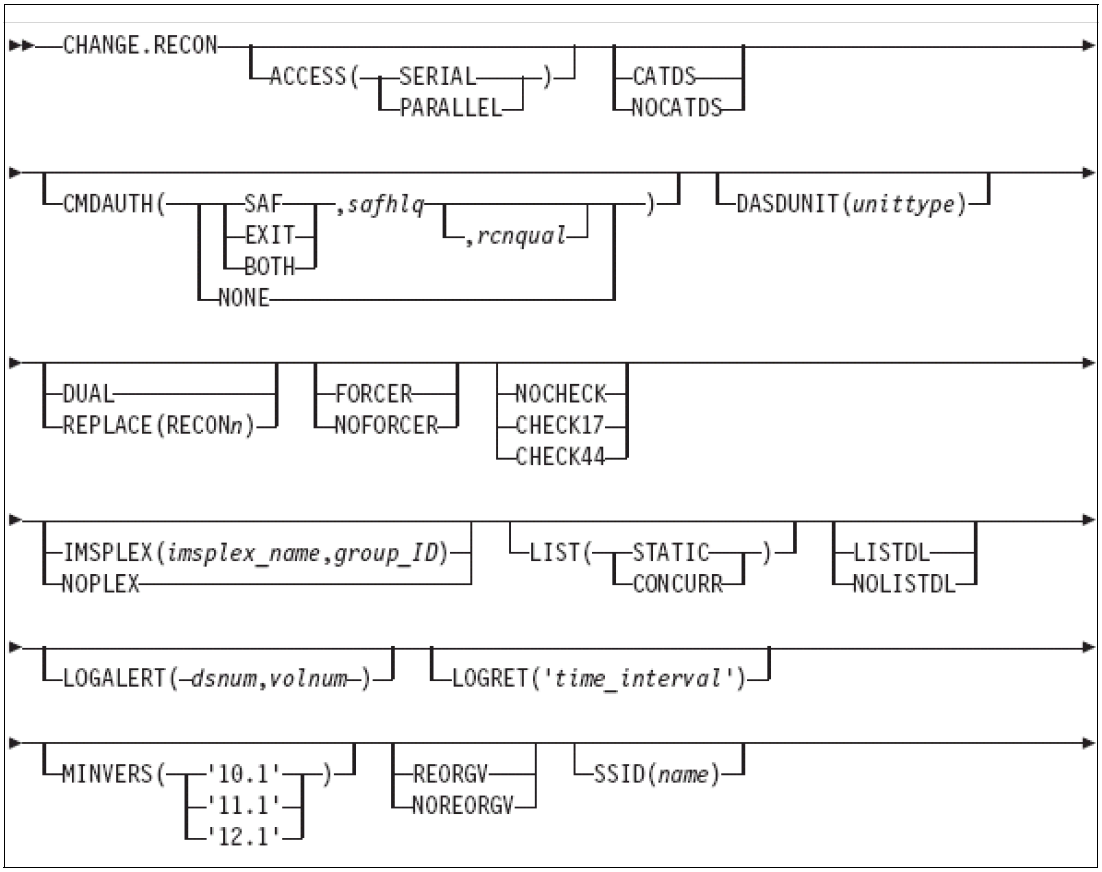

Figure 5-9 The CHANGE.RECON syntax

Using the CHANGE.UPGRADE command

Example 5-12 shows how to use the CHECKUP keyword to verify in advance if the RECON is ready to upgrade to IMS 12.

Example 5-12 The CHANGE.RECON UPGRADE command

```
IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0001
CHANGE.RECON UPGRADE CHECKUP
DSP1238I  RECON UPGRADE CHECKUP IS BEGINNING
DSP1239I  RECON UPGRADE CHECKUP COMPLETED WITH NO ERRORS FOUND
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 11.208 12:14:25.329216
         IMS VERSION 12 RELEASE 1 DATA BASE RECOVERY CONTROL          PAGE 0002
DSP0211I  COMMAND PROCESSING COMPLETE
DSP0211I  HIGHEST CONDITION CODE = 00
```

Example 5-13 shows sample JCL and control cards to perform the RECON upgrade from IMS 11 to IMS 12 in a copy of the RECON. This approach helps to determine how long it will take when using the actual RECON data sets.

Example 5-13 JCL sample to perform an upgrade in a RECON Copy

```
//CLEANUP  EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
  DELETE IMS11B.RECON1.COPY PURGE
  DELETE IMS11B.RECON2.COPY PURGE
  DELETE IMS11B.RECON3.COPY PURGE
  SET MAXCC=0
/*
//COPYALOC EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
  DEFINE CLUSTER (NAME(IMS11B.RECON1.COPY) VOL(SBOX01) CYL(7 0) -
  FOR(9999) SHR(3 3) BUFSPC(32768) NONSPANNED NOWRITECHECK) -
  DATA (NAME(IMS11B.RECON1.D.COPY) CISZ(32768) RECSZ(30 32600) -
  FSPC(30 35) KEYS(32 0)) -
  INDEX (NAME(IMS11B.RECON1.I.COPY) CISZ(2048))

  DEFINE CLUSTER (NAME(IMS11B.RECON2.COPY) VOL(SBOX01) CYL(9 0) -
  FOR(9999) SHR(3 3) BUFSPC(32768) NONSPANNED NOWRITECHECK) -
  DATA (NAME(IMS11B.RECON2.D.COPY) CISZ(32768) RECSZ(30 32600) -
  FSPC(30 35) KEYS(32 0)) -
  INDEX (NAME(IMS11B.RECON2.I.COPY) CISZ(2048))

  DEFINE CLUSTER (NAME(IMS11B.RECON3.COPY) VOL(SBOX01) CYL(9 0) -
  FOR(9999) SHR(3 3) BUFSPC(32768) NONSPANNED NOWRITECHECK) -
  DATA (NAME(IMS11B.RECON3.D.COPY) CISZ(32768) RECSZ(30 32600) -
  FSPC(30 35) KEYS(32 0)) -
  INDEX (NAME(IMS11B.RECON3.I.COPY) CISZ(2048))
/*
//COPY   EXEC PGM=DSPURX00,REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=IMS11B.SDFSRESL
//RECON1   DD DSN=IMS11B.RECON1,DISP=SHR
//RECON2   DD DSN=IMS11B.RECON2,DISP=SHR
//BACKUP1  DD DSN=IMS11B.RECON1.COPY,DISP=SHR
//BACKUP2  DD DSN=IMS11B.RECON2.COPY,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
  BACKUP.RECON BOTH
/*
//UPGRADE  EXEC PGM=DSPURX00,REGION=2048K
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//RECON1   DD DSN=IMS11B.RECON1.COPY,DISP=SHR
//RECON2   DD DSN=IMS11B.RECON2.COPY,DISP=SHR
//RECON3   DD DSN=IMS11B.RECON3.COPY,DISP=SHR
//SYSIN    DD *
  CHANGE.RECON UPGRADE
/*
//
```

Considerations for the Upgrade option

Optionally, issue the **CHANGE.RECON UPGRADE CHECKUP** command to ensure that your RECON data set is ready to be migrated.

Before you issue the **CHANGE.RECON UPGRADE** command against the production RECON data sets, upgrade a copy of the production RECON data sets to verify how long it will take to perform the upgrade. Issue the **CHANGE.RECON UPGRADE** command by using either the IMS 12 DBRC Recovery Control utility (DSPURX00) or the IMS 12 DBRC Command API request. IMS online Command is not allowed.

After this command successfully completes, DBRC sets the value for MINVERS (the minimum version of IMS that can sign on to DBRC) to '10.1' if the value was less than '10.1'.

Ensure that you have two active RECON data sets (COPY1 and COPY2) and a spare data set when you upgrade the RECON data sets while other jobs are accessing them.

Upgrading from IMS 10 can increase the size of the RECONs. Evaluate whether the current size space can accommodate the IMS 12 records

The upgrade process reads all database records to ensure that the high-order bit is on in all DMB numbers. If the high-order bit is not on (this should not occur), the bit is turned on if the database is not authorized and the DSP1235W message is displayed:

```
DSP1235W THE INTERNAL REPRESENTATION OF THE DMB NUMBER FOR DATABASE xxxxxxxx IS
INCORRECT
```

The high-order bit is not turned on if the database is authorized; instead, the upgrade fails and the DSP1236E message is displayed:

```
DSP1236E THE INTERNAL REPRESENTATION OF THE DMB NUMBER FOR DATABASE xxxxxxxx COULD
NOT BE CORRECTED BECAUSE THE DATABASE IS AUTHORIZED
```

Attention: After RECONs are upgraded to IMS 12, IMS 11 or IMS 10 Log Archive jobs use additional memory because versions of RECON records are kept in memory. Use **REGION=0M** for IMS 10 and IMS 11 archive jobs.

6

Connectivity enhancements

This chapter describes the changes and enhancements to IBM Information Management System (IMS) and IMS Connect to support asynchronous IMS to IMS communication, Multiple Systems Coupling (MSC), using TCP/IP and the new IMS Connect type-2 single point of control (SPOC) commands. It also documents the new recorder trace enhancements, the XML converter refresh, and the Resource Access Control Facility (RACF) return code changes.

This chapter includes the following sections:

- OTMA support for asynchronous IMS to IMS communications
- Multiple Systems Coupling using TCP/IP
- Other IMS Connect changes
- IMS Connect type-2 Single Point of Control commands

6.1 OTMA support for asynchronous IMS to IMS communications

Before IMS 12, if you wanted to route an asynchronous transaction from one IMS to another IMS over a TCP/IP network, you had to create a gateway application that received messages from one IMS using resume TPIPE processing. Then you had to insert it into the other IMS using send-only processing.

The need for a customer written gateway is removed with IMS 12. You can now define a remote IMS system in IMS Connect and an Open Transaction Manager Access (OTMA) descriptor in IMS (Figure 6-1). This way, an application program can push a message to the remote system using a normal sequence of CHNG, ISRT, and PURG calls. (PURG is only valid for an EXPRESS=YES PCB).

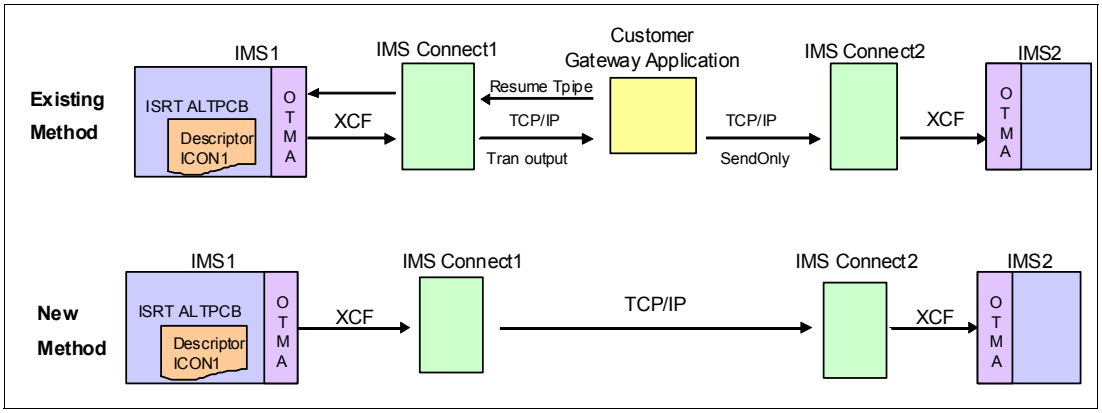

Figure 6-1 Asynchronous IMS to IMS

6.1.1 OTMA descriptor definitions

To define remote asynchronous IMS to IMS communications, you need to define an OTMA descriptor. To define an OTMA descriptor, you can add a descriptor to the DFSYDTx member of IMS proclib or define it dynamically.

IMS PROCLIB definitions

You can define OTMA descriptors by updating the DFSYDTx member of IMS.PROCLIB (Example 6-1). When you activate an OTMA descriptor this way, you must restart IMS.

Example 6-1 IMS.PROCLIB member DFSYDTC

```
D OTMA2CD TYPE=IMSCON TMEMBER=HWBI12C2 RMTIMSCON=HWSI12D1 RMTIMS=I12D
D OTMA2CD RMTTRAN=OTMAPRNT
```

You also need a matching entry in the other system (Example 6-2) so that the remote IMS can send replies. The reply message is not sent back to the originating transaction in the local IMS.

Example 6-2 IMS.PROCLIB member DFSYDTD

```
D OTMA2DC TYPE=IMSCON TMEMBER=HWBI12D4 RMTIMSCON=HWSI12C1 RMTIMS=I12C
D OTMA2DC RMTTRAN=OTMAPRNT
```

This entry gives you a destination that you can use with an alternate I/O PCB CHNG call when we want to send data from IMS C to IMS D or back from IMS D to IMS C.

Dynamic OTMA descriptors

It is much easier to define the OTMA descriptors dynamically using the new type-2 **CREATE OTMADESC** command. This approach does not require you to restart IMS. The statically defined definitions created by updating the DFSYDTx members can be updated or deleted by using the **UPDATE OTMADESC** or **DELETE OTMADESC** commands. You can use the **QUERY OTMADESC** command to see what you have defined.

6.1.2 Modified IMS commands

IMS 12 has updated the **CREATE OTMADESC**, **UPDATE OTMADESC**, **DELETE OTMADESC**, and **QUERY OTMADESC** commands to support the new asynchronous IMS to IMS communications.

The CREATE OTMADESC command

IMS 12 has added options to the **CREATE OTMADESC** command to set the **RMTIMS**, **RMTIMSCON USERID**, and **RMTTRAN** parameters.

Example 6-3 defines the same OTMA descriptors created with the static definitions in Example 6-1.

Example 6-3 Creating the first OTMA descriptor

```
CREATE OTMADESC NAME(OTMA2CD) -
SET(TYPE(IMSCON) TMEMBER(HWBI12C2) -
RMTIMSCON(HWSI12D1) RMTIMS(I12D) RMTTRAN(OTMAPRNT))
```

Example 6-4 defines the same OTMA descriptors created with the static definitions in Example 6-2.

Example 6-4 Creating the second OTMA descriptor

```
CREATE OTMADESC NAME(OTMA2DC) -
SET(TYPE(IMSCON) TMEMBER(HWBI12D4) -
RMTIMSCON(HWSI12C1) RMTIMS(I12C) RMTTRAN(OTMAPRNT))
```

The UPDATE OTMADESC command

IMS 12 has added the same options to the **UPDATE OTMADESC** command as the **CREATE OTMADESC** command to support changing the new parameters (Example 6-5).

Example 6-5 The Update OTMA descriptor

```
UPDATE OTMADESC NAME(OTMA2DC) SET(RMTTRAN(NEWTRAN))
```

The QUERY OTMADES command

IMS 12 has updated the **QUERY OTMASDESC** command to display the new options. To see the definitions, you can use the command shown in Example 6-6.

Example 6-6 The Query OTMA descriptor command

```
QRY OTMADESC NAME(*) OPTION(WILDCARD) -
SHOW(TMEMBER, RMTIMS, RMTIMSCON, RMTTRAN) TYPE(IMSCON)
```

Example 6-7 shows the output from the **QUERY OTMASDESC** command.

Example 6-7 Output from the QRY OTMADESC command

```
Response for: QRY OTMADESC NAME(*) OPTION(WILDCARD) SHOW(TMEMBER, RMTIMS, RMTIMSCON, RMTTRAN)
              TYPE(IMSCON)
DestName MbrName    CC Type     TMember          RmtIMSCon RmtIMS   RmtTran
-------------------------------------------------------------------------------------------------
OTMA2CD  I12C        0 IMSCON   HWBI12C3         HWSI12D1  I12D     OTMAPRNT
OTMA2DC  I12D        0 IMSCON   HWBI12D4         HWSI12C1  I12C     OTMAPRNT
```

Notice that, in these examples, we used **OPTION(WILDCARD)** as part of that command. With any OTMA descriptor, we can use an asterisk (*) at the end of the name of the descriptor. Therefore, a descriptor called OTMAD* matches OTMAD1 or OTMADX on a CHNG call. To display that one descriptor, we use **NAME(OTMAD*)** with the **OPTION(NOWILDCARD)**. If we want the command to look for any descriptors that start with OTMAD, we must specify **NAME(OTMAD*)** with **OPTION(WILDCARD)**. **OPTION(NOWILDCARD)** is the default and is supported for the **DELETE OTMADESC** command.

6.1.3 IMS Connect definitions

For IMS to make the connection from one IMS system to the other, you must update the IMS Connect configuration with a new RMTIMSCON definition. The remote IMS connection in the local IMS Connect must be defined to match the local OTMA descriptor. The **TMEMBER** and **RMTIMSCON** definitions on the OTMADESC must match the local **DATASTORE MEMBER** and **RMTIMSCON ID** parameters in IMS connect. The RMTIMS definition must match the **DATASTORE ID** in the remote IMS connect. If defined, RMTTRAN must point to a transaction definition in the remote system, it cannot point to a remote LTERM.

Example 6-8 shows the local IMS definitions.

Example 6-8 Local IMS Connect TCP/IP, data store, and remote IMS definitions

```
TCPIP=(EXIT=(HWSSMPL1),HOSTNAME=TCPIP,PORT(ID=7301))

DATASTORE=(GROUP=I12XOTMA,ID=I12C,
  MEMBER=HWBI12C3,TMEMBER=I12COTMA)

RMTIMSCON=(ID=HWSI12D1,
  HOSTNAME=WTSC64.ITSO.IBM.COM,PORT=7401,
  AUTOCONN=Y,PERSISTENT=Y,
  IDLETO=60000,RESVSOC=10)
```

Example 6-9 shows the remote IMS definitions.

Example 6-9 Remote IMS Connect TCP/IP, data store, and remote IMS definitions

```
TCPIP=(EXIT=(HWSSMPL1),HOSTNAME=TCPIP,PORT(ID=7401))

DATASTORE=(GROUP=I12XOTMA,ID=I12D,
  MEMBER=HWBI12D4,TMEMBER=I12DOTMA)

RMTIMSCON=(ID=HWSI12C1,
  HOSTNAME=WTSC63.ITSO.IBM.COM,PORT=7301,
  AUTOCONN=Y,PERSISTENT=Y,
  IDLETO=60000,RESVSOC=10)
```

You can see how the RMTIMSCON defines the connection to the PORT ID used by the remote system in both cases.

6.1.4 New and modified IMS Connect commands

IMS 12 has introduced a new set of commands for IMS to IMS communications. Also a new interface is available from the IMS SPOC to operate IMS Connect.

New and updated IMS Connect WTOR reply commands

The write to operator with reply (WTOR) reply commands in the following sections are updated or added to support asynchronous IMS to IMS communications.

The VIEWHWS command

The **VIEWHWS** command is updated to display additional information about the RMTIMSCON definitions. Example 6-10 shows the new output.

Example 6-10 Output from the VIEWHWS command

```
HWSC0001I    NO ACTIVE MSC

HWSC0001I    RMTIMSCON=HWSI12D1  STATUS=NOT ACTIVE
HWSC0001I      IP-ADDRESS=009.012.006.009  PORT=7401
HWSC0001I      HOSTNAME=WTSC64.ITSO.IBM.COM

HWSC0001I      AUTOCONN=Y  PERSISTENT=Y
HWSC0001I      IDLETO=60000
HWSC0001I      RESVSOC=10   NUMSOC=0
HWSC0001I      NO ACTIVE CLIENTS
```

The VIEWRMT ALL command

The new **VIEWRMT ALL** command shows the status of RMTIMSCON definitions. Example 6-11 shows the output.

Example 6-11 Output from the VIEWRMT ALL command

```
R 685,VIEWRMT ALL
IEE600I REPLY TO 685 IS;VIEWRMT ALL
HWSC0001I    RMTIMSCON=HWSI12B1  STATUS=NOT ACTIVE
HWSC0001I      IP-ADDRESS=009.012.006.009  PORT=7202
HWSC0001I      HOSTNAME=WTSC64.ITSO.IBM.COM

HWSC0001I      AUTOCONN=N  PERSISTENT=Y
HWSC0001I      IDLETO=0
HWSC0001I      RESVSOC=10   NUMSOC=0
HWSC0001I      NO ACTIVE CLIENTS
```

The VIEWRMT rmtimscon command

The new **VIEWRMT rmtimscon** command shows a specific RMTIMSCON definition. Example 6-12 shows the output, but only the named RMTIMSCON is displayed unlike the **VIEWRMT ALL** command, which shows all RMTIMSCON connections.

Example 6-12 Output from the VIEWRMT xxxx command

```
R 660,VIEWRMT HWSI12A1
IEE600I REPLY TO 660 IS;VIEWRMT HWSI12A1
```

```
HWSC0001I    RMTIMSCON=HWSI12A1  STATUS=ACTIVE
HWSC0001I      IP-ADDRESS=009.012.006.070  PORT=7102
HWSC0001I      HOSTNAME=WTSC63.ITSO.IBM.COM

HWSC0001I      AUTOCONN=N  PERSISTENT=Y
HWSC0001I      IDLETO=0
HWSC0001I      RESVSOC=10   NUMSOC=1
HWSC0001I      SENDCLNT LCLPLKID STATUS       SECOND SENDPORT
HWSC0001I      MSC51A86 MSC2B2A  CONN             62 39486
HWSC0001I      TOTAL SENDCLNTS=1 RECV=0 CONN=1 XMIT=0 OTHER=0
```

The STARTRMT rmtimscon command

IMS has added the **STARTRMT rmtimscon** command to activate a RMTIMSCON connection. Example 6-13 shows the output.

Example 6-13 Output from the STARTRMT HWSI12C1 command

```
R 709,STARTRMT HWSI12C1
IEE600I REPLY TO 709 IS;STARTRMT HWSI12C1
HWST3500I COMMUNICATIONS WITH REMOTE IMS CONNECT HWSI12C1 STARTED;
M=TSCH
```

The STOPRMT rmtimscon command

The new **STOPRMT rmtimscon** command stops a RMTIMSCON connection. Example 6-14 shows the output.

Example 6-14 Output from the STOPRMT HWSI12C1 command

```
R 710,STOPRMT HWSI12C1
IEE600I REPLY TO 710 IS;STOPRMT HWSI12C1
HWST3505I COMMUNICATIONS WITH REMOTE IMS CONNECT HWSI12C1 STOPPED;
M=TSCH
```

New IMS Connect z/OS modify commands

The commands in the following sections are added as IMS Connect z/OS modify commands.

QUERY RMTIMSCON NAME(*)

The new **QUERY RMTIMSCON NAME(*)** command is equivalent to the **VIEWRMT ALL** command. Example 6-11 on page 165 shows the output.

QUERY RMTIMSCON NAME(rmtinm)

The new **QUERY RMTSIMSCON** command is equivalent to **VIEWRMT rmtimscon** command. It only displays the listed RMTIMSCON. Example 6-12 on page 165 shows the output.

UPDATE RMTIMSCON NAME(rmtinm) START(COMM)

The new **UPDATE RMTIMSCON NAME(rmtinm) START(COMM)** command is equivalent to the **STARTRMT rmtimscon** command. Example 6-13 on page 166 shows the output.

UPDATE RMTIMSCON NAME(rmtinm) STOP(COMM)

The new **UPDATE RMTIMSCON NAME(rmtinm) STOP(COMM)** command is equivalent to the **STOPRMT rmtimscon** command. Example 6-14 on page 166 shows the output.

New IMS Connect commands

IMS Connect has a new type-2 command interface using the IMS SPOC. All of the existing WTOR replies and z/OS modify commands have a SPOC equivalent.

QUERY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(...)** command shows the status of all RMTIMSCON connections. Example 6-15 shows the output.

Example 6-15 Output from QRY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL)

```
Response for: QUERY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL)
RmtImsCon MbrName            CC IpAddress       HostName               Port AutoConn Persist     IdleTO
             ResvSoc     NumSoc Appl     UserID   Status
-------------------------------------------------------------------------------------------------------
HWSI12B1  HWSI12A1            0 9.12.6.9        WTSC64.ITSO.IBM.COM    7202 N        Y               0
                 10           0                   NOTACTIVE
HWSI12A1  HWSI12B1            0 9.12.6.70       WTSC63.ITSO.IBM.COM    7102 N        Y               0
                 10           0                   NOTACTIVE
HWSI12D1  HWSI12C1            0 9.12.6.9        WTSC64.ITSO.IBM.COM    7401 Y        Y           60000
                 10           0                   NOTACTIVE
HWSI12C1  HWSI12D1            0 9.12.6.70       WTSC63.ITSO.IBM.COM    7301 Y        Y           60000
                 10           0                   NOTACTIVE
```

QUERY IMSCON TYPE(RMTIMSCON) NAME(rmtinm) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(RMTIMSCON) NAME(rmtinm) SHOW(...)** command shows the status of a specific RMTIMSCON connection. The output is similar to the output from the **QRY RMTIMSCON NAME(*) SHOW(...)** command, but it is restricted to the listed connections. Example 6-16 shows the output.

Example 6-16 Output from the QRY IMSCON TYPE(RMTIMSCON) NAME(HWSI12C1) SHOW(ALL) command

```
Response for: QUERY IMSCON TYPE(RMTIMSCON) NAME(HWSI12C1) SHOW(ALL)
RmtImsCon MbrName            CC CCText                          IpAddress       HostName
             Port AutoConn Persist     IdleTO    ResvSoc     NumSoc Appl     UserID   Status
          TotSClnts TotRecv TotConn TotXmit TotOther SendClnt SendUID      Second SendPort SendStatus
-------------------------------------------------------------------------------------------------------
HWSI12C1  HWSI12D1            0                                  9.12.6.70       WTSC63.ITSO.IBM.COM
             7301 Y        Y            60000         10          1                    ACTIVE
                 1       0       1       0        0
```

UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) START(COMM)

The new **UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) START(COMM)** command starts a RMTIMSCON connection. Example 6-17 shows the output.

Example 6-17 Output from UPD IMSCON TYPE(RMTIMSCON) NAME(rmtinm) START(COMM)

```
Response for: UPDATE IMSCON TYPE(RMTIMSCON) NAME(HWSI12C1) START(COMM)
RmtImsCon MbrName            CC CCText
-------------------------------------------------------------------------
HWSI12C1  HWSI12D1            0
```

UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) STOP(COMM)

The new **UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) STOP(COMM)** command terminates communications for a RMTIMSCON connection. Example 6-18 shows the output.

Example 6-18 Output from UPD IMSCON TYPE(RMTIMSCON) NAME(rmtinm) STOP(COMM)

```
Response for: UPDATE IMSCON TYPE(RMTIMSCON) NAME(HWSI12C1) STOP(COMM)
RmtImsCon MbrName            CC CCText
------------------------------------------------------------------
HWSI12C1  HWSI12D1            0
```

QUERY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(ALL)

The new **QUERY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(...)** command shows the send sockets on the connection to the remote IMS Connect instance. Example 6-19 shows the output.

Example 6-19 Output from QRY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(ALL) command

```
Response for: QUERY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(ALL)
SendClnt MbrName            CC UserID   MscName      Second SendPort RmtImsCon Status
-------------------------------------------------------------------------------------
OTMA9644 HWSI12C1             0 IMSR3                    94     8148 HWSI12D1  CONN
OTM73C4B HWSI12D1             0 IMSR3                   207    35616 HWSI12C1  CONN
```

6.1.5 Super member support with asynchronous IMS to IMS communications

IMS provides a super member function that enables multiple, redundant instances of IMS Connect, which is the integrated TCP/IP server of IMS, to run in parallel as a single application on multiple z/OS images. IMS has expanded the super member function to support the IMS synchronous callout messages. There is support for IMS Connect super members with the new IMS to IMS asynchronous communications.

When you create the OTMA descriptor, you need to add the new **SMEM(Y)** parameter and change the value for the **TMEMBER** parameter to be the super member name. Example 6-20 shows the modified **CREATE OTMADESC** command. We can also activate super member support on an existing OTMA descriptor with the **UPDATE OTMADESC** command.

Example 6-20 CREATE OTMADESC with super member support

```
CREATE OTMADESC NAME(OTMA2CD) -
SET(TYPE(IMSCON) TMEMBER(I12S) SMEM(Y) RMTIMS(I12D) -
RMTIMSCON(HWSI12D1) RMTTRAN(OTMAPRNT))
```

If you define the OTMA descriptor in the IMS.PROCLIB(DFSYDTx) member, you must add **SMEM=YES** (the default is **SMEM=NO**) in that OTMA descriptor definition (Example 6-21).

Example 6-21 IMS.PROCLIB member DFSYDTC with super member support

```
D OTMA2CD TYPE=IMSCON TMEMBER=I12S RMTIMSCON=HWSI12D1
D OTMA2CD RMTTRAN=OTMAPRNT RMTIMS=I12D SMEM=YES
```

6.1.6 OTMA security

You define the security needed to establish the connection and run the transaction at the other remote IMS system in the following places:

- From the user ID that is running the transaction at the local system that uses the CHNG and ISRT DL/I calls to send a transaction to the destination defined by the OTMA descriptor
- From the user ID defined on the descriptor either in the DFSYDTx member (**USERID=xxx**) or on the **OTMADESC USERID(xxx)** parameter (overrides option 1)
- From the user ID defined in the **USERID=xxx** and **APPL=yyy** parameters on the **RMTIMSCON** statement in IMS Connect configuration member

  The security here is used with RACF to generate a PassTicket for the remote system. It is just for connection security to ensure that the local IMS Connect is authorized to connect to the remote IMS Connect and vice versa. This approach does not affect the user ID passed from one IMS system to the other in the OTMA header.

For an explanation of how to define **USERID=xxx**, **APPL=yyy**, and **RACF PTKTDATA** definitions to create a secure connection, see 6.2.6, “IMS Connect security using RACF PassTickets” on page 186.

6.1.7 Configuration summary for asynchronous IMS to IMS communications

Figure 6-2 shows two IMS systems. IMS1 needs to send a transaction to IMS2. Therefore, the OTMA descriptor DESC1 is defined in IMS1. The descriptor defines ICON1 as the local IMS Connect system and ICON2 IMS2 as the remote IMS system.

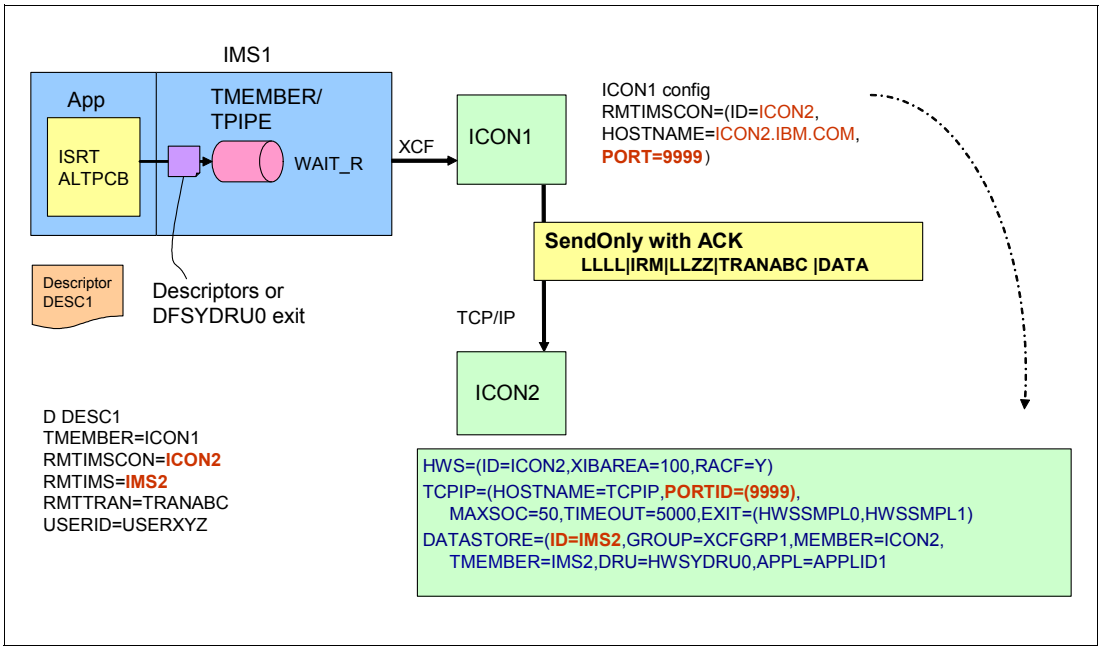

Figure 6-2 Remote IMS Connect configuration

ICON1 has a **RMTIMSCON** definition that defines ICON2 and gives the TCP/IP host name (or IP address) and the PORT of the remote IMS Connect. ICON2 is configured as normal with a TCP/IP statement that defines the PORT it should listen on and a DATASTORE to define the OTMA connection to its local IMS system IMS2.

A special security definition is provided so the transaction run at the remote system has the user ID (USERXYZ) as defined on the OTMA descriptor in IMS1. However no connection security is available using **USER=xxx**, **APPL=yyy**, and a PassTicket between ICON1 and ICON2.

In this example, if we need IMS2 to send transactions back to IMS1, we must add an **RMTIMSCON** in ICON2 and an OTMA descriptor in IMS2.

6.2 Multiple Systems Coupling using TCP/IP

IMS has had MSC using **TYPE=CTC**, **TYPE=MTM**, and **TYPE=VTAM** for many releases. The support in IMS 12 adds a new TYPE to the **MSPLINK** macro. We can now define an **MSPLINK** with **TYPE=TCPIP**.

In addition, a new function in IMS Connect establishes network connectivity between two IMS systems using **TYPE=TCPIP MSPLINK**. Figure 6-3 shows a general overview of how the TCP/IP MSC link support in IMS 12 is configured.

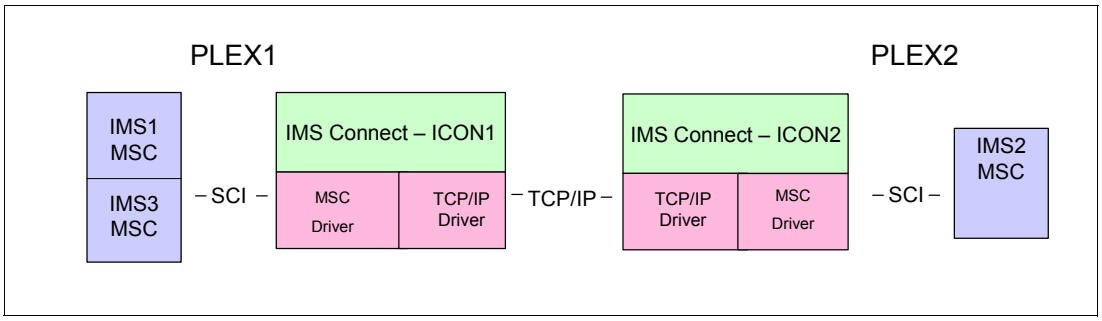

Figure 6-3 MSC using TCP/IP for IMS to IMS connectivity

6.2.1 Stage 1 definitions needed in IMS

The new TCP/IP MSC links must be defined in IMS in the stage1 or stage2 system generation in the same way that you define a **TYPE=VTAM**, **TYPE=CTC**, or **TYPE=MTM** link. Only the **MSPLINK** macro has changed. The other stage1 macros to define the **MSLINK** and **MSNAME** remain the same.

There are several changes to the **MSPLINK** macro to support a TCP/IP MSC link. The **NAME** parameter now defines the definition on a **RMTIMSCON**. Two additional parameters, **LCLICON** and **LCLPLKID**, define the IMS Connect and the MSC statement in the IMS Connect configuration that defines the link.

Example 6-22 shows the IMS stage1 macros that are needed to define an MSC link using TCP/IP for the local IMS system. The **MSLINK** and **MSNAME** macros have no special requirements.

Example 6-22 IMS stage 1 macros for a TCP/IP MSC link (local system)

```
LINKBA   MSPLINK TYPE=TCPIP,NAME=I12B,SESSION=2,BUFSIZE=4096,          X
               LCLICON=HWSI12A1,                                       X
               LCLPLKID=MSC2A2B
         MSLINK  PARTNER=BA,MSPLINK=LINKBA
MSCBA    MSNAME  SYSID=(102,101)
```

Example 6-23 shows the definitions for the remote IMS system.

Example 6-23 IMS stage 1 macros for a TCP/IP MSC link (remote system)

```
LINKBA   MSPLINK TYPE=TCPIP,NAME=I12A,SESSION=2,BUFSIZE=4096,          X
               LCLICON=HWSI12B1,                                       X
               LCLPLKID=MSC2B2A
         MSLINK  PARTNER=BA,MSPLINK=LINKBA
MSCBA    MSNAME  SYSID=(101,102)
```

Restriction: When the first **TYPE=TCPIP MSPLINK** is added to your IMS stage1, you must run an ALL or NUCLEUS system generation and restart IMS.

The relationship between the **MSPLINK** macro and the MSC configuration statements in IMS Connect is created by the **IMSPLEX**, **TMEMBER**, **NAME**, **LCLPLKID**, **LCLICON**, and **LCLIMS** specifications.

The IMS **MSVERIFY** utility and **/MSVERIFY** command is enhanced in IMS 12 to support the new TCP/IP MSC links. To use the **MSVERIFY** command, you must add an MSVID operand to the **IMSCTRL** macro before running a stage1 or stage2 generation. This method causes additional modules to be written to the MODBLKS data set. You can then run the **MSVERIFY** utility (Example 6-24).

Example 6-24 MSVERIFY utility job control language (JCL)

```
// JCLLIB ORDER=IMS12Q.PROCLIB
//STEP1   EXEC DFSMSV,ALL=''
//SYSIN     DD *
001,002,003,004
/*
```

The output from running the **MSVERIFY** utility shows the configuration and assignments that are active when the linked IMS systems are restarted (Example 6-25).

Example 6-25 Output from IMS MS Verification utility

```
DFS2300I IMS - MS VERIFICATION UTILITY -  RUN  TUESDAY   08/02/11 17:58:22

DFS2301I INPUT 001,002

DFS2302I SYSTEM MODULES
DFS2303I DFSMS001
DFS2303I DFSMS002
DFS2303I DFSMS003
DFS2303I DFSMS004

...

        |    MS001    |    MS002    |    MS003    |    MS004    |
-------------------------------------------------------------------
 0001   |    LOCAL    |    001 AB   |    001 AC   |    001 AD   |
 0002   |    002 AB   |    LOCAL    |    002 BC   |    002 BD   |
 0003   |    003 AC   |    003 BC   |    LOCAL    |    003 CD   |
 0004   |    004 AD   |    004 BD   |    004 CD   |    LOCAL    |
 0101   |    LOCAL    |    001 BA   |    001 CA   |    001 DA   |
 0102   |    002 BA   |    LOCAL    |    002 CB   |    002 DB   |
```

```
 0103   |    003 CA   |    003 CB   |    LOCAL    |    003 DC   |
 0104   |    004 DA   |    004 DB   |    004 DC   |    LOCAL    |
-----------------------------------------------------------------
 VTAM   |   AB 001--------AB 001    |             |             |
 VTAM   |   AC 003----------------------AC 001    |             |
 VTAM   |   AD 005-------------------------------------AD 001    |
  TCP   |   BA 002--------BA 002    |             |             |
  TCP   |   CA 004----------------------CA 002    |             |
  TCP   |   DA 006-------------------------------------DA 002    |
 VTAM   |             |   BC 003--------BC 003    |             |
 VTAM   |             |   BD 005----------------------BD 003    |
  TCP   |             |   CB 004--------CB 004    |             |
  TCP   |             |   DB 006----------------------DB 004    |
 VTAM   |             |             |   CD 005--------CD 005    |
  TCP   |             |             |   DC 006--------DC 006    |
-----------------------------------------------------------------

DFS2399I JOB TERMINATED - RETURN CODE 00
```

6.2.2 New and modified IMS commands

IMS 12 has added new function to some IMS type-1 commands and added or updated various type-2 commands to support operating the new MSC links using TCP/IP.

Updated IMS type-1 commands

Only one IMS type-1 command has changed for TCP/IP MSC links.

/DISPLAY ASSIGNMENT MSPLINK ALL

The **/DISPLAY ASSIGNMENT MSPLINK** command has changed to show the status of TCP/IP physical links. Example 6-26 shows the output.

Example 6-26 Output from the /DIS ASSIGNMENT MSPLINK ALL command

```
DFS4444I DISPLAY FROM ID=I12A
      LINK PLINK    TYPE  ADDR     MAXSESS  NODE
         1 LINKAB   VTAM  36000007     2    APPLI12B
         2 LINKBA   TCPIP ****         2    I12B
         3 LINKAC   VTAM  00000000     2    APPLI12C
         4 LINKCA   TCPIP ****         2    I12C
         5 LINKAD   VTAM  58000006     2    APPLI12D
         6 LINKDA   TCPIP ****         2    I12D
      *11214/165528*
```

New and updated IMS type-2 commands

IMS has added or modified type-2 query commands to support TCP/IP MSC links.

*QUERY MSPLINK NAME(msplinkname | *) SHOW(ALL)*

The **QUERY MSPLINK NAME(msplinkname | *) SHOW(ALL)** command is updated to show the TCP/IP MSC links. Example 6-27 on page 173 shows the output.

Example 6-27 Output from QUERY MSPLINK NAME(*) SHOW(ALL)

```
Response for: QRY MSPLINK NAME(*) SHOW(ALL)
MSPLink  MbrName    CC Type     NodeName RmtIms   LclImsCon LclPlkID LclStat
LINKAB   I12A        0 VTAM     APPLI12B
LINKAB   I12B        0 VTAM     APPLI12A
LINKAC   I12A        0 VTAM     APPLI12C
LINKAD   I12A        0 VTAM     APPLI12D
LINKBA   I12A        0 TCPIP              I12B     HWSI12A1  MSC2A2B
LINKBA   I12B        0 TCPIP              I12A     HWSI12B1  MSC2B2A
LINKBC   I12B        0 VTAM     APPLI12C
LINKBD   I12B        0 VTAM     APPLI12D
LINKCA   I12A        0 TCPIP              I12C     HWSI12A1  MSC2A2C
LINKCB   I12B        0 TCPIP              I12C     HWSI12B1  MSC2B2C
LINKDA   I12A        0 TCPIP              I12D     HWSI12A1  MSC2A2D
LINKDB   I12B        0 TCPIP              I12D     HWSI12B1  MSC2B2D
```

UPDATE MSPLINK NAME(msplinkname) SET(ICONPLKID(iconplkid))

The **UPDATE MSPLINK NAME(msplinkname) SET(ICONPLKID(iconplkid))** command has new operands that you can use to change the **MSPLINK** definition without needing to perform an IMS stage1 or stage2 system generation and restart of IMS.

Example 6-28 shows the **MSPLINK** being stopped, updated to have a new local **ICONPLIKID**, and then restarted.

Example 6-28 Output from UPD MSPLINK NAME(...) SET(ICONPLKID(...)) command

```
Response for: UPD MSPLINK NAME(LINKBA) STOP(LOGON)
MSPLink  MbrName    CC
-------------------------------------------------------------
LINKBA   I12A        0

Response for: UPD MSPLINK NAME(LINKBA) SET(ICONPLKID(MSC2A2B))
MSPLink  MbrName    CC
-------------------------------------------------------------
LINKBA   I12A        0

Response for: UPD MSPLINK NAME(LINKBA) START(LOGON)
MSPLink  MbrName    CC
-------------------------------------------------------------
LINKBA   I12A        0
```

UPDATE MSPLINK NAME(msplinkname) SET(IMSCON(imsconname))

The **UPDATE MSPLINK NAME(msplinkname) SET(IMSCON(imsconname))** command has a new operand so that you can change the name of the IMS Connect that an MSC link uses. Example 6-29 shows the output from a link being stopped, updated with a new IMSCON name, and then restarted.

Example 6-29 Output from UPD MSPLINK NAME(...) SET(IMSCON(...)) command

```
Response for: UPD MSPLINK NAME(LINKBA) STOP(LOGON)
MSPLink  MbrName    CC
-----------------------------------------------------------
LINKBA   I12A        0

Response for: UPD MSPLINK NAME(LINKBA) SET(IMSCON(HWSI12A1))
```

```
MSPLink  MbrName    CC
-------------------------------------------------------------
LINKBA   I12A        0

Response for: UPD MSPLINK NAME(LINKBA) START(LOGON)
MSPLink  MbrName    CC
-------------------------------------------------------------
LINKBA   I12A        0
```

UPDATE MSPLINK NAME(msplinkname) SET(RMTIMS(rmtims))

The **UPDATE MSPLINK NAME(msplinkname) SET(RMTIMS(rmtims))** command has a new operand that you can use to change the name of the remote IMS system. Example 6-30 shows the output from a link being stopped, updated with a new remote name, and then restarted.

Example 6-30 Output form UPD MSPLINK NAME(...) SET(RMTIMS(...)) command

```
Response for: UPD MSPLINK NAME(LINKBA) STOP(LOGON)
MSPLink  MbrName    CC
-------------------------------------------------------
LINKBA   I12A        0

Response for: UPD MSPLINK NAME(LINKBA) SET(RMTIMS(I12B))
MSPLink  MbrName    CC
-------------------------------------------------------
LINKBA   I12A        0

Response for: UPD MSPLINK NAME(LINKBA) START(LOGON)
MSPLink  MbrName    CC
-------------------------------------------------------
LINKBA   I12A        0
```

6.2.3 IMS Connect definitions

The new TCP/IP MSC links require two additional configurations in IMS Connect. An MSC statement to define the local **MSPLINK** and a **RMTIMSCON** statement to define the remote IMS Connect system. Example 6-31 shows the local definition required in IMS Connect.

Example 6-31 IMS Connect configuration for a TCP/IP MSC link (local system)

```
HWS=(ID=HWSI12A1,PSWDMC=N,RACF=N,RRS=Y,UIDCACHE=Y,XIBAREA=50)

TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=7102))

MSC=(LCLPLKID=MSC2A2B,RMTPLKID=MSC2B2A,
  LCLIMS=I12A,RMTIMS=I12B,
  IMSPLEX=(MEMBER=HWSI12A1,TMEMBER=IM12X),
  RMTIMSCON=HWSI12B1)

RMTIMSCON=(ID=HWSI12B1,
  HOSTNAME=WTSC64.ITSO.IBM.COM,PORT=7202,
  PERSISTENT=Y,RESVSOC=1)
```

Example 6-32 shows the remote definition required in IMS Connect.

Example 6-32 IMS Connect configuration for a TCP/IP MSC link (remote system)

```
HWS=(ID=HWSI12B1,PSWDMC=N,RACF=N,RRS=Y,UIDCACHE=Y,XIBAREA=50)

TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=7202))

MSC=(LCLPLKID=MSC2B2A,RMTPLKID=MSC2A2B,
  LCLIMS=I12B,RMTIMS=I12A,
  IMSPLEX=(MEMBER=HWSI12B1,TMEMBER=IM12X),
  RMTIMSCON=HWSI12A1)

RMTIMSCON=(ID=HWSI12A1,
  HOSTNAME=WTSC63.ITSO.IBM.COM,PORT=7102,
  PERSISTENT=Y,RESVSOC=1)
```

The relationship between the MSC and **RMTIMSCON** configuration statements in IMS Connect is created by the **RMTPLKID**, **RMTIMS**, **RMTIMSCON**, and **ID** specifications.

The number of reserved sockets (RESVSOC) is determined by the number of logical links (**MSLINK** macros) that are defined for the MSC link in the IMS stage1 and by the number of existing **MSLINK** macros that are assigned, by using the **/MSASSIGN** command, to the new TCP/IP MSC link.

The use of **AUTOCONN=N**, **PERSISTENT=N**, and a non-zero **IDLETO** is disallowed for **RMTIMSCON** connections used by MSC. IMS Connect resets the values (Example 6-33).

Example 6-33 IMS Connect automatic parameter changes

```
HWSX0920W VALUE OF PARAMETER AUTOCONN   IN STATEMENT RMTIMSCON=HWSI12B
 CHANGED TO N FROM Y BECAUSE PERSISTENT=N WAS SPECIFIED  ; M=XCFG
HWSX0920W VALUE OF PARAMETER PERSISTENT IN STATEMENT RMTIMSCON=HWSI12B
CHANGED TO Y FROM N BECAUSE THE RMTIMSCON IS USED BY MSC; M=XCFG
HWSX0920W VALUE OF PARAMETER IDLETO     IN STATEMENT RMTIMSCON=HWSI12B
 CHANGED TO 0 FROM 60000 BECAUSE THE RMTIMSCON IS USED BY MSC; M=XCFG
```

6.2.4 New and modified IMS Connect commands

The command processing for IMS Connect has had a number of new and updated commands to support TCP/IP MSC links and **RMTIMSCON** connections. WE have grouped them in the following sections:

- New and updated IMS Connect WTOR reply commands
- New and updated IMS Connect z/OS modify commands
- New type-2 IMS Connect Single Point of Control commands

New and updated IMS Connect WTOR reply commands

The commands in the following sections are updated or added as replies to the IMS Connect WTOR.

The VIEWHWS command

The **VIEWHWS** command is updated to add details of the MSC links and **RMTIMSCON** connections. Example 6-34 on page 176 shows the additional output.

Example 6-34 Output from the VIEWHWS command

```
HWSC0001I    MSC=MSC2A2B  STATUS=ACTIVE
HWSC0001I      RMTPLKID=MSC2B2A
HWSC0001I      LCLIMSID=I12A      RMTIMSID=I12B      GENIMSID=
  AFFINITY=
HWSC0001I      IMSPLEX=IM12X
HWSC0001I        MEMBER=HWSI12A1          TARGET MEMBER=IM12X
HWSC0001I      RMTIMSCON=HWSI12B1
HWSC0001I        IP-ADDRESS=009.012.006.009  PORT=7202
HWSC0001I        HOSTNAME=WTSC64.ITSO.IBM.COM

HWSC0001I      LINK       PARTNERID   STATUS       SENDCLNT   RECVCLNT
HWSC0001I      DFSLO002   BA          ACTIVE       MSCCE084   MSCE934B

HWSC0001I    RMTIMSCON=HWSI12B1  STATUS=ACTIVE
HWSC0001I      IP-ADDRESS=009.012.006.009  PORT=7202
HWSC0001I      HOSTNAME=WTSC64.ITSO.IBM.COM

HWSC0001I      AUTOCONN=N  PERSISTENT=Y
HWSC0001I      IDLETO=0
HWSC0001I      RESVSOC=10   NUMSOC=1
HWSC0001I      SENDCLNT LCLPLKID STATUS       SECOND SENDPORT
HWSC0001I      MSCCE084 MSC2A2B  CONN           3189 8438
HWSC0001I      TOTAL SENDCLNTS=1 RECV=0 CONN=1 XMIT=0 OTHER=0
```

The VIEWMSC ALL command

The new **VIEWMSC ALL** command shows the status of IMS Connect MSC connections. Example 6-35 shows the output.

Example 6-35 Output from the VIEWMSC ALL command

```
R 719,VIEWMSC ALL
IEE600I REPLY TO 719 IS;VIEWMSC ALL
HWSC0001I    MSC=MSC2A2B  STATUS=ACTIVE
HWSC0001I      RMTPLKID=MSC2B2A
HWSC0001I      LCLIMSID=I12A      RMTIMSID=I12B      GENIMSID=
  AFFINITY=
HWSC0001I      IMSPLEX=IM12X
HWSC0001I        MEMBER=HWSI12A1          TARGET MEMBER=IM12X
HWSC0001I      RMTIMSCON=HWSI12B1
HWSC0001I        IP-ADDRESS=009.012.006.009  PORT=7202
HWSC0001I        HOSTNAME=WTSC64.ITSO.IBM.COM

HWSC0001I      LINK       PARTNERID   STATUS       SENDCLNT   RECVCLNT
HWSC0001I      DFSLO002   BA          ACTIVE       MSCCE084   MSCE934B
```

The VIEWMSC mscid command

The new **VIEWMSC mscid** command shows a named MSC connection. Example 6-35 shows the output, but only one single MSC connection is displayed.

The VIEWRMT ALL command

The new **VIEWRMT ALL** command shows the status of all **RMTIMSCON** connections. Example 6-11 on page 165 shows the output.

The VIEWRMT rmtimscon command

The new **VIEWRMT rmtimscon** command shows the status of a specific **RMTIMSCON** connection. Example 6-12 on page 165 shows the output.

The STOPLINK linkname command

The new **STOPLINK linkname** command stops communication on an MSC link. To find the linkname, use the **VIEWMSC** command because there is no **VIEWLINK** command. Example 6-36 shows the output.

Example 6-36 Output from the STOPLINK linkname command

```
R 724,STOPLINK DFSL0002
IEE600I REPLY TO 724 IS;STOPLINK DFSL0002
HWSF3310I LOGICAL LINK DFSL0002 TERMINATED; MSC=MSC2A2B , M=DSCM
HWST3525I THE SEND CLIENT MSC70986 WAS TERMINATED FOR REMOTE IMS
CONNECT HWSI12B1; M=TCVC
```

The STOPLINK linkname lclplkid command

The new **STOPLINK linkname lclplkid** command stops communications on an MSC link (qualified with the MSC local physical link name). Example 6-37 shows the output.

Example 6-37 Output from the STOPLINK DFSL0001 MSC2A2B command

```
R 725,STOPLINK DFSL0002 MSC2A2B
IEE600I REPLY TO 725 IS;STOPLINK DFSL0002 MSC2A2B
HWSF3310I LOGICAL LINK DFSL0002 TERMINATED; MSC=MSC2A2B , M=DSCM
HWST3525I THE SEND CLIENT MSC1028B WAS TERMINATED FOR REMOTE IMS
CONNECT HWSI12B1; M=TCVC
```

The STARTMSC lclplkid command

The new **STARTMSC lclplkid** command starts communications on an MSC link. Example 6-38 shows the output.

Example 6-38 Output from the STARTMSC MSC2A2B command

```
R 727,STARTMSC MSC2A2B
IEE600I REPLY TO 727 IS;STARTMSC MSC2A2B
HWSF3300I COMMUNICATIONS ON MSC PHYSICAL LINK MSC2A2B  STARTED; M=ISC1
```

The STOPMSC lclplkid command

The new **STOPMSC lclplkid** command terminates communications on an MSC link. Example 6-39 shows the output.

Example 6-39 Output from the STOPMSC MSC2A2B command

```
R 726,STOPMSC MSC2A2B
IEE600I REPLY TO 726 IS;STOPMSC MSC2A2B
HWSF3360I THE TRANSMIT THREAD TERMINATED FOR MSC PHYSICAL LINK
MSC2A2B ; M=IXMT
HWST3525I THE SEND CLIENT MSCADD4E WAS TERMINATED FOR REMOTE IMS
CONNECT HWSI12B1; M=TCVC
HWSF3360I THE RECEIVE  THREAD TERMINATED FOR MSC PHYSICAL LINK
MSC2A2B ; M=IREC
HWSF3305I COMMUNICATIONS ON MSC PHYSICAL LINK MSC2A2B  STOPPED;
M=DSCM
```

The STARTRMT rmtimscon command

The new **STARTRMT rmtimscon** command activates an IMS Connect **RMTIMSCON** connection. Example 6-40 shows the output.

Example 6-40 Output from the STARTRMT HWSI12B1 command

```
R 703,STARTRMT HWSI12B1
IEE600I REPLY TO 703 IS;STARTRMT HWSI12B1
HWST3500I COMMUNICATIONS WITH REMOTE IMS CONNECT HWSI12B1 STARTED;
M=TSCH
```

The STOPRMT rmtimscon command

The new **STOPRMT rmtimscon** command stops an **RMTIMSCON** connection. Example 6-41 shows the output.

Example 6-41 Output from the STOPRMT HWSI12B1 command

```
R 702,STOPRMT HWSI12B1
IEE600I REPLY TO 702 IS;STOPRMT HWSI12B1
HWST3505I COMMUNICATIONS WITH REMOTE IMS CONNECT HWSI12B1 STOPPED;
M=TSCH
HWST3525I THE SEND CLIENT MSCE6706 WAS TERMINATED FOR REMOTE IMS
CONNECT HWSI12B1; M=TCVC
DFS3176E 19:04:23 IMS CONNECT ERROR MESSAGE RECEIVED,   I12A
DFS000I SENDMSG , RETCODE = 0C000018, RSNCODE = 00006408, LOSTSESS =
NONE,      I12A
DFS000I MODULE = DFSTC7A0, LINK = 002, DFSL0002   I12A
DFS2169I 19:04:23 DISCONNECTION COMPLETED ON LINK 0002   I12A
```

Notice that IMS reacted by disconnecting the MSC link, as shown in message `DFS2169I`.

The STOPSCLN rmtimscon sendclient command

The new **STOPSCLN rmtimscon sendclient** command terminates the send sockets on the connection to the remote IMS Connect instance. Example 6-42 shows the output.

Example 6-42 Output from the STOPSCLN MSCxxxxx command

```
R 723,STOPSCLN HWSI12B1 MSC7FDC9
IEE600I REPLY TO 723 IS;STOPSCLN HWSI12B1 MSC7FDC9
HWST3525I THE SEND CLIENT MSC7FDC9 WAS TERMINATED FOR REMOTE IMS
CONNECT HWSI12B1; M=TCVC
```

New and updated IMS Connect z/OS modify commands

IMS Connect has also added or modified the new type-2 modify commands in the following sections.

QUERY MEMBER TYPE(IMSCON) SHOW(ALL)

The **QUERY MEMBER TYPE(IMSCON SHOW(...)** command is updated to add the new status about MSC links and **RMTIMSCON** connections. The output is equivalent to the **VIEWHWS** command. Example 6-34 on page 176 shows the output.

QUERY MSC NAME(*)

The new **QUERY MSC NAME(*)** command shows the status of all MSC links. The output is equivalent to the **VIEWMSC ALL** command. Example 6-35 on page 176 shows the output.

QUERY MSC NAME(mscid)

The new **QRY MSC NAME(mscid)** command shows the status of a specific MSC link. The output is equivalent to the **VIEWMSC mscid** command. Example 6-35 on page 176 shows the output, but only one MSC link is displayed.

QUERY RMTIMSCON NAME(*)

The new **QUERY RMTIMSCON NAME(*)** command is equivalent to the **VIEWRMT ALL** command. Example 6-11 on page 165 shows the output.

QUERY RMTIMSCON NAME(rmtinm)

The new **QUERY RMTIMSCON NAME(rmtinm)** command is equivalent to the **VIEWRMT rmtimscon** command except that it only displays the listed **RMTIMSCON**. Example 6-12 on page 165 shows the output.

DELETE LINK NAME(linkname)

The new **DELETE LINK NAME(linkname)** command is equivalent to the **STOPLINK xxx** command. Example 6-43 shows the output. You must determine the MSC link name from a **VIEWMSC ALL**, **VIEWMSC xxx**, or **QUERY MSC NAME(...)** command. There is no **VIEWLINK** or **QUERY LINK NAME(...)** command.

Example 6-43 Output from the DELETE LINK NAME(DFSL0002) command

```
F IM12AHW1,DELETE LINK NAME(DFSL0002)
HWSF3310I LOGICAL LINK DFSL0002 TERMINATED; MSC=MSC2A2B , M=DSCM
```

DELETE LINK NAME(linkname) LCLPLKID(lclplkid)

The new **DELETE LINK NAME(linkname) LCLPLKID(lclplkid)** command is equivalent to the **STOPLINK linkname lclplkid** command. Example 6-37 on page 177 shows the output.

UPDATE MSC NAME(lclplkid) START(COMM)

The new **UPDATE MSC NAME(lclplkid)** command is equivalent to the **STARTMSC lclplkid** command. Example 6-38 on page 177 shows the output.

UPDATE MSC NAME(lclplkid) STOP(COMM)

The new **UPDATE MSC NAME(lclplkid)** command is equivalent to the **STOPMSC lclplkid** command. Example 6-39 on page 177 shows the output.

UPDATE RMTIMSCON NAME(rmtinm) START(COMM)

The **UPDATE RMTIMSCON NAME(rmtinm) START(COMM)** is the equivalent to the **STARTRMT rmtimscon** command. Example 6-40 on page 178 shows the output.

UPDATE RMTIMSCON NAME(rmtinm) STOP(COMM)

The **UPDATE RMTIMSCON NAME(rmtinm) STOP(COMM)** is the equivalent to the **STOPRMT rmtimscon** command. Example 6-41 on page 178 shows the output.

DELETE RMTIMSCON NAME(rmtinm) SENDCLNT(clientid)

The **DELETE RMTIMSCON NAME(rmtinm) SENDCLNT(clientid)** is the equivalent to the **STOPSCLN rmtimscon clientid** command. Example 6-42 on page 178 shows the output.

New type-2 IMS Connect Single Point of Control commands

As part of the support to allow IMS Connect to be operated from an IMS SPOC, the commands in the following sections are added.

QUERY IMSCON TYPE(CONFIG) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(CONFIG) SHOW(...)** command show the status of the IMS Connect system. Example 6-44 shows the output.

Example 6-44 Output from the QRY IMSCON TYPE(CONFIG) SHOW(ALL) command

```
Response for: QUERY IMSCON TYPE(CONFIG) SHOW(ALL)
MbrName            CC Version IconID   IPAddress       MaxSoc    TimeOut NumSoc WarnSoc WarnInc UidCache
                     UidAge RACF PswdMc RRS RRSStat    Recorder SMem     CmOAtoq  Adapter  ODBMAC
                     ODBMTO
-------------------------------------------------------------------------------------------------------
HWSI12A1             0 V12     HWSI12A1 009.012.006.070     50          0      5      80       5 Y
                  2147483647 N    N      Y   REGISTERED N                          Y        Y
                       18000
HWSI12B1             0 V12     HWSI12B1 009.012.006.009     50          0      5      80       5 Y
                  2147483647 N    N      Y   REGISTERED N                          Y        Y
                       18000
HWSI12C1             0 V12     HWSI12C1 009.012.006.070     50          0      5      80       5 Y
                  2147483647 N    N      Y   REGISTERED N                          Y        Y
                       18000
HWSI12D1             0 V12     HWSI12D1 009.012.006.009     50          0      5      80       5 Y
                  2147483647 N    N      Y   REGISTERED N                          Y        Y
                       18000
```

QUERY IMSCON TYPE(MSC) NAME(*) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(MSC) NAME(*) SHOW(...)** command shows the status of the MSC links in IMS Connect. Example 6-45 shows the output.

Example 6-45 Output from the QRY IMSCON TYPE(MSC) NAME(*) SHOW(ALL) command

```
Response for: QRY IMSCON TYPE(MSC) NAME(*) SHOW(ALL)
MscName  MbrName            CC CCText                          RmtPlkID LclIMS   RmtIMS   GenIMSID
         Affin    IpMember         IMSplex          RmtImsCon IpAddress HostName                Port
         Status    Link     Partner  SendClnt RecvClnt LinkStatus
-------------------------------------------------------------------------------------------------
MSC2A2B  HWSI12A1            0                                  MSC2B2A  I12A     I12B
                 HWSI12A1         IM12X            HWSI12B1  9.12.6.9  WTSC64.ITSO.IBM.COM     7202
         ACTIVE
MSC2A2B  HWSI12A1            0

                  DFSLO002 BA       MSCE6706 MSC51A86 ACTIVE
MSC2B2A  HWSI12B1            0                                  MSC2A2B  I12B     I12A
                 HWSI12B1         IM12X            HWSI12A1  9.12.6.70 WTSC63.ITSO.IBM.COM     7102
         ACTIVE
MSC2B2A  HWSI12B1            0

                  DFSLO002 BA       MSC51A86 MSCE6706 ACTIVE
```

QUERY IMSCON TYPE(MSC) NAME(mscid) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(MSC) NAME(mscid) SHOW(...)** command shows the status of a specific MSC link in IMS Connect. The output is equivalent only the MSC link matching the name pattern are displayed. Example 6-46 shows the output restricted to just the **SHOW(LINK)** option.

Example 6-46 Output from the QRY IMSCON TYPE(MSC) NAME(MSC2B2A) SHOW(LINK) command

```
Response for: QRY IMSCON TYPE(MSC) NAME(MSC2B2A) SHOW(LINK)
MscName  MbrName            CC CCText                          Link     Partner  SendClnt RecvClnt
         LinkStatus
```

```
-------------------------------------------------------------------------------------------------------------
MSC2B2A  HWSI12A1           10 No resources found

MSC2B2A  HWSI12B1            0

MSC2B2A  HWSI12B1            0                                  DFSL0002 BA       MSC57506 MSC2CC84
         ACTIVE
```

QUERY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(...)** command shows the status of all **RMTIMSCON** connections in IMS Connect. Example 6-47 shows the output.

Example 6-47 Output from the QRY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL) command

```
Response for: QRY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL)
RmtImsCon MbrName            CC IpAddress       HostName               Port AutoConn Persist     IdleTO
             ResvSoc     NumSoc Appl     UserID   Status    TotSClnts TotRecv TotConn TotXmit TotOther
          SendClnt LclPlkID     Second SendPort SendStatus
-------------------------------------------------------------------------------------------------------
HWSI12B1  HWSI12A1            0 9.12.6.9        WTSC64.ITSO.IBM.COM     7202 N        Y               0
                 10           1                   ACTIVE            1       0       1       0        0

HWSI12B1  HWSI12A1            0

          MSCE6706 MSC2A2B        1750     8405 CONN
HWSI12A1  HWSI12B1            0 9.12.6.70       WTSC63.ITSO.IBM.COM     7102 N        Y               0
                 10           1                   ACTIVE            1       0       1       0        0

HWSI12A1  HWSI12B1            0

          MSC51A86 MSC2B2A        1750    39486 CONN
HWSI12D1  HWSI12C1            0 9.12.6.9        WTSC64.ITSO.IBM.COM     7401 Y        Y           60000
                 10           0                   NOTACTIVE

HWSI12C1  HWSI12D1            0 9.12.6.70       WTSC63.ITSO.IBM.COM     7301 Y        Y           60000
                10           0                    NOTACTIVE
```

QUERY IMSCON TYPE(RMTIMSCON) NAME(rmtinm) SHOW(ALL / showparm)

The new **QUERY IMSCON TYPE(RMTIMSCON) NAME(rmtinm) SHOW(...)** command shows the status of a specific **RMTIMSCON** connection in IMS Connect. Example 6-47 shows the output, but only one **RMTIMSCON** is displayed.

QUERY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(ALL)

The new **QUERY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(...)** command shows details about the TCP/IP sending clients. Example 6-48 shows the output.

Example 6-48 Output from the QRY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(ALL) command

```
Response for: QUERY IMSCON TYPE(SENDCLNT) NAME(*) SHOW(ALL)
SendClnt MbrName            CC UserID   MscName      Second SendPort RmtImsCon Status
-------------------------------------------------------------------------------------
MSC15F4C HWSI12A1            0          MSC2A2B        3030     8137 HWSI12B1  CONN
MSC1C844 HWSI12B1            0          MSC2B2A        3030    35474 HWSI12A1  CONN
```

UPDATE IMSCON TYPE(LINK) NAME(linkname) STOP(COMM)

The new **UPDATE IMSCON TYPE(LINK) NAME(linkname) STOP(COMM)** command stops communication on an MSC link. You first need to find the link name using the **QRY IMSCON TYPE(MSC) NAME(MSC2B2A) SHOW(LINK)** command as shown in Example 6-46 on page 180. Example 6-49 shows the results of running this command.

Example 6-49 Output from UPD IMSCON TYPE(LINK) NAME(DFSLxxxx) STOP(COMM)

```
Response for: UPDATE IMSCON TYPE(LINK) NAME(DFSL0002) STOP(COM...
Link     MscName  MbrName            CC CCText
DFSL0002 MSC2A2B  HWSI12A1            0
DFSL0002 MSC2B2A  HWSI12B1            0
```

UPDATE IMSCON TYPE(LINK) NAME(linkname) MSC(lclplkid) STOP(COMM)

The new **UPDATE IMSCON TYPE(LINK) NAME(linkname) MSC(lclplkid) STOP(COMM)** command terminates communications on a named MSC link. In some cases, more than one system can have the same IMS generated LINK name so that you can qualify the command with the MSC name. Example 6-50 shows the output.

Example 6-50 Output from the UPD IMSCON TYPE(LINK) NAME(x) MSC(m) STOP(COMM) command

```
Response for: UPDATE IMSCON TYPE(LINK) NAME(DFSL0002) MSC(MSC2A2B) STOP(COMM)
Link     MscName  MbrName            CC CCText
-------------------------------------------------------------------------------------------------------
DFSL0002 MSC2A2B  HWSI12A1            0
```

UPDATE IMSCON TYPE(MSC) NAME(lclplkid) START(COMM)

The new **UPDATE IMSCON TYPE(MSC) NAME(lclplkid) START(COMM)** command starts communications for an MSC link. Example 6-51shows the output.

Example 6-51 Output from UPD IMSCON TYPE(MSC) NAME(MSC2A2B) START(COMM)

```
Response for: UPDATE IMSCON TYPE(MSC) NAME(MSC2A2B) START(COMM)
MscName  MbrName            CC CCText
-------------------------------------------------------------
MSC2A2B  HWSI12A1             0
```

UPDATE IMSCON TYPE(MSC) NAME(lclplkid) STOP(COMM)

The new **UPDATE IMSCON TYPE(MSC) NAME(lclplkid) STOP(COMM)** command terminates communication for an MSC link. Example 6-52 shows the output.

Example 6-52 Output from UPD IMSCON TYPE(MSC) NAME(MSC2A2B) STOP(COMM)

```
Response for: UPDATE IMSCON TYPE(MSC) NAME(MSC2A2B) STOP(COMM)
MscName  MbrName            CC CCText
-------------------------------------------------------------
MSC2A2B  HWSI12A1             0
```

UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) START(COMM)

The new **UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) START(COMM)** command initiates communications from the local IMS Connect to a remote IMS Connect system. Example 6-53 on page 183 shows the output.

Example 6-53 Output from UPD IMSCON TYPE(RMTIMSCON) NAME(rmtinm) START(COMM)

```
Response for: UPDATE IMSCON TYPE(RMTIMSCON) NAME(HWSI12A1) START(COMM)
RmtImsCon MbrName            CC CCText
-------------------------------------------------------------------
HWSI12A1  HWSI12B1            0
```

UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) STOP(COMM)

The new **UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtinm) STOP(COMM)** command stops communications to a remote IMS Connect system. Example 6-54 shows the output.

Example 6-54 Output from UPD IMSCON TYPE(RMTIMSCON) NAME(rmtinm) STOP(COMM)

```
Response for: UPDATE IMSCON TYPE(RMTIMSCON) NAME(HWSI12A1) STOP(COMM)
RmtImsCon MbrName            CC CCText
-------------------------------------------------------------------
HWSI12A1  HWSI12B1            0
```

UPDATE IMSCON TYPE(SENDCLNT) NAME(cl) RMTIMSCON(rmt) STOP(COMM)

The new **UPDATE IMSCON TYPE(SENDCLNT) NAME(clientid) RMTIMSCON(rmtinm) STOP(COMM)** command deactivates a TCP/IP sending client in IMS Connect. Example 6-55 shows the output.

Example 6-55 Output from UPD IMSCON TYPE (SENDCLNT) NAME(cl) RMTIMSCON(rmt) STOP(COMM)

```
Response for: UPDATE IMSCON TYPE(SENDCLNT) NAME(MSCCCAC6) RMTIMSCON(HWSI12A1) STOP(COMM)
SendClnt RmtImsCon MbrName            CC CCText
MSCCCAC6 HWSI12A1  HWSI12B1            0
```

6.2.5 Generic MSC name support

Figure 6-4 on page 184 shows four IMS systems in three separate IMSPlexes. Each physical path between two IMS systems has an **MSPLINK** macro and a corresponding MSC configuration statement in the local IMS connect to define the path within the IMSPlex. IMS1 and IMS2 are using shared queues. IMS3 and IMS4 have an MSC link to connect to the shared queues systems. To configure that link using TCP/IP MSC links, you need to use generic MSC support.

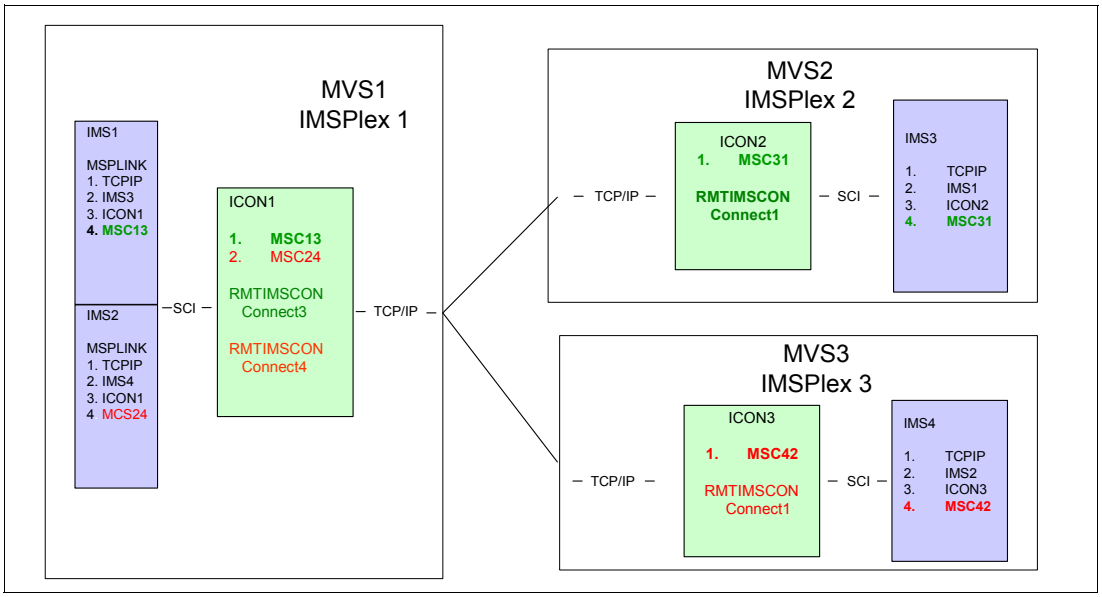

Figure 6-4 TCP/IP MSC with IMS shared queues

Additional IMS definitions

To connect the shared queues systems, you must define a new TCP/IP **MSPLINK** in the queue sharing IMS system. We already have the definitions in the original systems as shown in Example 6-22 on page 170 and Example 6-23 on page 171.

In the new queue sharing IMS system, we add the **MSPLINK**, **MSLINK**, and **MSNAME** as shown in Example 6-56. The existing definition remains unchanged.

Example 6-56 IMS stage 1 macros for a TCP/IP MSC link (shared queues)

```
LINKCB   MSPLINK TYPE=TCPIP,NAME=I12B,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12C1,                                       X
               LCLPLKID=MSC2C2B
         MSLINK  PARTNER=CB,MSPLINK=LINKCB
MSCBC    MSNAME  SYSID=(102,103)
```

If this is the first time you add an MSC link with **TYPE=TCPIP**, you must run a stage1 or stage2 ALL or NUCLEUS system definition and restart IMS to make the MSC link available.

You must also update the IMS.PROCLIB(DFSDCxxx) member for both queue sharing IMS systems to define their generic IMS ID. This update requires an IMS WARM restart to activate the generic IMS ID. Example 6-57 shows the new specification.

Example 6-57 Additional statement in IMS.PROCLIB(DFSDCxxx)

```
GENIMSID=ACIM,
```

This generic IMS ID is only needed in the queue sharing systems. The **/DISPLAY ACTIVE** command shows the generic IMS ID when it is activated.

New IMS type-2 commands

Two new type-2 commands are available to control generic MSC links. No equivalent type-1 commands are available.

*UPDATE MSPLINK NAME(msplinkname | *) START(GENLOGON)*

The new **UPDATE MSPLINK NAME(...) START(GENLOGON)** command activates a generic MSC link. Example 6-58 shows the output.

Example 6-58 Output from the UPD MSPLINK NAME(*) START(GENLOGON) command

```
Response for: UPD MSPLINK NAME(*) START(GENLOGON)
MSPLink  MbrName    CC CCText
LINKBA   I12A        0
LINKCB   I12C        0
```

*UPDATE MSPLINK NAME(msplinkname | *) STOP(GENLOGON)*

The new **UPDATE MSPLINK NAME(...) STOP(GENLOGON)** command stops a generic MSC link. Example 6-59 shows the output.

Example 6-59 Output from the UPD MSPLINK NAME(*) STOP(GENLOGON) command

```
Response for: UPD MSPLINK NAME(*) STOP(GENLOGON)
MSPLink  MbrName    CC CCText
LINKBA   I12A        0
LINKCB   I12C        0
```

Additional IMS Connect definitions

To support the new generic MSC links, we add a second MSC link to our existing configuration. Example 6-60 shows the modified definition for the link from I12A to I12B and the new definition for I12C to I12B.

Example 6-60 Modified MSC definitions in the local IMS Connect

```
MSC=(LCLPLKID=MSC2A2B,RMTPLKID=MSC2B2A,
  LCLIMS=I12A,RMTIMS=I12B,
  GENIMSID=ACIM,
  IMSPLEX=(MEMBER=HWSI12A1,TMEMBER=IM12X),
  RMTIMSCON=HWSI12B1)

MSC=(LCLPLKID=MSC2C2B,RMTPLKID=MSC2B2C,
  LCLIMS=I12C,RMTIMS=I12B,
  GENIMSID=ACIM,
  IMSPLEX=(MEMBER=HWSI12A1,TMEMBER=IM12X),
  RMTIMSCON=HWSI12B1)

RMTIMSCON=(ID=HWSI12B1,
   HOSTNAME=WTSC64.ITSO.IBM.COM,PORT=7202,
   AUTOCONN=Y,RESVSOC=10)
```

The shared queues system that is running for I12A and I12C now has a generic IMS ID of ACIM. The one IMS Connect is used by both IMS systems.

The IMS Connect configuration for the remote system must also change for generic support. Example 6-61 shows that we have updated the MSC definition to use the generic IMS ID rather than a specific RMTIMS system.

Example 6-61 Modified MSC definitions in the remote IMS Connect

```
MSC=(LCLPLKID=MSC2B2A,RMTPLKID=MSC2A2B,
  LCLIMS=I12B,RMTIMS=ACIM,
  IMSPLEX=(MEMBER=HWSI12B1,TMEMBER=IM12X),
  RMTIMSCON=HWSI12A1)

RMTIMSCON=(ID=HWSI12A1,
  HOSTNAME=WTSC63.ITSO.IBM.COM,PORT=7102,
  AUTOCONN=Y,RESVSOC=10)
```

The **RMTIMSCON** definitions are unchanged but are included in both examples for clarity.

6.2.6 IMS Connect security using RACF PassTickets

The only security that you can use for an MSC link using TCP/IP is the PassTicket support for connection security. This security is implemented by defining **USERID=xxx** and **APPL=yyy** on the **RMTIMSCON** definitions in IMS Connect.

You must create PTKTDATA and APPL definitions in the RACF database. At the local system, you need PTKTDATA so that system can generate a PassTicket (Example 6-62).

Example 6-62 Local RACF definitions

```
SETROPTS CLASSACT(PTKTDATA)
SETROPTS RACLIST(PTKTDATA)
RDEFINE PTKTDATA APPLI12B SSIGNON(KEYMASKED(E001193519561977)) UACC(N)
SETROPTS REFRESH RACLIST(PTKTDATA)
```

At the remote system, create PTKTDATA (used to verify the incoming PassTicket) and an APPL, and permit the remote user ID read access to the APPL (Example 6-63).

Example 6-63 Remote RACF definitions

```
DELUSER USER002
ADDUSER USER002 PASSWORD(PSWD0002) TSO(ACCTNUM(D1001) PROC(TPROC02))

SETROPTS CLASSACT(PTKTDATA)
SETROPTS RACLIST(PTKTDATA)
RDEFINE PTKTDATA APPLI12B SSIGNON(KEYMASKED(E001193519561977)) UACC(N)
SETROPTS REFRESH RACLIST(PTKTDATA)

SETROPTS CLASSACT(APPL)
SETROPTS RACLIST(APPL)
RDEFINE APPL APPLI12B UACC(N)
PERMIT APPLI12B ACCESS(READ) CLASS(APPL) ID(USER002)
SETROPTS RACLIST(APPL) REFRESH
RLIST APPL APPLI12B AU
```

KEYMASKED value: The value used for KEYMASKED must be identical on both systems.

You must then update the **RMTIMSCON** definitions to use the remote USERID and APPL created at the remote system (Example 6-64).

Example 6-64 Changes to the RMTIMSCON definition for security

```
RMTIMSCON=(ID=HWSI12B1,
  HOSTNAME=WTSC64.ITSO.IBM.COM,PORT=7202,
  PERSISTENT=Y,RESVSOC=1,
  USERID=USER002,APPL=APPLI12B)
```

6.2.7 Configuration summary for MSC using TCP/IP

Figure 6-5 on page 188 shows two IMS systems connected with a TCP/IP non-generic MSC link.

IMS1 has **MSPLINK** with the new parameters for TCP/IP. The NAME matches the **RMTIMS** parameter defined on the MSC definition in the local IMS Connect.

The **LCLICON** matches the **MEMBER** parameter of the IMSPLEX statement in the MSC definition in the local IMS Connect. The **LCLPLKID** matches the **LCLPLKID** parameter in the MSC definition.

The local IMS Connect has the MSC definition and the **RMTIMSCON** definition. On the MSC definition, the LCLIMS name must match the IMSID of the local IMS system. The **RMTIMS** defines the IMS ID of the remote system (or the generic name if GENIMSID is used). The **RMTIMSCON** name must match the ID parameter of the **RMTIMSCON** definition. On the **RMTIMSCON** definition you define the ID and the TCP/IP parameters so that you can find the remote system within the network.

IMS2 has **MSPLINK**, which points to NAME, LCLICON, and LCLPLKID.

The remote IMS Connect has the MSC definition with **RMTIMS**, **LCLIMS**, **LCLPLKID**, and **RMTIMSCON**. It also has the **RMTIMSCON** definition to define the other IMS Connect.

No connection security is defined on this link.

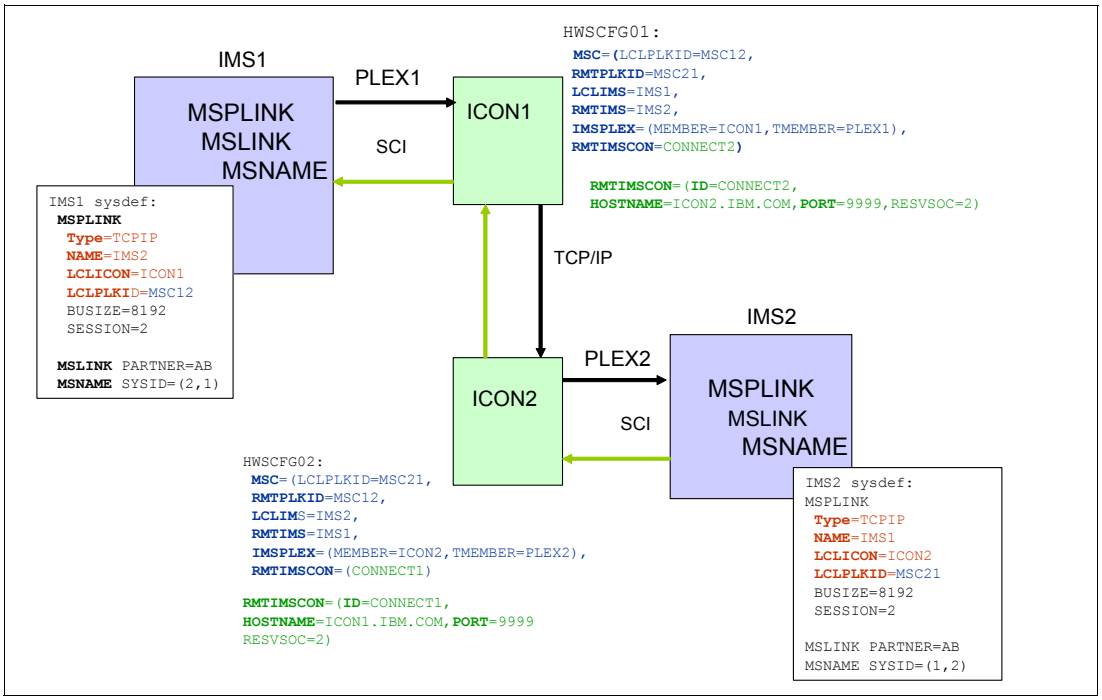

Figure 6-5 TCP/IP MSC configuration

6.3 Other IMS Connect changes

The following minor changes have also been made to IMS and IMS Connect in version 12:

- IMS Connect Recorder Trace has new tracing points.
- IMS Connect can now use RACF user ID caching to reduce storage use and reduce the number of calls made to RACF.
- IMS Connect now supports RACF return codes and reason codes for security violations.
- With XML Converter Refresh, a module can be refreshed without restarting IMS Connect.
- Partial read status support helps with clients that have not completed sending data.
- Load modules for exits are packaged in addition to sample exits source.
- QUERY MSLINK STATISTICS changes for TCP/IP MSC links to allow additional statistics.

We provide a brief description in the following sections.

6.3.1 IMS Connect Recorder Trace

IMS 12 adds a new level of tracing to IMS Connect. It adds records for TCP/IP and MSC, and cross-system coupling facility (XCF) sends and receives at the trace points listed in Table 6-1.

Table 6-1 IMS Connect additional recorder trace entries

Trace point (eyecatcher)	What is traced	Tracing method
ICONTR	TCP/IP Receive	BPE
ICONTS	TCP/IP Send	BPE

Trace point (eyecatcher)	What is traced	Tracing method
ICONIR	IMS OTMA Receive	BPE
ICONIS	IMS OTMA Send	BPE
ICONMS	MSC send	Old tracing
ICONMR	MSC receive	Old tracing
ICONRR	Remote IMS Connect to local IMS Connect	Old tracing

Of the new records, those capturing the entire message, and therefore generating a lot of data, are *only* recorded in the Base Primitive Environment (BPE) External trace. They have the following IDs (eyecatchers):

- ICONTR TCP/IP Receive
- ICONTS TCP/IP Send
- ICONIR IMS OTMA Receive
- ICONIS IMS OTMA Send

The new records generating small amounts of data are captured by using the existing, old method. They have the IDs (eyecatchers):

- ICONMS MSC send
- ICONMR MSC receive
- ICONRR Remote IMS Connect to local IMS Connect

The existing trace points are still recorded in both the new recorder trace and the existing HWSRCORD trace:

- ICONRC: User Msg Exit Receive
- ICONSN: User Msg Exit XMIT

The support for a BPE-based recorder trace was included in IMS 11.

Tip: Remove the existing recorder trace, and replace it with the new BPE-based trace.

Defining the new trace in IMS Connect

Before you can use the new IMS Connect recorder trace, complete these steps:

1. Update IMS Connect JCL to remove the HWSRCORD data set (Example 6-65).

Example 6-65 Remove the old recorder trace

```
//IM12AHW1 PROC RGN=0M,TME=1440,SOUT=*,
// BPECFG=BPEHWS2A,HWSCFG=HWCF12A1
...
//*HWSRCORD DD    DSN=IMS12Q.IMS12A.HWSRCDR,DISP=SHR /* Not used */
```

2. Update the BPE configuration to add a TRCLEV and EXTTRACE definition to define the GDG base for the new recorder trace (Example 6-66).

Example 6-66 Updated IMS.PROCLIB(BPEHWSxx) member

```
TRCLEV=(RCTR,MEDIUM,HWS,EXTERNAL=YES)
#
# DEFINITION FOR NEW STYLE RECORDER TRACE
#
EXTTRACE(
```

```
  GDGDEF(
    DSN(IMS12Q.IMS12A.HWS.RCTR)
    UNIT(SYSALLDA)
    VOLSER(SBOXI5)
    SPACE(15)
    SPACEUNIT(TRK)
    BLKSIZE(32760)
  )
  COMP(HWS)
)
```

3. Define the GDG base data set by using **IDCAMS** or option 6 of ISPF (Example 6-67).

Example 6-67 Defining the GDG base data set

```
//STEP1  EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 DEFINE GDG( -
 NAME('IMS12Q.IMS12A.HWS.RCTR') -
 LIMIT(10) -
 SCRATCH -
 )
```

4. Restart IMS Connect, which then creates a recorder trace data set.

New commands

When you want to activate the recorder trace, you must issue a modify command (Example 6-68) that is actioned by BPE. Regardless of the specification in the BPE configuration, the recorder trace is always inactive when IMS Connect starts. It can only be activated by an explicit **UPDATE TRACETABLE** command.

Example 6-68 BPE command to activate the recorder trace

```
F IM12AHW1,UPDATE TRACETABLE NAME(RCTR) OWNER(HWS) LEVEL(HIGH) EXTERNAL(YES)
```

To terminate the recorder trace, you issue another BPE **UPDATE** command (Example 6-69).

Example 6-69 BPE command to terminate the recorder trace

```
F IM12AHW1,UPDATE TRACETABLE NAME(RCTR) OWNER(HWS) LEVEL(NONE) EXTERNAL(NO)
```

6.3.2 RACF user ID caching

User ID caching is a new function in IMS 12 to reduce IMS Connect storage usage and reduce the number of calls made to RACF to check user IDs. If the same user ID connects from more than one client or on more than one port, IMS Connect searches its cache to find security credentials (assuming they have not expired due to aging). If the user ID is not found, only then does it call RACF.

New configuration definition

Example 6-70 on page 191 shows the new specification for UIDCACHE and UIDAGE. UIDAGE gives better control for when IMS Connect removes credentials from storage and calls RACF to renew them. UIDCACHE can be controlled by an external command. UIDAGE can only be controlled by updating the HWSCFG member and restarting IMS Connect.

Example 6-70 IMS Connect configuration member

```
HWS=(ID=HWSI12A1,
  PSWDMC=R,RACF=Y,
  UIDCACHE=Y,UIDAGE=500,
  RRS=Y,XIBAREA=50)
```

Example 6-71 shows the **QUERY MEMBER** (or equivalent **VIEWHWS**) command with the current values for UIDCACHE and UIDAGE.

Example 6-71 Output from the QUERY MEMBER command

```
F IM12DHW1,QUERY MEMBER TYPE(IMSCON) SHOW(ALL)
HWSC0001I   HWS ID=HWSI12D1 RACF=N  PSWDMC=R
HWSC0001I      UIDCACHE=Y   UIDAGE=500
HWSC0001I      MAXSOC=50  TIMEOUT=0
HWSC0001I      NUMSOC=5      WARNSOC=80%  WARNINC=5%
HWSC0001I      RRS=Y   STATUS=ACTIVE
HWSC0001I      VERSION=V12 IP-ADDRESS=009.012.006.070
HWSC0001I      SUPER MEMBER NAME=      CM0 ACK TOQ=
```

New IMS Connect commands

Three new commands control user ID caching. Table 6-2 shows the commands to control user ID caching and to refresh the in-storage data for a user ID. No support is available for using a generic user ID on the refresh command.

Table 6-2 New commands for user ID caching

Type-2 command	WTOR reply	Modify command
UPD IMSCON TYPE(CONFIG) SET(UIDCACHE(ON))	**SETUIDC ON**	**UPDATE MEMBER TYPE(IMSCON) SET(UIDCACHE(ON))**
UPD IMSCON TYPE(CONFIG) SET(UIDCACHE(OFF))	**SETUIDC OFF**	**UPDATE MEMBER TYPE(IMSCON) SET(UIDCACHE(OFF))**
UPDATE IMSCON TYPE(RACFUID) NAME(userid) OPTION(REFRESH)	**REFRESH RACFUID NAME(userid)**	**UPDATE RACFUID NAME(userid) OPTION(REFRESH)**

6.3.3 RACF return codes

New support is in the IMS Connect exits to pass any bad return code from RACF back to the client. This process is done by extending the header for the *REQSTS* RSM when it is returned to the client. Example 6-72 shows the new RACFRC field in the RSM as mapped by **IMS12Q.MACLIB(HWSIMSCB)**.

Example 6-72 New layout for RSM

```
RSMMask        DSECT             Request status message dsect
RSM_Len        DS   H            Length of RSM
RSM_FLGS       DS   0H           RSM FLAG BYTES              @KWT0001
RSM_FLG1       DS   X            FLAG BYTE                   @KWT0001
RSM_AMSG       EQU  X'80'        ASYNCH MSG Q'D IN IMS       @KWT0001
RSM_CONV       EQU  X'40'        CONVERSATIONAL OUTPUT       @PQ46195
RSM_ACK_NAK    EQU  X'20'        ACK/NAK REQUIRED            @PQ46195
RSM_RACFRC     DS   0X           RETURN CODE FROM RACF       @U12EDC2
RSM_OTMARSN    DS   X            REASON CODE FROM OTMA       @PK37758
```

```
RSM_Id          DS   CL8           RSM id '*REQSTS*' ascii/ebcdic
RSM_RetCod      DS   F             Return code
RSM_RsnCod      DS   F             Reason code
RSMMask_Len     EQU  *-RSMMask     Size of RSM
```

The REXX application was amended to send in a bad password. The HWCSCFG was updated to have **RACF=Y**. In addition, the REXX error handler was updated to display the header when IMS Connect returns a *REQSTS* RSM.

Example 6-73 shows the new REXX code used to handle the *REQSTS*. RSM_RetCod and RSM_RsnCod were already being interpreted.

*Example 6-73 REXX handling for *REQSTS* RSM*

```
if pos('*REQSTS*',page) > 0 then do
   parse var page rsm_header '*REQSTS*' +8 retc +4 rsn
   say "*REQSTS*" "RC:" c2d(retc) "'" || d2x(c2d(retc)) || "'x",
       "RSN:" c2d(rsn) "'" || d2x(c2d(rsn)) || "'x"
   say "HDR:" c2x(rsm_header)
   parse var rsm_header llll +4 rsm_len +2 rsm_FLG1 +1 rsm_RACFRC
   say "LLLL:" c2d(llll) "'" || d2x(c2d(llll)) || "'x"
   say "RSM_Len:" c2d(rsm_len) "'" || d2x(c2d(rsm_len)) || "'x"
   say "RSM_FLG1:" c2d(rsm_FLG1) "'" || d2x(c2d(rsm_FLG1)) || "'x"
   say "RSM_RACFRC:" c2d(rsm_RACFRC) "'" || d2x(c2d(rsm_RACFRC)) || "'x"
 end
```

Example 6-74 shows that, after the RACF error, IMS Connect returns `LLLL=24 (x'00000018')` because HWSSMPL1, `RSM_Len=20 (x'14')`, `RSM_FLG1=x'00'`, and `RSM_RACFRC=x'08'` are used.

Example 6-74 Output from IMS Connect

```
*REQSTS* RC: 8 '8'x RSN: 40 '28'x
HDR: 0000001800140008
LLLL: 24 '18'x
RSM_Len: 20 '14'x
RSM_FLG1: 0 '0'x
RSM_RACFRC: 8 '8'x
```

6.3.4 XML Converter Refresh

IMS 12 adds a new function so that an XML converter module can be refreshed without restarting IMS Connect. One new command can be used as a WTOR reply, a modify command, or from an IMS SPOC to refresh an XML converter module (Table 6-3).

Table 6-3 XML converter refresh command

Type-2 command	WTOR reply	Modify command
UPD IMSCON TYPE(CONVERTER) NAME(modname) OPTION(REFRESH)	**REFRESH CONVERTER NAME(modname)**	**UPDATE CONVERTER NAME(modname) OPTION(REFRESH)**

6.3.5 Partial read status

Partial read is a TCP/IP status where the client sending data has not sent the whole message that the listener is expecting. This condition can lead to unexpected hangs in IMS Connect or in the client process.

IMS Connect in IMS 12 now has a function to deal with clients that have not completed their send of data or have the wrong value for the length passed to the IMS Connect exit. You can see which clients are waiting in with a partial read.

Example 6-75 shows the output from a **VIEWPORT** command with a client using HWSSMPL1 that has an invalid full length value (LLLL). The client is hanging waiting for IMS Connect. IMS Connect is waiting for the client to send the missing data.

Example 6-75 Output from the VIEWPORT command with a partial read client

```
R 822,VIEWPORT 7400
IEE600I REPLY TO 822 IS;VIEWPORT 7400
HWSC0001I    PORT=7400     STATUS=ACTIVE     KEEPAV=0 NUMSOC=2 EDIT=
       TIMEOUT=0
HWSC0001I      CLIENTID USERID   TRANCODE DATASTORE STATUS
SECOND CLNTPORT IP-ADDRESS            APSB-TOKEN
HWSC0001I      DELDUMMY                            READ
386 9180   127.000.000.001
HWSC0001I      TOTAL CLIENTS=1  RECV=0 READ=1 CONN=0 XMIT=0 OTHER=0
```

Example 6-76 shows the same status by using the **QUERY IMSCON** command from the IMS batch SPOC. You can also use the **QRY IMSCON TYPE(PORT) NAME(7400) SHOW(STATUS,CLIENT)** command to reduce the response to just the information you need.

Example 6-76 Output from the QRY IMSCON TYPE(PORT) command with a partial read client

```
Response for: QRY IMSCON TYPE(PORT) NAME(7400) SHOW(ALL)
Port     MbrName            CC CCText                          KeepAv     NumSoc Edit        TimeOut
         Status    TotClnts TotRecv TotRead TotConn TotXmit TotOther ClientID UserID   Trancode DataStore
         CStatus     Second ClntPort IpAddress       ApsbToken
-------------------------------------------------------------------------------------------------------
7400     HWSI12D1            0                                        0          2                   0
         ACTIVE           1       0       1       0       0        0

7400     HWSI12D1            0                                                  DELDUMMY
         READ           262 9180     127.0.0.1
```

Example 6-77 shows usage of the **STOPCLNT** command to terminate the connection from the remote client and break the hang condition.

Example 6-77 The STOPCLNT command

```
R 832,STOPCLNT 7400 DELDUMMY
IEE600I REPLY TO 832 IS;STOPCLNT 7400 DELDUMMY
HWSS0761I TCPIP COMMUNICATION WITH CLIENT=7400    _DELDUMMY STOPPED;
M=SCCM
```

Example 6-78 shows the same client being terminated by using the new **UPDATE IMSCON TYPE(CLIENT)** command.

Example 6-78 The UPD IMSCON TYPE(CLIENT) command to terminate a partial read client

```
Response for: UPD IMSCON TYPE(CLIENT) NAME(DELDUMMY) PORT(7400) STOP(COMM)
ClientID Port     MbrName            CC CCText
--------------------------------------------------------------------------------
DELDUMMY 7400     HWSI12D1            0
```

6.3.6 Load modules for exits

IBM supplies samples for some IMS Connect exits, including HWSUINIT, HWSJAVA0, HWSSMPL0, and HWSSMPL1. These exits are working examples, and many customers use the IBM supplied exits without modifications.

In IMS 12, the exits are being repackaged as load modules and sample source. Users who want to modify the IBM supplied samples can still do so. Customer who assemble and bind the current samples without modification can remove a task from their migration and implementation plans.

If you need to assemble the sample source for any reason, then the JCL used to for this task must include IMS.SDFSMAC, SYS1.MACLIB, and SYS1.MODGEN. Otherwise, the assembly will fail.

6.3.7 QUERY MSLINK STATISTICS changes for TCP/IP MSC links

IMS 12 has added new statistics to the output from a **QRY MSLINK SHOW(STATISTICS)** command. The new values (shown in Table 6-4) are added for TCP/IP MSC links. They include the high, low, and total send I/O times for the local and remote SCI, IMS Connect, and TCP/IP components.

Table 6-4 New TCP/IP MSC link statistics

Short name	Long name	Meaning
HLISIOT	HiLocIconSendIOTime	The longest interval of time that the local IMS Connect instance is required to process a message from SCI and send it to TCP/IP.
HLSSIOT	HiLocSciSendIOTime	The longest interval of time that the local SCI instance is required to process a message from IMS and send it to the local IMS Connect.
HRISIOT	HiRmtIconSendIOTime	The longest interval of time that the remote IMS Connect instance is required to process a message from TCP/IP and send it to the remote SCI.
HRSSIOT	HiRmtSciSendIOTime	The longest interval of time that the remote SCI instance is required to process a message from the remote IMS Connect instance and send it to the remote IMS system.
HTCSIOT	HiTcpipSendIOTime	The longest interval of time that a message is required to travel from the local IMS Connect instance to the remote IMS Connect instance on the TCP/IP network.
LLISIOT	LowLocIconSendIOTime	The shortest interval of time that the local IMS Connect instance is required to process a message from SCI and send it to TCP/IP.
LRISIOT	LowRmtIconSendIOTime	The shortest interval of time that the remote IMS Connect instance is required to process a message from TCP/IP and send it to the remote SCI.

Short name	Long name	Meaning
LRSSIOT	LowRmtSciSendIOTime	The shortest interval of time that the remote SCI instance is required to process a message from the remote IMS Connect instance and send it to the remote IMS system.
LTCSIOT	LowTcpipSendIOTime	The shortest interval of time that a message is required to travel from the local IMS Connect instance to the remote IMS Connect instance on the TCP/IP network.
TLISIOT	TotLocIconSendIOTime	The total amount of time that the local IMS Connect instance is required to process all messages from SCI and send them to TCP/IP.
TLSSIOT	TotLocSciSendIOTime	The total amount of time that the local SCI instance is required to process all messages from IMS and send them to the local IMS Connect.
TRISIOT	TotRmtIconSendIOTime	The total amount of time that the remote IMS Connect instance required to process all messages from TCP/IP and send them to the remote SCI.
TRSSIOT	TotRmtSciSendIOTime	The total amount of time that the remote SCI instance is required to process all messages from the remote IMS Connect instance and send them to the remote IMS system.
TTCSIOT	TotTcpipSendIOTime	The sum total of the amount of time that all messages is required to travel from the local IMS Connect instance to the remote IMS Connect instance on the TCP/IP network.

6.4 IMS Connect type-2 Single Point of Control commands

IMS Connect is enhanced in IMS 12 to support a new type-2 command interface from the IMS SPOC. The following groups of commands are added:

- Display commands
- Start commands
- Stop and close commands
- Set, reset, and refresh commands

6.4.1 Display commands

Table 6-5 shows the new IMS Connect type-2 SPOC commands and the equivalent WTOR reply or type-2 modify command.

Table 6-5 IMS Connect type-2 display commands

Type-2 command	WTOR reply	Modify command
`QUERY IMSCON TYPE(ALIAS) NAME(*) SHOW(ALL | showparm)`	`VIEWIA ALL`	Not applicable
`QUERY IMSCON TYPE(ALIAS) NAME(alias) SHOW(ALL | showparm)`	`VIEWIA alias`	Not applicable
`QUERY IMSCON TYPE(ALIAS) NAME(alias) ODBM(odbmname)`	`VIEWIA alias odbmname`	Not applicable
`QUERY IMSCON TYPE(CONFIG) SHOW(ALL | showparm)`	`VIEWHWS`	`QUERY MEMBER TYPE(IMSCON) SHOW(ALL)`
`QUERY IMSCON TYPE(DATASTORE) NAME(*) SHOW(ALL | showparm)`	`VIEWDS ALL`	`QUERY DATASTORE NAME(*) SHOW(ALL)`

Type-2 command	WTOR reply	Modify command
QUERY IMSCON TYPE(DATASTORE) NAME(datastore) SHOW(ALL | showparm)	VIEWDS datastore	QUERY DATASTORE NAME(datastore)
QUERY IMSCON TYPE(IMSPLEX) NAME(*) SHOW(ALL | showparm)	VIEWIP ALL	Not applicable
QUERY IMSCON TYPE(IMSPLEX) NAME(IMSplexname) SHOW(ALL | showparm)	VIEWIP IMSplexname	Not applicable
QUERY IMSCON TYPE(MSC) NAME(*) SHOW(ALL | showparm)	VIEWMSC ALL	QUERY MSC NAME(*)
QUERY IMSCON TYPE(MSC) NAME(mscid) SHOW(ALL | showparm)	VIEWMSC mscid	QUERY MSC NAME(mscid)
QUERY IMSCON TYPE(PORT) NAME(*) SHOW(ALL | showparm)	VIEWPORT ALL	QUERY PORT NAME(*) SHOW(ALL)
QUERY IMSCON TYPE(PORT) NAME(portname) SHOW(ALL | showparm)	VIEWPORT portname	QUERY PORT NAME(portname) SHOW(ALL)
QUERY IMSCON TYPE(PORT) NAME(LOCAL) SHOW(ALL | showparm)	VIEWPORT LOCAL	QUERY PORT NAME(LOCAL) SHOW(ALL)
QUERY IMSCON TYPE(RMTIMSCON) NAME(*) SHOW(ALL | showparm)	VIEWRMT ALL	QUERY RMTIMSCON NAME(*)
QUERY IMSCON TYPE(RMTIMSCON) NAME(rmtimscon) SHOW(ALL | showparm)	VIEWRMT rmtimscon	QUERY RMTIMSCON NAME(rmtimscon)
QUERY IMSCON TYPE(UOR) NAME(*) SHOW(ALL | showparm)	VIEWUOR ALL	QUERY UOR NAME(*) SHOW(ALL)
QUERY IMSCON TYPE(UOR) NAME(uorid) SHOW(ALL | showparm)	VIEWUOR uorid	QUERY UOR NAME(uorid) SHOW(ALL)

6.4.2 Start commands

Table 6-6 shows the new IMS Connect type-2 SPOC commands and the equivalent WTOR reply or type-2 modify command.

Table 6-6 IMS Connect type-2 start commands

Type-2 command	WTOR reply	Modify command
UPDATE IMSCON TYPE(ALIAS) NAME(alias) ODBM(odbmname) START(COMM)	STARTIA alias odbmname	Not applicable
UPDATE IMSCON TYPE(CONFIG) START(RECORDER)	RECORDER OPEN	UPDATE MEMBER TYPE(IMSCON) START(TRACE)
UPDATE IMSCON TYPE(DATASTORE) NAME(datastore) START(COMM)	OPENDS datastore or STARTDS datastore	UPDATE DATASTORE NAME(datastore) START(COMM)
UPDATE IMSCON TYPE(IMSPLEX) NAME(IMSplexname) START(COMM)	OPENIP IMSplexname or STARTIP IMSplexname	UPDATE IMSPLEX NAME(IMSplexname) START(COMM)
UPDATE IMSCON TYPE(MSC) NAME(lclplkid) START(COMM)	STARTMSC lclplkid	UPDATE MSC NAME(lclplkid) START(COMM)

Type-2 command	WTOR reply	Modify command
UPDATE IMSCON TYPE(ODBM) NAME(odbmname) START(COMM)	STARTOD odbmname	Not applicable
UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtimscon) START(COMM)	STARTRMT rmtimscon	UPDATE RMTIMSCON NAME(rmtimscon) START(COMM)
UPDATE IMSCON TYPE(PORT) NAME(portname) START(COMM)	OPENPORT portname or STARTPT portname	UPDATE PORT NAME(portname) START(COMM)

6.4.3 Stop and close commands

Table 6-7 shows the new IMS Connect type-2 SPOC commands and the equivalent WTOR reply or type-2 modify command.

Table 6-7 IMS Connect type-2 stop or close commands

Type-2 command	WTOR reply	Modify command
UPDATE IMSCON TYPE(ALIAS) NAME(alias) ODBM(odbmname) STOP(COMM)	STOPIA alias odbmname	Not applicable
UPDATE IMSCON TYPE(CLIENT) NAME(client_name) PORT(portname) STOP(COMM)	STOPCLNT portname clientid	DELETE PORT NAME(portName) CLIENT(clientName)
UPDATE IMSCON TYPE(CONFIG) SHUTDOWN(COMM)	CLOSEHWS	SHUTDOWN MEMBER
UPDATE IMSCON TYPE(CONFIG) SHUTDOWN(COMM) OPTION(FORCE)	CLOSEHWS FORCE	SHUTDOWN MEMBER OPTION(FORCE)
UPDATE IMSCON TYPE(CONFIG) SHUTDOWN(COMM) OPTION(QUIESCE)	CLOSEHWS QUIESCE	SHUTDOWN MEMBER OPTION(QUIESCE)
UPDATE IMSCON TYPE(DATASTORE) NAME(datastore) STOP(COMM)	STOPDS datastore	UPDATE DATASTORE NAME(datastore) STOP(COMM)
UPDATE IMSCON TYPE(IMSPLEX) NAME(IMSplexname) STOP(COMM)	STOPIP IMSplexname	UPDATE IMSPLEX NAME(IMSplexname) STOP(COMM)
UPDATE IMSCON TYPE(LINK) NAME(linkname) STOP(COMM)	STOPLINK linkname	DELETE LINK NAME(linkname)
UPDATE IMSCON TYPE(MSC) NAME(lclplkid) STOP(COMM)	STOPMSC lclplkid	UPDATE MSC NAME(lclplkid) STOP(COMM)
UPDATE IMSCON TYPE(ODBM) NAME(odbmname) STOP(COMM)	STOPOD odbmname	Not applicable
UPDATE IMSCON TYPE(RMTIMSCON) NAME(rmtimscon) STOP(COMM)	STOPRMT rmtimscon	UPDATE RMTIMSCON NAME(rmtimscon) STOP(COMM)
UPDATE IMSCON TYPE(SENDCLNT) NAME(sendclient_name) RMTIMSCON(rmtimscon) STOP(COMM)	STOPSCLN rmtimscon sendclient	DELETE RMTIMSCON NAME(rmtimscon) SENDCLNT(clientid)
UPDATE IMSCON TYPE(PORT) NAME(portname) STOP(COMM)	STOPPORT portname	UPDATE PORT NAME(portname) STOP(COMM)
UPDATE IMSCON TYPE(CONFIG) STOP(RECORDER)	RECORDER CLOSE	UPDATE MEMBER TYPE(IMSCON) STOP(TRACE)

6.4.4 Set, reset, and refresh commands

Table 6-8 shows the new IMS Connect type-2 SPOC commands and the equivalent WTOR reply or type-2 modify command.

Table 6-8 IMS Connect type-2 set, reset, and refresh commands

Type-2 command	WTOR reply	Modify command
UPDATE IMSCON TYPE(CONFIG) SET(OAUTO(ON))	SETOAUTO YES	UPDATE MEMBER TYPE(IMSCON) SET(OAUTO(ON))
UPDATE IMSCON TYPE(CONFIG) SET(OAUTO(OFF)	SETOAUTO NO	UPDATE MEMBER TYPE(IMSCON) SET(OAUTO(OFF))
UPDATE IMSCON TYPE(CONFIG) SET(PSWDMC(ON))	SETPWMC ON	UPDATE MEMBER TYPE(IMSCON) SET(PSWDMC(ON))
UPDATE IMSCON TYPE(CONFIG) SET(PSWDMC(OFF))	SETPWMC OFF	UPDATE MEMBER TYPE(IMSCON) SET(PSWDMC(OFF))
UPDATE IMSCON TYPE(CONFIG) SET(PSWDMC(RCF))	SETPWMC RCF	UPDATE MEMBER TYPE(IMSCON) SET(PSWDMC(RCF))
UPDATE IMSCON TYPE(CONFIG) SET(RACF(ON))	SETRACF ON	UPDATE MEMBER TYPE(IMSCON) SET(RACF(ON))
UPDATE IMSCON TYPE(CONFIG) SET(RACF(OFF))	SETRACF OFF	UPDATE MEMBER TYPE(IMSCON) SET(RACF(OFF))
UPDATE IMSCON TYPE(CONFIG) SET(RRS(ON))	SETRRS ON	Not applicable
UPDATE IMSCON TYPE(CONFIG) SET(RRS(OFF))	SETRRS OFF	Not applicable
UPDATE IMSCON TYPE(CONFIG) SET(UIDCACHE(ON))	SETUIDC ON	UPDATE MEMBER TYPE(IMSCON) SET(UIDCACHE(ON))
UPDATE IMSCON TYPE(CONFIG) SET(UIDCACHE(OFF))	SETUIDC OFF	UPDATE MEMBER TYPE(IMSCON) SET(UIDCACHE(OFF))
UPDATE IMSCON TYPE(CONVERTER) NAME(converter_name) OPTION(REFRESH)	REFRESH CONVERTER NAME(converter_name)	UPDATE CONVERTER NAME(converter_name) OPTION(REFRESH)
UPDATE IMSCON TYPE(RACFUID) NAME(userid) OPTION(REFRESH)	REFRESH RACFUID NAME(userid)	UPDATE RACFUID NAME(userid) OPTION(REFRESH)

7

IMS repository

The IMS repository is a new capability in IBM Information Management System (IMS) 12. This repository stores various types of data related to resource definitions and descriptors in a centralized store that is accessible to all IMS systems in the IMSplex.

Dynamic resource definition (DRD) exploits this new function by using the IMSRSC type of repository to simplify management of MODBLKS resources among multiple IMS systems. DRD also maintains the resource definitions of all IMS systems in a single centralized store. The IMSRSC repository is a strategic alternative to the resource definition data set (RDDS).

This chapter includes the following sections:

- Introducing and explaining the value of the repository
- Components of the repository
- Repository Server
- Repository data sets
- Common Service Layer
- Batch utilities
- Migrating to the repository
- IMSRSC repository access
- Using the repository in business operations
- Security considerations
- DRD user interface enhancements
- IVP enhancements for repository
- Value of using the IMS repository with DRD

7.1 Introducing and explaining the value of the repository

Users of IMS DRD can now use the repository to manage MODBLKS resources in a single centralized location. From these centralized data sets, the resource definitions can be stored and retrieved by different IMS systems existing together in an IMSplex. They can also be shared among the systems and be dynamically updated. The main goal of the IMS repository is to simplify resource management, easing the overhead involved in making and keeping track of definitional changes among IMS systems.

If you are already using DRD with separate RDDS for each IMS system, you can perform a few simple migration steps to begin using the repository instead. This will eliminate the need to manually coordinate and manage several RDDSs across different IMS systems. If you have never implemented DRD, you can use the definitions that exist in your MODBLKS data set as a starting point, eventually porting them to the new repository.

Similar to the RDDS, the IMSRSC repository contains MODBLKS definitions of the following resources:

- Databases
- Database descriptors
- Programs
- Program descriptors
- Routing codes
- Routing code descriptors
- Transactions
- Transaction descriptors

Implementation of the repository is in alignment with the future direction of IMS in that it provides a simplified, more dynamic method of managing resource definitions. Using DRD with the repository provides the highest availability for your IMS system MODBLKS resources. You no longer need to perform sysgen or online change to manage these resources. The repository centralizes all of these definitions in a single location.

7.2 Components of the repository

Several components work together to facilitate use of the repository. This section explores these components, which include the IMSRSC repository that contains stored resource definitions, the RS, RS catalog repository, required Common Service Layer (CSL) elements, and the utilities that interact with the IMSRSC repository itself. Throughout this section, as each component is explained, see Figure 7-1 on page 201 to help you understand how all of these moving parts work together.

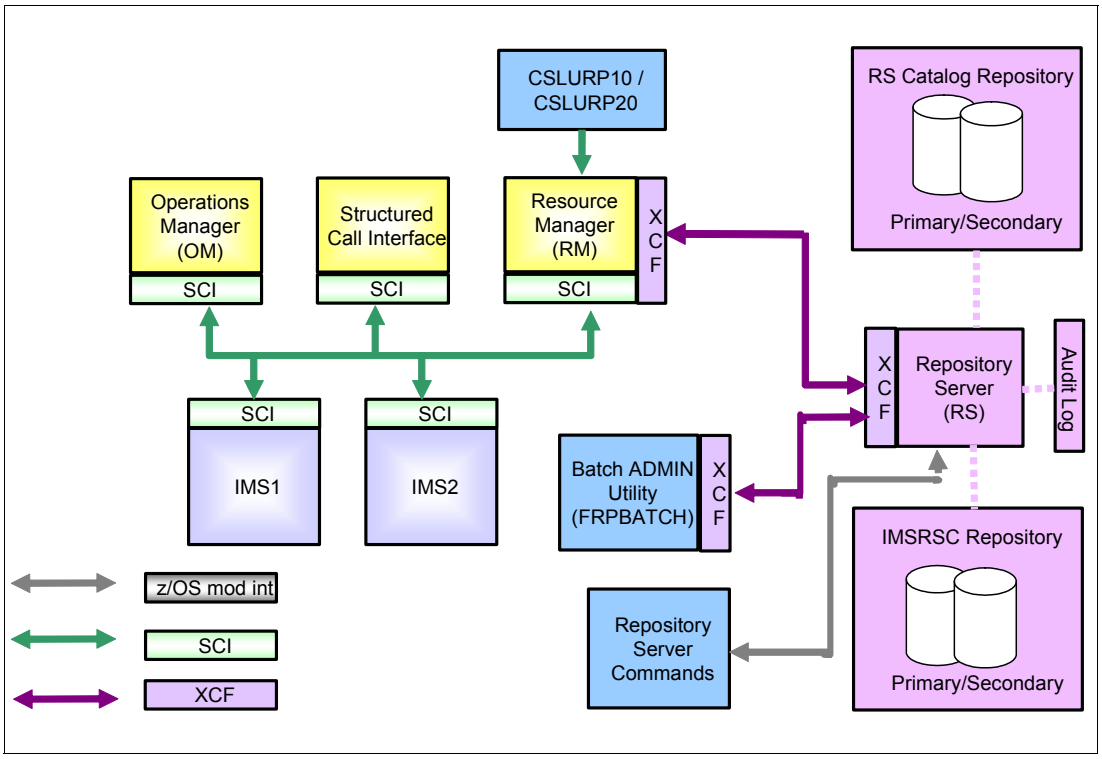

Figure 7-1 Components of the IMS repository

7.3 Repository Server

The user repository that contains MODBLKS stored resource definitions is managed by a new address space called the *Repository Server* (RS). The RS, in turn, works with the RM address space whenever access to the user repository is requested. It also has its own repository called the *RS catalog repository*, which is explained in 7.4.1, “Repository Server catalog repository” on page 202. A single master RS manages access to the repository data sets, but several subordinate Repository Servers can take over for the master RS if it fails. The master RS is the Repository Server that gains access to the user repository first. It is required to have one master RS per IMSplex, residing on any LPAR, even if it is on a different LPAR than the one on which an IMS system is running. Having a subordinate Repository Servers is optional but is recommended for availability.

The Repository Server is responsible for managing registrations and connections to the repository. It ensures data integrity within the repository, and restricts access to the repository so that only authorized users can retrieve data from it. The RS also has an audit trail capability which you can set up to track certain events that occur when attempts to access the repository occur. Finally, the RS provides a tracing capability that uses the Base Primitive Environment (BPE), because it is based on this component.

As shown in Figure 7-1, the RS communicates with the Resource Manager component of the Common Service Layer using z/OS cross-system coupling facility (XCF) services to process incoming requests from RM and from the batch ADMIN utility. The RM utilities can be used to populate the repository and to read from the repository. The RM utilities are useful in migration and fallback because they work with both the RDDS and repository. The batch ADMIN utility performs administration tasks for both the user and the RS catalog repository.

For more information about these sets of utilities, see 7.8.2, “Offline access through RM utilities” on page 228, and “Batch ADMIN commands” on page 241.

7.4 Repository data sets

When you use DRD with the repository, two different types of repositories are used. One type is called the *Repository Server catalog repository*, which manages the information contained in the user repositories. The other type is called the *user repository*. The IMSRSC repository is a user repository that contains the MODBLKS resource definitions associated with the IMS systems.

Both types of repositories consist of two pairs of VSAM key-sequenced data sets (KSDS): a primary repository data set pair and a secondary repository data set pair. Each data set pair is made up of an *index data set* that contains all of the search fields for members that exist in the repository (including the member name). Each data set pair is also made up of a *member data set* that contains the member data that is indexed by the index data set. In addition to its primary and secondary repository data sets, the user repository can have a spare repository data set for availability.

RS catalog repository: The RS catalog repository does not have spare capability.

The following sections explore these two types of repositories further, starting with the RS catalog repository followed by the IMSRSC repository.

7.4.1 Repository Server catalog repository

The Repository Server has its own repository, which maintains the user repositories that contain the MODBLKS stored resource definitions, establishing their name references. The information contained in the RS catalog repository includes user repository names, their status (such as whether they are currently started or stopped), and the date they were last updated (with the identity of the updater). The RS is the only address space that can communicate with its catalog repository, and it does so when administrative tasks are performed such as adding a user repository name to the RS catalog repository or updating an existing one.

The catalog repository must be defined before any user repositories are defined, and it will consist of two pairs of VSAM key sequenced data sets: a primary pair and a secondary or duplex pair.

7.4.2 IMSRSC repository data sets

The IMSRSC repository is shared among multiple IMS systems within an Ites the need to manage individual Resource Definition Data Sets (RDDSs) for each IMS system, simplifying the resource management process.

Like the RS catalog repository, the IMSRSC repository consists of a primary and secondary pair of VSAM KSDS repository data sets, but it also has an optional spare pair. If a repository *write* failure occurs on the primary or secondary data sets, the data set that still contains valid data is copied to the spare data set and the failed copy is marked as discarded. In the event of a *read* error, the remaining valid data set is read and no copy to spare is initiated. For information about the recovery process, see “Recovery activities” on page 257.

To distinguish between these different types of repository data sets, a “state” is assigned to each one. The primary repository data set is referred to as COPY1, the secondary repository data set is referred to as COPY2, and the spare repository data set is referred to as SPARE. If a write error occurs on the primary or secondary repository data set, its state is changed from either COPY1 or COPY2 to DISCARD. You can display the status for each of the repository data sets with a command as explained in 7.8.4, “Direct repository access using z/OS modify interface” on page 230.

You can have more than one IMSRSC repository per Repository Server, for example for test and production IMS systems. However, it is recommended to have one Repository Server per IMSplex so typically you will have one IMSRSC repository per Repository Server per IMSplex.

So far, the IMSRSC repository has been explained in general terms of it containing MODBLKS stored resource definitions. The following sections examine the contents within the IMSRSC repository from a structural perspective.

Repository data

An IMSRSC repository keeps track of the MODBLKS stored resource definitions for each IMS system in the IMSplex. So, how does it do this? For each DRD-enabled IMS system that is using the repository, the following two entities are in the IMSRSC repository:

- IMS resource lists

  These lists contain the names of resources that are defined to each IMS. Up to eight resource lists can be in the repository for each IMS, one for each resource type: DB, DBDESC, TRAN, TRANDESC, PGM, PGMDESC, RTC, and RTCDESC. If an IMS does not have a resource of a certain type, the resource list for that type of resource does not exist in the repository. The DBCTL system does not have a transaction or routing code resource and descriptor resource list.

- Resource definitions

  The resource definition of each resource is defined in the repository. The resource definition consists of the generic definition that applies to all IMS systems that have the resource defined. If an IMS system has one or more attributes that are different from the generic definition, a specific definition is maintained for each IMS. The entire resource definition for a resource with the generic and specific sections is stored as one entity. Each resource definition is stored as one entity, with the key and other information in the repository index data set and the attribute information in the repository member data set.

You can query the resource definitions from the repository and the IMS systems that own the resources by using the type-2 **QUERY** command for the resources in question. For more information, see “QUERY for resources and descriptors” on page 234, and Example 7-37 on page 234.

When IMS restarts, it reads its own IMS resource list in the repository to determine the list of resource names to be autoimported. The stored resource definitions of the resources owned by the IMS are read from the repository during autoimport. When these definitions are read into the running IMS system, they are referred to as *runtime resource definitions*.

7.5 Common Service Layer

Using DRD with the repository also requires a Common Service Layer (CSL) environment and requires that the following address spaces are available for both single-IMS IMSplexes or multiple-IMS IMSplexes:

- Operations Manager (OM) to process type-2 commands for repository functions
- Resource Manager (RM) to gain access to the Repository Server (which in turn can access the IMSRSC repository or the RS catalog repository using z/OS XCF services)
- Structured Call Interface (SCI) to enable communication between members of the IMSplex

Important: SCI is not used for communication between RM and the Repository Server. Communication between these two address spaces is handled by using z/OS XCF services.

A single point of control (SPOC) is also required for entering certain types of repository commands. For example, you can issue the **`EXPORT DEFN TARGET(REPO)`** command by using a SPOC to write stored resource definitions to the repository.

Repository Server in command output: The Repository Server can be included in the command output for a **`QUERY IMSPLEX`** command, and is shown as an active member of the IMSplex. However, to include the Repository Server in this command output, it must first register with SCI. However, registration is optional. This is the only instance in which SCI will access the RS component of the repository environment. RS registers to SCI if **`IMSPLEX(NAME=)`** is specified in the FRPCFG member.

If you are already familiar with the CSL and with the RM address space in particular, you might be aware of the ability of RM to work in conjunction with a coupling facility resource structure for certain functions. If a resource structure is available in your repository environment, it will be used to provide repository name and repository type consistency within the IMSplex.

7.6 Batch utilities

Several utilities are provided for use with the repository environment. One is a batch **`ADMIN`** utility named FRPBATCH, which performs administrative tasks such as adding a repository to the RS catalog repository, updating an existing repository, listing the attributes of a given repository, or starting and stopping a repository.

Other utilities, provided by RM, are available for assistance in migrating to the repository environment and for falling back from it. The RDDS to Repository utility (**`CSLURP10`**) populates a user repository with the contents of a specified RDDS, and the Repository to RDDS RM utility (**`CSLURP20`**) reverts definitions from a repository back to an RDDS.

For information about both of these utilities, see 7.8.2, “Offline access through RM utilities” on page 228, and “Batch ADMIN commands” on page 241.

7.7 Migrating to the repository

Before IMS 12, using the DRD capability required the use of RDDSs. If you are already using DRD with RDDSs, you can replace your multiple RDDSs with a single, shared repository. Even if you have not yet implemented DRD in your shop, you can do so now and use the repository instead of RDDSs for storing your resource definitions. (In this scenario, a small amount of additional setup is required.)

This section explores the implementation steps for using the repository in IMS 12 for both environments: one in which DRD has already been implemented with RDDSs, and one in which DRD will be implemented for the first time.

To begin, the following section outlines the general setup steps that apply to both of these environments.

7.7.1 Setting up the migration

We begin our setup with a walkthrough of allocating the data sets that are required for repository usage, followed by defining the PROCLIB members that are read upon initialization of the address spaces that are part of the repository environment. This section explains the following tasks:

- Allocating the repository data sets
- Setting up the Repository Server
- Setting up the Common Service Layer
- Setting up IMS
- Ensuring parameter consistency

Allocating the repository data sets

We first must allocate the physical data set pairs (VSAM KSDSs) required to use the repository, including the following repositories:

IMSRSC repository This contains MODBLKS stored resource definitions for our IMS system or systems.

Repository Server catalog repository
This contains information about the user repository, manages the Repository Server functions, and provides a link between the user repository name and VSAM data sets.

Regardless of the repository data set type, remember that each repository data set consists of an index data set and a member data set. The IMSRSC repository can contain a spare in addition to the primary and secondary data set, but a spare is not permitted with the Repository Server catalog repository. Therefore, a maximum of 10 data sets must be defined: two each for the primary, secondary and spare IMSRSC repository data sets, and two each for the primary and secondary RS catalog repository data sets. If a spare is not used, then the user only needs eight data sets.

Tip: Define the primary, secondary and spare data set pairs on different volumes, to ensure availability. Also make sure that the size of the secondary index and member data sets is greater than the size of the primary index and member data sets. Finally, the size of the spare index and member data sets should be greater than the size of the secondary index and member data sets.

Example 7-1 shows the job control language (JCL) used in our test environment for allocating these data sets. We used the following data set names for our user repositories:

- Primary user repository index data set: IMS12Q.IMS12X.REPO.IMSPRI.RID
- Primary user repository member data set: IMS12Q.IMS12X.REPO.IMSPRI.RMD
- Secondary user repository index data set: IMS12Q.IMS12X.REPO.IMSSEC.RID
- Secondary user repository member data set: IMS12Q.IMS12X.REPO.IMSSEC.RMD
- Spare user repository index data set: IMS12Q.IMS12X.REPO.IMSSPR.RID
- Spare user repository member data set: IMS12Q.IMS12X.REPO.IMSSPR.RMD

In addition, for our RS catalog repositories we used the following data set names to maintain consistency with our naming convention:

- Primary Repository Server catalog repository index data set: IMS12Q.IMS12X.REPO.CATPRI.RID
- Primary Repository Server catalog repository member data set: IMS12Q.IMS12X.REPO.CATPRI.RMD
- Secondary Repository Server catalog repository index data set: IMS12Q.IMS12X.REPO.CATSEC.RID
- Secondary Repository Server catalog repository member data set: IMS12Q.IMS12X.REPO.CATSEC.RMD

Example 7-1 JCL for allocating user repository and RS catalog repository data sets

```
//*********************************************************************
//* FUNCTION: ALLOCATE DATA SETS NEEDED FOR THE REPOSITORY USAGE FOR DRD
//*********************************************************************
//RDSALLOC JOB ACTINFO1,'PGMRNAME',CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=&SYSUID,REGION=128M
//*
/*JOBPARM S=SC64
// JCLLIB ORDER=IMS12Q.PROCLIB
//*
//* ALLOCATE DATA SETS
//ALLOCATE EXEC PGM=IDCAMS,DYNAMNBR=200
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.CATPRI.RID) REUSE INDEXED -
               KEYS(128,0) FREESPACE(10 10) RECORDSIZE(282 282)    -
               SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
               VOLUMES(SBOXI5) CYLINDERS(1 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.CATPRI.RMD) REUSE INDEXED -
               KEYS(12,0) FREESPACE(20 20) RECORDSIZE(8185 8185)   -
               SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
               VOLUMES(SBOXI5) CYLINDERS(1 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.CATSEC.RID) REUSE INDEXED -
               KEYS(128,0) FREESPACE(10 10) RECORDSIZE(282 282)    -
               SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
               VOLUMES(SBOXI5) CYLINDERS(2 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.CATSEC.RMD) REUSE INDEXED -
               KEYS(12,0) FREESPACE(20 20) RECORDSIZE(8185 8185)   -
               SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
               VOLUMES(SBOXI5) CYLINDERS(2 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.IMSPRI.RID) REUSE INDEXED -
               KEYS(128,0) FREESPACE(10 10) RECORDSIZE(282 282)    -
               SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
```

```
               VOLUMES(SBOXI5) CYLINDERS(1 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.IMSPRI.RMD) REUSE INDEXED -
               KEYS(12,0) FREESPACE(20 20) RECORDSIZE(8185 8185)   -
               SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
               VOLUMES(SBOXI5) CYLINDERS(1 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.IMSSEC.RID) REUSE INDEXED -
               KEYS(128,0) FREESPACE(10 10) RECORDSIZE(282 282)    -
                SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
                VOLUMES(SBOXI5) CYLINDERS(2 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.IMSSEC.RMD) REUSE INDEXED -
                KEYS(12,0) FREESPACE(20 20) RECORDSIZE(8185 8185)   -
                SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
                VOLUMES(SBOXI5) CYLINDERS(2 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.IMSSPR.RID) REUSE INDEXED -
                KEYS(128,0) FREESPACE(10 10) RECORDSIZE(282 282)    -
                SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
                VOLUMES(SBOXI5) CYLINDERS(3 1))
DEFINE CLUSTER(NAME(IMS12Q.IMS12X.REPO.IMSSPR.RMD) REUSE INDEXED -
                KEYS(12,0) FREESPACE(20 20) RECORDSIZE(8185 8185)   -
                SHAREOPTIONS(2 3) CONTROLINTERVALSIZE(8192)         -
                VOLUMES(SBOXI5) CYLINDERS(3 1))
```

Now that the user repository data sets and RS catalog repository data sets have both been allocated, the next step is to set up the Repository Server.

Setting up the Repository Server

The RS is a BPE-based address space, therefore it requires that a BPE configuration member is defined. In addition, the Repository Server is configured by the parameters specified in the FRPCFG member of PROCLIB. Both of these members are read during initialization of the RS address space.

BPE configuration member

Define the BPE configuration member to specify trace settings for the RS address space. This requires a z/OS PPT entry for BPE, which will most likely already be present in your shop.

Example 7-2 shows the BPE configuration member that we used in our test environment for our Repository Server address space.

Example 7-2 BPE configuration member for Repository Server address space

```
# DEFINITIONS FOR REPO TRACES
TRCLEV=(*,HIGH,REPO,PAGES=300)/* DEFAULT ALL TRACES TO HIGH */
```

For more information about BPE, see *IMS Version 12 System Administration*, SC19-3020.

FRPCFG configuration member

Define your FRPCFG configuration member using an 8-character name. In our test system, we named our member FRP12XRP, which is referenced later in the startup procedure for the Repository Server address space in Example 7-4 on page 208.

Example 7-3 shows the FRPCFG configuration member that we used in our test system; the name of our IMSplex is IM12X.

Important: The IMSplex that you specify in the FRPCFG configuration member must be the same IMSplex that you specify in your Common Service Layer configuration member (either in the CSL section in the DFSDFxxx member or in the DFSCGxxx member) and the CSL initialization members for SCI, RM, and OM.

Also note in the example that we have specified the names of the RS catalog repository primary and secondary data sets that we allocated in the previous section. The **RSNAME=** parameter represents the REPOID that will be appended to all messages issued by the Repository Server. The characters “RP” will be added as a suffix to the RSNAME that you specify. Our REPOID will be IMS12XRP because we specified **RSNAME=IMS12X**. Because **IMSPLEX(NAME=)** is specified, RS will attempt to register to the SCI address space on the same LPAR as the RS if SCI is available.

Another important parameter to specify is the XCF group name, which must be the same for RM, in the CSLRIxxx member, the RS FRPCFG parameter **XCF_GROUP_NAME**, and on the **XCFGROUP=** in the FRPBACTH JCL.

Important: The XCF group name specified on the **XCF_GROUP_NAME=** parameter in the FRPCFG member *must* match the XCF group name specified in both the RM initialization member CSLRIxxx and in the **FRPBATCH** (batch **ADMIN**) utility JCL that defines the user repositories to the RS catalog repository (using the **ADD** function).

For a complete description of the other parameter values included in the FRPCFG configuration member, see *IMS Version 12 System Administration*, SC19-3020.

Example 7-3 FRPCFG configuration member parameter definitions

```
XCF_THREADS=8
MAX_COMMUNICATION_RETRY=32
MBR_CORE_MAX=1024
IMSPLEX(NAME=IM12X)
RSNAME=IMS12X
PRIMARY_CATALOG_REPOSITORY_INDEX=IMS12Q.IMS12X.REPO.CATPRI.RID
PRIMARY_CATALOG_REPOSITORY_MEMBER=IMS12Q.IMS12X.REPO.CATPRI.RMD
SECONDARY_CATALOG_REPOSITORY_INDEX=IMS12Q.IMS12X.REPO.CATSEC.RID
SECONDARY_CATALOG_REPOSITORY_MEMBER=IMS12Q.IMS12X.REPO.CATSEC.RMD
VSAM_BUFNO=128
VSAM_BUFSIZE=8
XCF_GROUP_NAME=IM12XREP
AUDIT=NO
AUDIT_FAIL=CONTINUE
AUDIT_LEVEL=HIGH
AUDIT_DEFAULT=NOAUDIT
```

Next, we must create the startup procedure JCL for the Repository Server, so that we can later start this address space as a task. Example 7-4 shows the RS startup procedure that we used in our test environment.

Example 7-4 Repository Server startup procedure JCL

```
//IM12XREP PROC RGN=128M,BPECFG=BPERECFN,
//             FRPCFG=FRP12XRP,SOUT='*'
```

```
//*
//RESPPROC  EXEC PGM=BPEINI00,REGION=&RGN,
//  PARM='BPEINIT=FRPINI00,BPECFG=&BPECFG,FRPCFG=&FRPCFG'
//*
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//*
//FRPPRINT DD  SYSOUT=&SOUT
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
```

Setting up the Common Service Layer

CSL initialization PROCLIB members must be set up when using the RS. The SCI initialization member (CSLSIxxx) and the OM initialization member (CSLOMxxx) simply need to contain standard CSL parameters, where the RM initialization PROCLIB member (CSLRIxxx) contains the standard CSL parameters plus some unique parameters for using the IMSRSC repository and communication with the RS. In this section, we focus on the parameters in these PROCLIB members that are new in IMS 12. For more information about other parameters not expanded upon here, see *IMS Version 12 System Definition*, GC19-3021.

Resource Manager: If you are already using the SCI and OM components of the CSL in your environment, you only need to complete the setup steps in this section for Resource Manager. Then you can skip to “Resource Manager” on page 211.

Structured Call Interface

Define the CSLSIxxx PROCLIB member and the startup procedure JCL for this address space. Later, you start the SCI address space as a task using the startup procedure, which then reads the initialization member that you defined.

Example 7-5 shows the SCI initialization member that we used in our test system.

Example 7-5 SCI initialization PROCLIB member CSLSI12D

```
*-------------------------------------------------------------------*
* SCI INITIALIZATION PROCLIB MEMBER   CSLSI12D                      *
*-------------------------------------------------------------------*
ARMRST=N,                    /* SHOULD ARM RESTART SCI ON FAILURE  */
SCINAME=IMS12D,              /* SCI NAME (SCIID = IMS12DSC         */
IMSPLEX(NAME=IM12X)          /* IMSPLEX NAME (CSLIM12X)            */
* FORCE(ALL,SHUTDOWN)   /* TO CLEAN UP THE GLOBAL INTERFACE STORAGE */
*-------------------------------------------------------------------*
* END OF MEMBER CSLSI12D                                            *
*-------------------------------------------------------------------*
```

Example 7-6 shows the SCI startup procedure that we used in our test system (used later when we start the SCI address space).

Example 7-6 SCI startup procedure JCL

```
//*-------------------------------------------------------------------*
//*     PARAMETERS:                                                   *
//*     BPECFG  - NAME OF BPE MEMBER                                  *
//*     SCIINIT - SUFFIX FOR YOUR CSLSIXXX MEMBER  ==> CSLSI12D       *
//*     ARMRST  - INDICATES IF ARM SHOULD BE USED                     *
```

```
//*     SCINAME - NAME OF THE SCI BEING STARTED ==> IMS12DSC         *
//*-------------------------------------------------------------------*
//*
//IEFPROC  EXEC PGM=BPEINI00,REGION=3000K,
//  PARM=('BPECFG=BPECONFG','BPEINIT=CSLSINI0','SCIINIT=12D',
//            'ARMRST=N','SCINAME=IMS12D')
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//PROCLIB  DD  DSN=IMS12Q.PROCLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//*
```

Operations Manager

Define the CSLOIxxx PROCLIB member and the startup procedure JCL for this address space. Later you start the OM address space as a task using the startup procedure, which then reads the initialization member that you defined.

Example 7-7 shows the OM initialization member that we used in our test system.

Example 7-7 OM initialization PROCLIB member CSLOI12D

```
*-------------------------------------------------------------------*
* OM INITIALIZATION PROCLIB MEMBER - CSLOI12D                        *
*-------------------------------------------------------------------*
ARMRST=N,                     /* SHOULD ARM RESTART OM ON FAILURE  */
CMDLANG=ENU,                  /* USE ENGLISH FOR COMMMAND DESC     */
CMDSEC=N,                     /* NO COMMAND SECURITY               */
OMNAME=IMS12D,                /* OM NAME (OMID = IMS12DOM)         */
IMSPLEX(
  NAME=IM12X),                /* IMSPLEX NAME (CSLIM12X)           */
*IMSPLEX(
* NAME=IM12X,                 /* IMSPLEX NAME (CSLIM12X)           */
* AUDITLOG=SYSLOG.OM2QO1.LOG), /* MVS LOG STREAM                   */
CMDTEXTDSN=IMS12Q.SDFSDATA    /* CMD TEXT DATASET                  */
*-------------------------------------------------------------------*
* END OF MEMBER CSLOI12D                                            *
*-------------------------------------------------------------------*
```

Example 7-8 shows the OM startup procedure that we used in our test system (used later when we start the OM address space).

Example 7-8 OM startup procedure JCL

```
//IM12DOM  PROC RGN=128M,TME=1440,SOUT=*,
//             BPECFG=BPECONFG,
//             OMINIT=12D,
//             CSLOI=CSLOINI0,
//             PARM1='ARMRST=N,CMDSEC=N'
//*-------------------------------------------------------------------*
//*   OM                                                              *
//*-------------------------------------------------------------------*
//*     PARAMETERS:                                                   *
//*     BPECFG  - NAME OF BPE MEMBER                                  *
//*     OMINIT  - SUFFIX FOR YOUR CSLOIXXX MEMBER                     *
//*     ARMRST  - INDICATES IF ARM SHOULD BE USED                     *
//*     CMDLANG - LANGUAGE FOR COMMAND DESCRIPTION TEXT               *
```

```
//*     CMDSEC  - COMMAND SECURITY METHOD                          *
//*     OMNAME  - NAME OF THE OM BEING STARTED ==> FROM OMINIT     *
//*-------------------------------------------------------------------*
//*
//OMPROC  EXEC PGM=BPEINI00,REGION=&RGN,TIME=&TME,
//  PARM='BPECFG=&BPECFG,BPEINIT=&CSLOI,OMINIT=&OMINIT,&PARM1'
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//PROCLIB  DD  DSN=IMS12Q.PROCLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=&SOUT
//SYSUDUMP DD  SYSOUT=&SOUT
```

Resource Manager

Define the CSLRIxxx PROCLIB member and the startup procedure JCL for this address space. Later you start the RM address space as a task using the startup procedure, which then reads the initialization member that you defined.

Example 7-9 shows the RM initialization member that we used in our test system.

Example 7-9 RM initialization PROCLIB member CSLRIRMX

```
ARMRST=N,
RMNAME=RMX,
IMSPLEX(NAME=IM12X)
<SECTION=REPOSITORY>
REPOSITORY=(NAME=IMS12XRP,TYPE=IMSRSC,GROUP=IM12XREP,
AUDITACCESS=NOAUDIT)
```

The REPOSITORY section shown after the other RM initialization parameters is new for IMS 12. Here, we define the name of the IMSRSC repository, the XCF group name, and optional audit log access parameters. There can only be one REPOSITORY= statement. The parameter values (new in this IMS release) have the following meanings:

REPOSITORY=() This value defines the IMS repository parameters for RM initialization. It is specified within a section with the header <SECTION=REPOSITORY>.

NAME= This value specifies the repository name that is managed by RM. This name must be same as the repository name defined to the RS. A repository is defined to the RS with the batch **ADMIN** utility **ADD** command (see “ADD command” on page 241). The repository name can be up to 44 characters long and can contain the alphanumeric characters (A–Z, 0 - 9) and the following symbols: period (.) at sign (@), number sign (#), underscore (_), and dollar sign ($). The alphabetic characters A–Z can be uppercase only.

> **Restriction:** A repository name of CATALOG cannot be specified, because it is reserved for use by the RS.

TYPE= This value specifies the repository type. The only valid value is IMSRSC.

GROUP= This value specifies the Repository Server z/OS XCF group name. This value must be the same as the XCF group name specified on the XCF_GROUP_NAME parameter of the FRPCFG member. RM and the RS must be in the same XCF group. The value must be eight characters padded on the right with blanks. Valid characters are A-Z (uppercase only), 0 - 9, and the following symbols: number sign (#), dollar sign ($), and at sign (@).

AUDITACCESS= This is an optional parameter. It specifies the repository audit access level for the specified repository. If this value is not specified, the audit access level

defaults to the level of auditing set by the **AUDIT_DEFAULT=** parameter in the FRPCFG member of the IMS PROCLIB data set. The **AUDITACCESS=** parameter has the following valid values:

DEFAULT	Use the rule specified in the **AUDIT_DEFAULT** parameter of the FRPCFG member.
NOAUDIT	No auditing of member access.
SECURITY	Audit security failures only.
UPDATE	Audit member access with update intent.
READ	Audit member access with read or update intent.
SYSTEMREAD	Audit member access with system-level read, read, or update intent. A read of the resource definition by the system before the update request is identified as a “system read” request.

Read request: Under an audit access rule of READ, system read requests do not cause a read audit record to be generated. Under an audit access rule of SYSTEMREAD, all read requests, including system read requests, are audited.

You can specify **AUDITACCESS=** in the CSLRIxxx member if you have more than one IMSRSC repository being managed by the RS address space and want to have different audit level specifications for each repository. Example 7-10 shows the RM startup procedure that we used in our test system (executed later when we started the RM address space).

Example 7-10 RM startup procedure JCL

```
//*-------------------------------------------------------------------*
//*   RM                                                              *
//*-------------------------------------------------------------------*
//*     PARAMETERS:                                                   *
//*     BPECFG  - NAME OF BPE MEMBER                                  *
//*     RMINIT  - SUFFIX FOR YOUR CSLRIXXX MEMBER                     *
//*     ARMRST  - INDICATES IF ARM SHOULD BE USED                     *
//*     RMNAME  - NAME OF THE RM BEING STARTED                        *
//*-------------------------------------------------------------------*
//*
//IEFPROC  EXEC PGM=BPEINI00,REGION=3000K,
//  PARM=('BPECFG=BPECONFG','BPEINIT=CSLRINI0','RMINIT=RMX')
//*
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//PROCLIB  DD  DSN=IMS12Q.PROCLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//*
```

Setting up IMS

Upon initialization, IMS reads the DFSDFxxx PROCLIB member (Example 7-11) to apply specific processing options for various functions. This member contains multiple sections that apply to these functions. Here, we focus on the sections that apply to the CSL, DRD, and repository, again with emphasis on the parameters that are new in IMS 12.

Example 7-11 System Definition PROCLIB member DFSDF12D

```
*-------------------------------------------------------------------*
*         MEMBER   DFSDF12D
* DFSDF= PARAMETER ON CONTROL REGION EXECUTION OR DFSPBXXX
*-------------------------------------------------------------------*
* PARAMETERS IN DFSSQXXX AND DFSCGXXX MEMBERS
* OVERRIDE THE ATTRIBUTES DEFINED IN THE DFSDFXXX MEMBER
*-------------------------------------------------------------------*
* COMMON SERVICE LAYER SECTION                                      *
*-------------------------------------------------------------------*
<SECTION=COMMON_SERVICE_LAYER>
IMSPLEX=IM12X                    /* IMSPLEX NAME                   */
MODBLKS=DYN                      /* DRD ENABLED;MODBLKS OLC DISABLE */
*-------------------------------------------------------------------*
* DYNAMIC RESOURCES SECTION                                         *
*-------------------------------------------------------------------*
<SECTION=DYNAMIC_RESOURCES>
AUTOEXPORT=AUTO,
AUTOIMPORT=AUTO,
RDDSDSN=(
  IMS12Q.IMS12D.RDDS1,
  IMS12Q.IMS12D.RDDS2,
  IMS12Q.IMS12D.RDDS3)
*-------------------------------------------------------------------*
* REPOSITORY SECTION                                                *
*-------------------------------------------------------------------*
<SECTION=REPOSITORY>
REPOSITORY=(TYPE=IMSRSC)
*-------------------------------------------------------------------*
* END OF MEMBER DFSDF12D                                            *
```

For each of the following sections, refer back to Example 7-11 on page 213. For more information about other parameters that are not expanded upon here, see *IMS Version 12 System Definition*, GC19-3021.

Common Service Layer section

CSL enablement parameters have historically been defined in the DFSCGxxx PROCLIB member, but it is now recommended to define them in the DFSDFxxx member in the CSL section flagged by a <SECTION=COMMON_SERVICE_LAYER> header. If parameters are specified in both members, the DFSCGxxx member will take precedence.

Define the following parameters in the CSL section of the DFSDFxxx member for repository enablement:

- **MODBLKS=DYN** to indicate DRD usage (versus MODBLKS online change)
- **RMENV=Y** to indicate that an RM address space will be used

Dynamic Resource Definition section

The **AUTOIMPORT=AUTO** or **AUTOIMPORT=REPO** parameter is important to define in the DRD section of the DFSDFxxx member (flagged by a <SECTION=DYNAMIC_RESOURCES> header) for autoimport from the repository.

The **AUTOIMPORT=AUTO** parameter specifies that resource and descriptor definitions are automatically imported during IMS cold start. Automatic import from the IMS repository is enabled if all of the following conditions are true:

- IMS is enabled with DRD.
- The repository section of the DFSDFxxx member is defined with **TYPE=IMSRSC**.
- IMS is enabled with RM services.
- The CSLRIxxx member is defined for the repository with **TYPE=IMSRSC**.
- The repository contains stored resource definitions for the IMS system.
- RM is started with the repository enabled.
- The RS address space is started and available.

Otherwise, automatic import is attempted from the RDDS or MODBLKS if certain other conditions are true.

The **AUTOIMPORT=REPO** parameter specifies that stored resource and descriptor definitions are imported (automatic import) from the IMSRSC repository. In this case, the CSLRIxxx member and the REPOSITORY section of the DFSDFxxx member must also be defined with the **TYPE=IMSRSC** parameter. Take into account the following considerations when the **AUTOIMPORT=REPO** parameter is specified:

- If the repository does not contain the stored resource definitions for the IMS, then IMS comes up with no resources. IMS issues the DFS4404I message if the repository is empty.
- If the IMS resource list in the repository is not empty, IMS processes the resource definitions returned by the RM.
- If an error occurs while processing the returned definitions, the action that is taken is based on the **IMPORTERR=** parameter setting.
- If there is an error reading from the repository, other than if the IMS resource list is not found, a DFS4401E message is issued with the RM return and reason code. Action is taken based on the **REPOERR=** parameter setting.
- If the **AUTOIMPORT=REPO** parameter is specified and no REPOSITORY section is defined, or the **REPOSITORY=** statement for the repository is not defined, the DFS4403E message is issued. IMS initialization abends with U0071 with return code X'27'. The DFS2930 message is issued with completion code 27,2108 before the abend.
- If the **AUTOIMPORT=REPO** parameter is specified and **RMENV=N** is specified in the CSL section, IMS initialization abends with U0071 with return code X'27', because IMS cannot access the repository for the stored resource definitions. IMS requires the CSL RM address space to access the repository. The DFS2930 message is issued with completion code 27,210C before the abend.

For detailed information about automatic import from these other sources, see *IMS Version 12 System Definition*, GC19-3021.

Attention: Example 7-11 shows the DFSDFxxx member that we used in our test system. We began with a DRD-enabled IMS system, and therefore the **AUTOEXPORT** and **RDDSDSN** parameters were included in its DFSDFxxx member. **AUTOEXPORT=** does *not* apply to the repository and should be removed post-migration, as should the RDDSDSN parameter. To write resource definitions to the repository, the type-2 **EXPORT** command is required. These parameters are shown in our aforementioned example to capture the current state of our IMS system before repository migration.

If you have not yet enabled DRD, you can disregard these parameters in the sample because your environment does not have them currently defined. For more information about the post-migration items mentioned here, see 7.7.9, “Cleaning up the DFSDFxxx member” on page 227.

Repository section

There is a new repository section flagged by a <SECTION=REPOISTORY> header that specifies the type of IMS repository that will be used. As mentioned earlier, the type of repository used with DRD is **TYPE=IMSRSC**, which is currently the only valid option. There can be only one **TYPE=** statement within this section.

Ensuring parameter consistency

Two major parameters tie together the processing for a Repository Server. The first parameter is the z/OS XCF group name, which is used for communications with the Repository Server. The same XCF group name must be used in all the member definitions that use a particular repository.

The second parameter is the actual name of the IMSRSC repository that holds the DRD definitions for the IMSplex. Figure 7-2 illustrates each parameter in more detail.

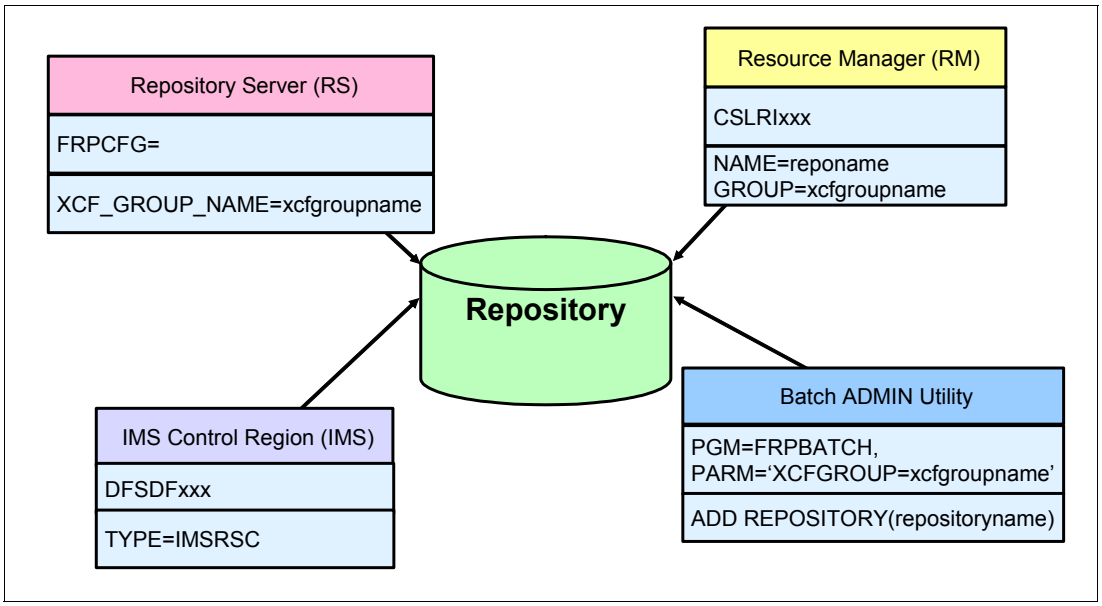

Figure 7-2 IMS repository parameter consistency requirements

XCF group name

The parameter for the XCF group name specifies the Repository Server z/OS cross-system coupling facility group name. Resource Manager and the Repository Server must be in the same XCF group. The value must be eight characters and padded on the right with blanks.

More specifically, the same XCF group name must be specified in the Repository Server FRPCFG configuration member, RM initialization CSLRIxxx member, and the FRPBATCH JCL for invoking the batch ADMIN utility. It is important to ensure that the XCF group name parameter value is consistent in each of these places for a given repository.

IMSRSC repository

The parameter for the IMSRSC repository specifies the IMSRSC repository name that is managed by RM. The repository name can be up to 44 characters long. The name of the IMSRSC repository is defined in the RM initialization PROCLIB member (CSLRIxxx), and must match the repository name specified when you invoke the batch **ADMIN** utility.

Now that you have defined the PROCLIB members required for the repository environment, you can begin initializing the address spaces associated with them.

7.7.2 Initializing the SCI and OM Common Service Layer components

SCI is the first address space that must be initialized in an IMSplex. This is because every other address space that attempts to join an IMSplex must first register with SCI before being permitted to do so. In our test environment, we started our SCI address space named IM12DSCI as a task using the startup procedure JCL in Example 7-6 on page 209.

Next, we initialized our OM address space named IM12DOM using the startup procedure JCL in Example 7-8 on page 210.

7.7.3 Initializing the Repository Server

Now that we have initialized the SCI and OM address spaces, we can now initialize our RS address space. The RS is generally initialized and started before RM before any client can connect to the repository. We initialized our RS named IM12XREP by using the startup procedure JCL in Example 7-4 on page 208. It attained master RS status because no other RS currently exists in the IMSplex and this is reflected in a `FRP2002I` message, shown in Example 7-12.

Example 7-12 FRP messages displayed upon Repository Server initialization

```
IEF695I START IM12XREP WITH JOBNAME IM12XREP IS ASSIGNED TO USER STC
$HASP373 IM12XREP STARTED
IEF403I IM12XREP - STARTED - TIME=22.15.58 - ASID=00C5 - SC64
FRP2006I - Server starting: Release 1.2.0, XCF group IM12XREP
FRP2012I - Opening repository: CATALOG
FRP2016I - Repository opened: CATALOG
FRP2002I - Master repository server status obtained IMS12XRP
FRP2025I - Server start completed IMS12XRP
FRP2026I - XCF group IM12XREP joined successfully IMS12XRP
```

Master and subordinate Repository Servers

If the master RS fails, a subordinate RS can take over for it to maintain availability. Any RS address space initialized after a master RS is active will become a subordinate RS. It will wait in an initialization state until it detects that the master RS has failed. At this point, the subordinate RS will complete the startup process. Because you can have multiple subordinate RS address spaces, the first one to complete this startup process will become the new master. The others will remain subordinate RSs.

Now that we have initialized our RS address space, we can define our user repository to the RS catalog repository.

7.7.4 Defining the IMSRSC repository to the Repository Server catalog

To define an IMSRSC repository to the RS catalog repository, use the batch **ADMIN** utility to issue the **ADD** command. After the IMSRSC repository has been added, you can then start it by using a **START** command. To add and start our IMSRSC repository named IMS12XRP, we used the JCL shown in Example 7-13.

Example 7-13 Defining an IMSRSC repository to the RS catalog repository with FRPBATCH

```
//DEFNREPO JOB ACTINFO1,
// 'PGMRNAME',
// CLASS=A,
// MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=IMSR2,
// REGION=128M
//*
/*JOBPARM S=SC64
// JCLLIB ORDER=IMS12Q.PROCLIB
//*
//REPOADD  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 ADD REPOSITORY(IMS12XRP)                    +
     REPDSN1RID(IMS12Q.IMS12X.REPO.IMSPRI.RID)   +
     REPDSN1RMD(IMS12Q.IMS12X.REPO.IMSPRI.RMD)   +
     REPDSN2RID(IMS12Q.IMS12X.REPO.IMSSEC.RID)   +
     REPDSN2RMD(IMS12Q.IMS12X.REPO.IMSSEC.RMD)   +
     REPDSN3RID(IMS12Q.IMS12X.REPO.IMSSPR.RID)   +
     REPDSN3RMD(IMS12Q.IMS12X.REPO.IMSSPR.RMD)   +
     AUTOOPEN(YES)
 START REPOSITORY(IMS12XRP)
//*
```

We named our IMS12XRP IMSRSC repository on the **REPOSITORY()** parameter, and we specified the names of our IMSRSC repository primary, secondary, and spare index and member data sets that we previously allocated in Example 7-1 on page 206.

Repository name: The repository name is converted to uppercase if it is specified with anything else.

You can also control whether the repository data sets you are specifying with this command are opened when the repository is started (**AUTOOPEN(YES)** is the default, which we have included for clarity) or when a user first connects to it (**AUTOOPEN(NO)**). Lastly, after adding our user repository to the RS catalog repository, we started it with the **START** command.

Now that we have defined our IMSRSC repository to the RS catalog repository, we can initialize the RM address space.

7.7.5 Initializing the RM Common Service Layer component

In our test environment, we started our RM address space named IM12XRM as a task using the startup procedure JCL in Example 7-10 on page 212.

When the RM address space is initializing, RM attempts to connect to the repository name specified in the CSLRIxxx member on the **REPOSITORY=** statement. In our case, it connects to the IMSRSC repository defined to the RS catalog repository (Example 7-13 on page 217). RM then issues message CSL2500I (Example 7-14) that we received when we initialized RM in our test environment. If the repository is empty and this is the first RM initialized repository, you also see a CSL2501I message.

Example 7-14 RM successfully connecting to IMSRSC repository

```
IEF695I START IM12XRM  WITH JOBNAME IM12XRM  IS ASSIGNED TO
$HASP373 IM12XRM  STARTED
IEF403I IM12XRM - STARTED - TIME=22.16.48 - ASID=00B0 - SC64
CSL2500I RM RMXRM    CONNECT REQUEST SUCCESSFUL FOR  893
REPOSITORY NAME=IMS12XRP
REPOSITORY TYPE=IMSRSC   RMXRM
CSL0020I RM  READY RMXRM
```

Attention: If you are already using RM in your shop, you do not need to restart the RM address space to enable it for repository usage. Instead, you can issue a type-2 **UPDATE RM** command to dynamically enable it using the following syntax:

```
UPDATE RM TYPE(REPO) REPOTYPE(IMSRSC) SET(REPO(Y))
```

Ensure that your CSLRIxxx and DFSDFxxx members have been defined with the required repository enablement parameters before issuing this command.

With APAR PM41952 applied: If you started RM before the RS is started, RM initialization will issue a CSL2502A highlighted message and will attempt to register to RS every 5 seconds until it is successful or RM is terminated. Also, if RS is started, but the repository name RM is trying to connect to is not defined to the RS or is not available, RM will issue a CSL2503A highlighted message and attempt to connect to the repository every 5 seconds.

Now that RM has been started, we can begin working with the IMSRSC repository in various ways. We begin by populating the IMSRSC repository with resource definitions.

7.7.6 Populating the IMSRSC repository

You can populate the IMSRSC repository in several ways. The best method is determined by factors such as whether IMS is active or inactive, and whether you have already implemented DRD in your shop. This section reviews the multiple ways that you can populate the IMSRSC repository, beginning with using the RDDS.

Populating the repository from RDDS

To populate the IMSRSC repository with the contents of an RDDS, you can run the RDDS to Repository utility (**CSLURP10**). This method is the recommended way to populate the repository if you have already implemented DRD in your shop and your IMS is currently *inactive*. The idea here is to prepare the repository offline by first copying the stored resource definitions in the RDDS to the IMSRSC repository, and then restarting your IMS system with **AUTOIMPORT=AUTO** specified in its DFSDFxxx member so that it will read in the resource definitions from the IMSRSC repository.

If **AUTOIMPORT** is not used on a cold start or IMS is restarting with a warm or emergency restart, you issue the **IMPORT** command to read the DRD definitions from the repository.

Tip: Choose the most current system RDDS for input to the RDDS to Repository utility (**CSLURP10**). You can determine which system RDDS is the most current by browsing each RDDS and viewing the timestamp information, which is included in clear text in the header record. Determine the system RDDS names by viewing the **RDDSDSN=()** parameter in the DFSDFxxx member of the IMS system.

To test this utility in our environment we used the most current system RDDS associated with our IM12D system, which was IMS12Q.IMS12D.RDDS1. Example 7-15 shows the JCL that we used to run the RDDS to Repository utility (**CSLURP10**).

Example 7-15 Populating an IMSRSC repository from an RDDS

```
//POPREPOS JOB ACTINFO1,
// 'PGMRNAME',
// CLASS=A,
// MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=IMSR2,
// REGION=128M
//*
/*JOBPARM S=SC64
// JCLLIB ORDER=IMS12Q.PROCLIB
//*********************************************************************
//* FUNCTION: Populate data into the IMS repository from RDDS
//*********************************************************************
/*
//STEP1    EXEC PGM=CSLURP10,MEMLIMIT=4G
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//RDDSDSN  DD DISP=SHR,DSN=IMS12Q.IMS12D.RDDS1
//SYSIN    DD *
 IMSPLEX(NAME=IM12X IMSID(I12D))
//*
```

After we ran the utility, we browsed the output to confirm that the definitions were successfully copied from our specified RDDS to the IMSRSC repository which is shown in Example 7-16.

Example 7-16 RDDS to Repository utility (CSLURP10) job output

```
CSL2603I CSLURP10 IS PROCESSING RDDS IMS12Q.IMS12D.RDDS1
CSL2618I CSLURP10 IS PROCESSING PLEX=CSLIM12X, IMSID LIST FROM SYSIN, I12D
CSL2620I CSLURP10 SUCCESSFUL REGISTRATION WITH RM, RMNAME=RMXRM
CSL2600I CSLURP10 WRITE TO REPOSITORY WAS SUCCESSFUL FOR REPOTYPE=IMSRSC  ,
REPONAME=IMS12XRP

   **** SUMMARY ****

DB       COUNT     : 15
DBDESC   COUNT     : 0
PGM      COUNT     : 53
PGMDESC  COUNT     : 0
RTC      COUNT     : 3
RTCDESC  COUNT     : 0
```

```
TRAN     COUNT     : 38
TRANDESC COUNT     : 0
DB       DUPLICATES: 0
DBDESC   DUPLICATES: 0
PGM      DUPLICATES: 0
PGMDESC  DUPLICATES: 0
RTC      DUPLICATES: 0
RTCDESC  DUPLICATES: 0
TRAN     DUPLICATES: 0
TRANDESC DUPLICATES: 0
```

If you had already implemented DRD in your shop and you want to populate the IMSRSC repository while IMS is active, you can do so dynamically by using a type-2 **EXPORT** command, as explained in the following section.

Populating the repository from current IMS runtime resource definitions

If you are migrating an *active* DRD-enabled IMS to the repository, you can capture its runtime resource definitions by issuing a type-2 **EXPORT** command. To use this method of populating the repository, it should be empty at this point. Use the following syntax to ensure that all of its runtime resource definitions are captured:

```
EXPORT DEFN TARGET(REPO) TYPE(ALL) NAME(*) OPTION(ALLRSP)
```

Important: Route the command to the IMS system whose runtime resource definitions you want to capture. If you do not specify any command routing, ensure that you include the IMSID on the **SET(IMSID())** parameter.

We issued this flavor of the **EXPORT** command and routed it to our repository-enabled IMS (I12D); the output is shown in Figure 7-3.

```
 File  Action  Manage resources   SPOC  View  Options  Help
 ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 IM12X                    IMS Single Point of Control
 Command ===>

sssssssssssssssssssss   Plex . .        Route . . I12D       Wait . .
 Response for: EXPORT DEFN TARGET(REPO) TYPE(ALL) NAME(*) OPTIO...  More:   +
Name     Type     MbrName    CC
AUTODB   DB       I12D        0
DBFSAMD1 DB       I12D        0
DBFSAMD2 DB       I12D        0
DBFSAMD3 DB       I12D        0
DBFSAMD4 DB       I12D        0
DI21PART DB       I12D        0
EMPDB2   DB       I12D        0
IPODB    DB       I12D        0
IVPDB1   DB       I12D        0
IVPDB1I  DB       I12D        0
IVPDB2   DB       I12D        0
IVPDB3   DB       I12D        0
IVPDB4   DB       I12D        0
SINDEX11 DB       I12D        0
SINDEX22 DB       I12D        0
I12D     LIST     I12D        0
AUTPSB11 PGM      I12D        0
DBFSAMP1 PGM      I12D        0
DBFSAMP2 PGM      I12D        0
DBFSAMP3 PGM      I12D        0
DBFSAMP4 PGM      I12D        0
DBFSAMP5 PGM      I12D        0
  F1=Help      F3=Exit      F4=Showlog   F6=Expand    F9=Swap     F12=Cancel
```

Figure 7-3 Writing resource definitions to the repository with the EXPORT command

Populating the repository from MODBLKS

If you are migrating to DRD for the first time, you can populate the IMSRSC repository using the MODBLKS as a starting point.

Attention: Migration from MODBLKS online change to DRD requires an IMS cold start and some other general setup. For more information about migrating from MODBLKS online change to DRD, see *IMS Version 12 System Definition*, GC19-3021.

Currently no utility is available that uses a MODBLKS data set as input and directly generates an equivalent IMSRSC repository. Two utilities must be used: one that creates a non-system RDDS from MODBLKS, and the other that generates an IMSRSC repository from the non-system RDDS created with the first utility.

As you can see, a non-system RDDS must be used as a temporary bridge between the MODBLKS and IMSRSC repository. Begin by allocating a non-system RDDS for use with these utilities. Then use the Create RDDS from MODBLKS utility (**DFSURCM0**) to generate an RDDS with contents equivalent to your MODBLKS data set. You can then use this RDDS, in turn, as input to the RDDS to Repository utility (**CSLURP10**) to generate equivalent IMSRSC

repository contents. For more information about these utilities, see *IMS Version 12 System Utilities*, SC19-3023.

We begin by allocating a non-system RDDS named IMSR2.TEMPRDDS using the JCL shown in Example 7-17.

Example 7-17 JCL to allocate a non-system RDDS

```
//RDDSALLC JOB  CLASS=A,MSGCLASS=H,MSGLEVEL=(1,1)
//S1       EXEC PGM=IEBGENER
//SYSOUT   DD  SYSOUT=*
//SYSPRINT DD  SYSOUT=*
//SYSUT1   DD  DUMMY,BLKSIZE=32760,RECFM=VB
//SYSUT2   DD  DSN=IMSR2.TEMPRDDS,
//             DCB=(RECFM=VB,LRECL=32756,BLKSIZE=32760),
//             UNIT=SYSDA,
//             DISP=(,CATLG),SPACE=(TRK,(10,10))
//SYSIN    DD  DUMMY
```

To populate our IMSRSC repository with the stored definitions in our MODBLKS, we ran the JCL shown in Example 7-18. This JCL invoked the Create RDDS from MODBLKS utility (**DFSURCM0**) and the RDDS to Repository utility (**CSLURP10**).

Tip: The **SUFFIX=** parameter (can be abbreviated as **SUF=**) shown in Example 7-18 specifies a 1-character value for the suffix that is associated with the members in the MODBLKS data set. Ensure that this parameter is specified correctly by confirming the suffix character for the members that exist within your MODBLKS data set. The SUFFIX default value is 0.

Example 7-18 Populating an IMSRSC repository from MODBLKS using DFSURCM0 and CSLURP10

```
//POPREPOS JOB ACTINFO1,
// 'PGMRNAME',
// CLASS=A,
// MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=IMSR2,
// REGION=128M
//*
/*JOBPARM S=SC64
// JCLLIB ORDER=IMS12Q.PROCLIB
//*********************************************************************
//* FUNCTION: Populate data into the IMS repository
//*********************************************************************
//STEP1    EXEC PGM=DFSURCM0
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//MODBLKS  DD DISP=SHR,DSN=IMS12Q.IMS12D.MODBLKSA
//RDDSDSN  DD DSN=IMSR2.TEMPRDDS,DISP=SHR,
//            UNIT=SYSDA,VOL=SER=SBOX79,
//            SPACE=(CYL,(1,1),RLSE),
//            DCB=(LRECL=32756,BLKSIZE=32760,RECFM=VB)
//SYSPRINT DD SYSOUT=*,
//            DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//REPORT   DD SYSOUT=*,
//            DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//CONTROL  DD *
IMSID=I12D
```

```
SYSTYPE=DBDC
SUF=D
/*
//STEP2    EXEC PGM=CSLURP10,MEMLIMIT=4G
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//RDDSDSN  DD DISP=SHR,DSN=IMSR2.TEMPRDDS
//SYSIN    DD *
 IMSPLEX(NAME=IM12X IMSID(I12D))
//*
```

After the job is run, we browse the output (Example 7-19).

Example 7-19 Job output from running DFSURCM0 and CSLURP10

```
* ****************************************************************************
 *  RDDS BUILD FROM MODBLKS / DFSURCM0     DATE: 2011/214   TIME: 18:04
 * ****************************************************************************
 *
 * CONTROL: IMSID=I12D
 * CONTROL: SYSTYPE=DBDC
 * CONTROL: SUF=D
 *
 *  RDDS DATA SET NAME:
 *   IMSR2.TEMPRDDS
 *
 *  MODBLKS DATA SET NAME:
 *   IMS12Q.IMS12D.MODBLKSA
 *
 *  IMSID   USED . . : I12D
 *  SUFFIX  USED . . : D
 *  SYSTYPE USED . . : DBDC
 *
 *  TRAN MEMBER NAME. . . . . . . . : DFSSMBOD
 *       SIZE OF MEMBER . . . . . . :     6440
 *       SIZE OF MODBLKS BLOCK. . . :      184
 *       SIZE OF CHKP BLOCK . . . . :      184
 *       SIZE OF RSCX EXTENSION . . :       60
 *       TOTAL NUMBER OF BLOCKS . . :       35
 *       BLOCKS PER RDDS RECORD . . :      134
 *
 *  DB   MEMBER NAME. . . . . . . . : DFSDDIRD
 *       SIZE OF MEMBER . . . . . . :     2520
 *       SIZE OF MODBLKS BLOCK. . . :      168
 *       SIZE OF CHKP BLOCK . . . . :       51
 *       SIZE OF RSCX EXTENSION . . :       60
 *       TOTAL NUMBER OF BLOCKS . . :       15
 *       BLOCKS PER RDDS RECORD . . :       64
 *
 *  PGM  MEMBER NAME. . . . . . . . : DFSPDIRD
 *       SIZE OF MEMBER . . . . . . :     5712
 *       SIZE OF MODBLKS BLOCK. . . :      112
 *       SIZE OF CHKP BLOCK . . . . :       24
 *       SIZE OF RSCX EXTENSION . . :       60
 *       TOTAL NUMBER OF BLOCKS . . :       50
```

```
 *       BLOCKS PER RDDS RECORD . . :       88
 *
 *       * BLOCK FOR DBF#FPUO PDIR WAS REMOVED
 *
 *  RTC  MEMBER NAME. . . . . . . . : DFSRCTED
 *       SIZE OF MEMBER . . . . . . :      144
 *       SIZE OF MODBLKS BLOCK. . . :       48
 *       SIZE OF CHKP BLOCK . . . . :       28
 *       SIZE OF RSCX EXTENSION . . :       60
 *       TOTAL NUMBER OF BLOCKS . . :        3
 *       BLOCKS PER RDDS RECORD . . :       88
 *
 *  RDDS BUILD TIME : 2011.214 22:04:14.714869-UTC
 *  RDDS BLKSIZE    : 32760
 *
 * ******************************************************************************
 *       RDDS BUILD INFORMATION SUMMARY
 *
 * TOTAL # OF NON COMMENT CONTROL STATEMENTS READ . . :        3
 * TOTAL # OF TRANSACT EDIT ROUTINE CONTROL STMTS . . :        0
 * TOTAL # OF RDDS RECORDS WRITTEN. . . . . . . . . . :        6
 * TOTAL # OF TRAN ENTRIES IN MODBLKS . . . . . . . . :       35
 * TOTAL # OF TRAN RDDS RECORDS WRITTEN . . . . . . . :        1
 * TOTAL # OF DB ENTRIES IN MODBLKS . . . . . . . . . :       15
 * TOTAL # OF DB RDDS RECORDS WRITTEN . . . . . . . . :        1
 * TOTAL # OF PGM ENTRIES IN MODBLKS  . . . . . . . . :       50
 * TOTAL # OF PGM RDDS RECORDS WRITTEN  . . . . . . . :        1
 * TOTAL # OF RTC ENTRIES IN MODBLKS  . . . . . . . . :        3
 * TOTAL # OF RTC RDDS RECORDS WRITTEN  . . . . . . . :        1
 * ******************************************************************************
CSL2603I CSLURP10 IS PROCESSING RDDS IMSR2.TEMPRDDS
CSL2618I CSLURP10 IS PROCESSING PLEX=CSLIM12X, IMSID LIST FROM SYSIN, I12D
CSL2620I CSLURP10 SUCCESSFUL REGISTRATION WITH RM, RMNAME=RMXRM
CSL2600I CSLURP10 WRITE TO REPOSITORY WAS SUCCESSFUL FOR REPOTYPE=IMSRSC  ,
REPONAME=IMS12XRP
   **** SUMMARY ****

DB       COUNT     : 15
DBDESC   COUNT     : 0
PGM      COUNT     : 50
PGMDESC  COUNT     : 0
RTC      COUNT     : 3
RTCDESC  COUNT     : 0
TRAN     COUNT     : 35
TRANDESC COUNT     : 0
DB       DUPLICATES: 0
DBDESC   DUPLICATES: 0
PGM      DUPLICATES: 0
PGMDESC  DUPLICATES: 0
RTC      DUPLICATES: 0
RTCDESC  DUPLICATES: 0
TRAN     DUPLICATES: 0
TRANDESC DUPLICATES: 0
```

Now that your repository has been populated with stored resource definitions, follow the remainder of the DRD migration steps outlined in *IMS Version 12 System Definition*, GC19-3021. When you restart your IMS system with the **AUTOIMPORT=AUTO** parameter specified in its DFSDFxxx member, it reads in the resource definitions from the IMSRSC repository.

7.7.7 Starting IMS

The next step is starting your IMS system. In our test environment, we restarted our IMS. Because we specified the **AUTOIMPORT=AUTO** parameter in its DFSDF12D member (see Example 7-11 on page 213), it read in the stored resource definitions from the IMSRSC repository that we previously populated offline (see Example 7-18 on page 222).

Attention: If your IMS system is DRD-enabled and you have been using RDDSs up to this point, you do not need to restart your IMS system to enable it for repository usage. Instead, you can issue a type-2 **UPDATE IMS** command to dynamically enable it using the following syntax:

```
UDPATE IMS SET(LCLPARM(REPO(Y) REPOTYPE(IMSRSC))
```

Ensure that your DFSDFxxx member has been defined with the required repository enablement parameters before issuing this command. Afterwards, if you have not already populated your repository, you can use the **EXPORT** command to export all of the runtime resource definitions of your IMS to it at this time.

7.7.8 Listing status information for IMSRSC repository with FRPBATCH

Another action you can take before or after you start your IMS system is to display information about a specific IMSRSC repository defined to the RS catalog. You use the batch **ADMIN** utility to issue the **LIST REPOSITORY()** command. To display information about our IMSRSC repository named IMS12XRP, we used the JCL shown in Example 7-20.

Example 7-20 Batch ADMIN LIST command to display the information of a single IMSRSC repository

```
//LISTREPO JOB ACTINFO1,
// 'PGMRNAME',
// CLASS=A,
// MSGCLASS=H,MSGLEVEL=(1,1),
// NOTIFY=IMSR2,
// REGION=128M
//*
/*JOBPARM S=SC64
// JCLLIB ORDER=IMS12Q.PROCLIB
//*
//* FUNCTION: List the information of the IMS repository
//REPOLST  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
//*
 LIST REPOSITORY(IMS12XRP)
```

After the batch **ADMIN** utility finished executing we browsed the output, which is shown in Example 7-21.

Example 7-21 Output for the batch ADMIN LIST REPOSITORY command

```
LIST REPOSITORY(IMS12XRP)
Repository Name . : IMS12XRP

 Last updated date/time  : 2011/07/26 01:44:31
 Status  . . . . . . . . : OPEN
 Auto-open . . . . . . . : YES
 Security Class  . . . . : NOT DEFINED

Repository Data Set pair 1
 Index (RID) . . : IMS12Q.IMS12X.REPO.IMSPRI.RID
 Member (RMD)  . : IMS12Q.IMS12X.REPO.IMSPRI.RMD
 Status  . . . . : COPY1

Repository Data Set pair 2
 Index (RID) . . : IMS12Q.IMS12X.REPO.IMSSEC.RID
 Member (RMD)  . : IMS12Q.IMS12X.REPO.IMSSEC.RMD
 Status  . . . . : COPY2

Repository Data Set pair 3
 Index (RID) . . : IMS12Q.IMS12X.REPO.IMSSPR.RID
 Member (RMD)  . : IMS12Q.IMS12X.REPO.IMSSPR.RMD
 Status  . . . . : SPARE

FRP4750I - LIST command processing completed successfully
```

There is also a flavor of the batch **ADMIN LIST** command that displays general information about all user repositories that are defined to the RS. In Example 7-20 on page 225, simply replace the **LIST REPOSITORY()** parameter with **LIST STATUS**. We ran the batch **ADMIN LIST STATUS** command in our test environment and received the output shown in Example 7-22.

Example 7-22 The batch ADMIN LIST STATUS command to display all IMSRSC repository information

```
LIST STATUS
Repository                                  Status   Changed    ID       RDS1     RDS2     RDS3
------------------------------------------  -------- ---------- -------- -------- -------- --------
IMS12XRP                                    OPEN     2011/07/26 IMSR3    COPY1    COPY2    SPARE
FRP4750I - LIST command processing completed successfully
```

Notice that the output indicates a status for the primary, secondary, and spare repository data sets. When the user repository data sets are originally defined to the RS catalog repository, the primary starts out with a COPY1 status, the secondary with COPY2 status, and the spare with SPARE status. These statuses will change when a write error occurs on either the primary or secondary repository data sets. In this case, the RS will drive recovery and the statuses for the repository data sets will change.

For example, when a primary repository data set starts out with a COPY1 status and a write error occurs on it, its status will change from COPY1 to DISCARD status. The current status of the spare data set changes from SPARE to COPY1. You must then allocate and define a new repository data set as the new spare and manually set its status to SPARE with the batch **ADMIN DSCHANGE** command. For more information about this command, see “DSCHANGE command” on page 244.

7.7.9 Cleaning up the DFSDFxxx member

After you successfully migrate an IMS to the repository, remove the **RDDSDSN()** parameter from its DFSDFxxx member because it is no longer required. If you specified **AUTOIMPORT=AUTO**, then the next time you restart this IMS system, it reads from the repository. Lastly, if you specified **AUTOEXPORT=AUTO**, you can also remove this definition because it does not apply to an environment in which repository DRD is being used.

Tip: You can disable autoexport for an IMS after it is enabled to use the repository by issuing the **UPDATE IMS SET(AUTOEXPORT(NO))** command. Otherwise, if your RDDSs are still defined, autoexport will continue to occur at each system checkpoint if definitional changes have been made since the previous system checkpoint.

7.8 IMSRSC repository access

You can access the IMS RS by using the RM address space, online by using type-2 commands or offline by using RM utilities. In addition, you can use facilities that do not use RM to access the repository: the batch **ADMIN** utility (**FRPBATCH**), which uses XCF, and a set of RS commands that use the z/OS modify interface. These facilities are used for repository management. This section explores the use of each of these methods for repository access.

7.8.1 Online access through RM

During online operation, several new and modified RM and IMS type-2 commands apply to the repository environment:

- **UPDATE RM**
- **QUERY RM**
- **UPDATE IMS**
- **QUERY IMS**
- **EXPORT DEFN**
- **IMPORT DEFN**
- **DELETE DEFN**
- **QUERY DB/DBDESC/PGM/PGMDESC/TRAN/TRANDESC/RTC/RTCDESC** with the following SHOW() parameters:
  - **SHOW(DEFN)**
  - **SHOW(DEFN,IMSID)**
  - **SHOW(DEFN,LOCAL)**
  - **SHOW(DEFN,GLOBAL)**
  - **SHOW(DEFN,IMSID,LOCAL)**
  - **SHOW(DEFN,IMSID,GLOBAL)**
  - **SHOW(IMSID)**

These commands are used for dynamic enablement and disablement of a repository, to display status of RM and IMS, and to create, update, delete, and query the DRD stored resource definitions in the IMSRSC repository. Remember that the **DRD CREATE**, **UPDATE**, and **DELETE** commands work with runtime definitions, not the stored resource definitions in the repository. For more information about these commands, see 7.9.1, “IMS repository commands” on page 230.

7.8.2 Offline access through RM utilities

Two RM utilities are provided to write to and read from the IMSRSC repository, and they can be used for migration and fallback with the repository. They access the repository offline through RM. The RDDS to Repository utility (**CSLURP10**) populates an IMSRSC repository with the contents of a specified RDDS. The Repository to RDDS utility (**CSLURP20**) creates definitions from a repository and stores them in an RDDS.

CSLURP10

CSLURP10 takes the contents of a system or non-system RDDS and writes these definitions to an IMSRSC repository. This utility can be used to initially populate an IMSRSC repository and update definitions at some later time. Because **CSLURP10** uses RM to communicate with the repository, an SCI address space on the LPAR where the utility is being run and an RM address space must be available. Example 7-23 shows a job that runs the **CSLURP10** utility to generate an IMSRSC repository.

Example 7-23 JCL to populate a repository with stored definitions within an RDDS

```
//RDDS2RPO JOB,USER,CLASS=A,MSGCLASS=X,NOTIFY=USER
//*
//JOBLIB DD DSN=IMSTESTL.TNUCO,DISP=SHR
//*
//STEP1 EXEC PGM=CSLURP1O,MEMLIMIT=4G
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//*
//*************************************************************/
//* SPECIFY A VALID RDDS DSN FOR INPUT */
//*************************************************************/
//RDDSDSN DD DSN=IMSTESTG.NONSYS.IMSRDDS1,DISP=SHR
//*
//*************************************************************/
//* IMSID MAY BE SPECIFIED ON SYSIN OR DEFAULT TO THE IMSID */
//* ON THE RDDS HEADER RECORD. SUBSTITUTE THE SYSIN STATEMENT */
//* BELOW TO CHANGE BEHAVIOUR */
//*************************************************************/
//SYSIN DD *
IMSPLEX(NAME=PLEX1 IMSID(SYS3,IMS2,IMS3))
//*
```

CSLURP20

CSLURP20 generates a non-system RDDS from an IMSRSC repository. It can be used for backup or fallback. Because **CSLURP20** uses RM to communicate with the repository, an SCI address space and an RM address space must be available. Example 7-24 shows a job that runs the **CSLURP20** utility to generate an RDDS.

Example 7-24 JCL to populate an RDDS with stored definitions within an IMSRSC repository

```
//RPO2DDS JOB ,USER,CLASS=A,MSGCLASS=X,NOTIFY=USER
//*
//JOBLIB DD DSN=IMSTESTL.TNUCO,DISP=SHR
//*
//STEP1 EXEC PGM=CSLURP2O
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
```

```
//*
//*********************************************************************/
//* SPECIFY A VALID NON-SYSTEM RDDS DSN FOR OUTPUT */
//*********************************************************************/
//RDDSDSN DD DSN=IMSTESTG.IMS1.NONSYS.IMSRDDS1,DISP=SHR
//*
//*************************************************************/
//* IMSID MUST BE SPECIFIED ON SYSIN. */
//*************************************************************/
//SYSIN DD *
IMSPLEX(NAME=PLEX1 IMSID(IMS1))
//*
```

7.8.3 Direct access without RM using the batch ADMIN utility

You can also use the repository batch **ADMIN** utility (called **FRPBATCH**) to help manage IMSRSC repositories. Eight commands are provided. This utility does not use RM to access the repository; instead it accesses the repository directly as a batch job using XCF. This information about IMSRSC repositories is kept in the RS catalog repository.

The **ADD**, **UPDATE**, **RENAME**, and **DELETE** commands provide the capability to manage IMSRSC repository definitions. The **DSCHANGE** command provides the capability to change a data set disposition (used to set up new SPARE data sets). The **LIST** command provides a display of IMSRSC information. The **START** and **STOP** commands allow and prevent access to an IMSRSC repository.

Example 7-25 shows JCL that you can use to run the batch **ADMIN** utility. The commands are entered as part of the SYSIN DD statement.

Example 7-25 JCL that executes the ADD, START, and LIST functions of the batch ADMIN utility

```
//FRPBAT  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
      ADD REPOSITORY(IMS12XRP) +
      REPDSN1RID(IMS12Q.IMS12X.REPO.IMSPRI.RID) +
      REPDSN1RMD(IMS12Q.IMS12X.REPO.IMSPRI.RMD) +
      REPDSN2RID(IMS12Q.IMS12X.REPO.IMSSEC.RID) +
      REPDSN2RMD(IMS12Q.IMS12X.REPO.IMSSEC.RMD) +
      REPDSN3RID(IMS12Q.IMS12X.REPO.IMSSPR.RID) +
      REPDSN3RMD(IMS12Q.IMS12X.REPO.IMSSPR.RMD) +
      AUTOOPEN(NO)

      START REPOSITORY(IMS12XRP) MAXWAIT(30,CONTINUE)

      LIST REPOSITORY(IMS12XRP)
//*
```

7.8.4 Direct repository access using z/OS modify interface

Several RS commands are available to help you manage the RS and IMSRSC repositories. You enter these commands by using the z/OS modify interface:

- **ADMIN** (administrative functions for IMSRSC repositories: change data set disposition, display data sets, and start and stop repositories)
- **AUDIT** (dynamically turn auditing on or off)
- **SECURITY** (refresh in-storage RACF profile definitions)
- **SHUTDOWN** (shut down RS address spaces)
- **STOP** (stop or shut down RS)

7.9 Using the repository in business operations

Now that you understand the repository infrastructure and required setup, the focus shifts to how to use the repository in your business operations.

7.9.1 IMS repository commands

First, we focus on commands and describe the following topics:

- IMS and RM IMSplex commands issued from SPOC
- Security considerations for commands
- Batch ADMIN commands
- Repository Server commands issued through z/OS modify interface
- Repository commands comparison

IMS and RM IMSplex commands issued from SPOC

This section describes the new and enhanced commands in IMS 12 that apply to repository DRD. These commands are “IMSplex” commands (also known as *type-2 commands*) that can be issued to one or more IMS systems in an IMSplex through an OM interface. This section explains when it is appropriate to issue each command, describes how each command is useful in different scenarios, and shows the syntax for reference.

For more information about a particular command beyond what is explained here, such as available parameter values and their meanings, see *IMS Version 12 Commands, Volume 1: IMS Commands A-M*, SC19-3009, or *IMS Version 12 Commands, Volume 2: IMS Commands N-V*, SC19-3010.

UPDATE RM command

Use the new **UPDATE RM** command to dynamically enable the RM address space to use the repository, or change the audit access level that was originally specified in the FRPCFG member. Example 7-26 shows the command syntax.

Example 7-26 UPDATE RM command syntax

```
UPDATE RM TYPE(REPO) REPOTYPE(IMSRSC) SET(REPO(Y|N) AUDITACCESS())
```

Notice that the command must be issued with **TYPE(REPO)** and **REPOTYPE(IMSRSC)** to indicate that we want to target a repository of type “IMSRSC”. These are the only valid values for these parameters.

To dynamically enable RM for repository usage, specify the **SET(REPO(Y))** parameter. Then command processing rereads and reprocesses the REPOSITORY section within the CSLRIxxx member. This is why it is important to add repository definitions to the CSLRIxxx member before issuing this command. Also during command processing, RM registers to the RS if RM is not already registered. RM connects to the repository name specified in the REPOSITORY section of the CSLRIxxx member.

If the command is successful at the command master RM, the command master RM communicates the changes to other active RMs in the IMSplex. All RMs in the IMSplex will have the same repository settings. If RM is defined to use the resource structure, the command master RM will update the resource structure with the repository name and repository type that it is connected to. Subsequent RMs that are restarted after the change will ensure that they are connected to the same repository name and repository type as read from the resource structure.

If the RM repository usage is already enabled, you can dynamically disable it by specifying **SET(REPO(N))**. The CSLRIxxx member is not reread or reprocessed in this case like it is when **SET(REPO(Y))** is specified. Therefore, as part of the repository disabling process, you can remove the repository definitions from CSLRIxxx either before or after UPDATE RM is issued with **SET(REPO(N))**. If the repository definitions specified on the REPOSITORY= statement are still present in CSLRIxxx, any RMs that start after the **UPDATE RM** … **SET(REPO(N))** command is issued will reconnect to the repository during RM startup and enable the IMSRSC repository at all RMs in the IMSplex.

With the **AUDITACCESS()** parameter, you can dynamically change the audit level settings and override what was originally specified on the **AUDIT_DEFAULT** parameter in the FRPCFG member. Example 7-27 shows an **UPDATE RM** command being issued to change the **AUDITACCESS** parameter value to read.

Example 7-27 UPDATE RM command dynamically updating the AUDITACCESS setting

```
Response for: UPDATE RM TYPE(REPO) REPOTYPE(IMSRSC) SET(AUDITACCESS(READ))
RepositoryType MbrName    CC RepositoryName
IMSRSC         RMXRM       0 IMS12XRP
```

QUERY RM command

Issue the **QUERY RM** command to determine whether an RM address space is enabled for repository usage, or to view the audit access level or status of RM. The RM can have one of the following statuses:

CONNECTED RM is connected to the IMSRSC repository and the repository is available for use.

CONNECT-INCOMPLETE
RM successfully connected to the repository, but RM failed to correctly update the repository global entry in the resource structure.

DISCONNECT-INCOMPLETE
RM successfully disconnected from the repository, but RM failed to correctly update the repository global entry in the resource structure.

NOTAVAIL The repository is not available.

RS-NOTAVAIL No master RS is available.

SPARERECOV The repository spare recovery process is in progress.

SPARERCVERR The repository spare recovery process resulted in an error and the repository is not available for use.

UPDATE-AUDACC-INCOMPLETE
RM successfully updated the audit access setting in the repository, but RM failed to correctly update the repository global entry in the resource structure.

For information about the repository spare recovery process, see “Recovery activities” on page 257.

Example 7-28 shows the **QUERY** command syntax.

Example 7-28 QUERY RM command syntax

```
QUERY RM TYPE(REPO) SHOW(ATTRIB|STATUS|ALL)
```

You can filter the information associated with RM by specifying the **SHOW()** parameter accordingly. For example, display only the repository attributes in RM by using the command shown in Example 7-29. The only attribute value that is displayed when the **SHOW(ATTRIB)** parameter is applied is the audit access level.

Example 7-29 Displaying the audit access setting using the QUERY RM command

```
Response for: QUERY RM TYPE(REPO) SHOW(ATTRIB)
RepositoryType MbrName    CC AuditAccess RepositoryName
IMSRSC         RMXRM       0 READ        IMS12XRP
```

Alternatively, you can choose to display only the status of RM using the command shown in Example 7-30.

Example 7-30 Displaying the status of RM using the QUERY RM command

```
Response for: QUERY RM TYPE(REPO) SHOW(STATUS)
RepositoryType MbrName    CC Status    RepositoryName
IMSRSC         RMXRM       0 CONNECTED IMS12XRP
```

Lastly, you can display the audit access setting and the status, the name of the IMSRSC repository with which RM is associated, and the repository group in which it is contained. See Example 7-31.

Example 7-31 Displaying all information associated with RM using the QUERY RM command

```
Response for: QUERY RM TYPE(REPO) SHOW(ALL)
RepositoryType MbrName    CC Status    AuditAccess RepositoryName RepositoryGroup
IMSRSC         RMXRM       0 CONNECTED READ        IMS12XRP       IM12XREP
```

QUERY RM command: The **QUERY RM** command can be issued to determine whether RM is repository-enabled in the IMSplex. For example, you can issue this command after an **UPDATE RM** command is issued to dynamically enable it for repository usage. If the **UPDATE RM** command failed, you know that RM was not successfully repository-enabled by observing the non-zero **UPDATE** command completion code. However, keep in mind that you will not know if the **UPDATE RM** command failed at non-master RMs that received the broadcast message to enable the repository. Because this information is not part of the command response, issuing the **QUERY RM** command shows whether all RMs are connected to or disconnected from the repository.

For detailed information about the input and output of the **QUERY RM** command, see *IMS Version 12 Commands, Volume 2: IMS Commands N-V*, SC19-3010.

UPDATE IMS command

You can dynamically enable an IMS system to use the repository by issuing the **UPDATE IMS** command, or use it to disable the automatic export capability. Example 7-32 shows the command syntax.

XRF: In an XRF environment, the **UPDATE IMS** command is processed both at the XRF active IMS and the XRF alternate IMS to dynamically enable and disable usage of repository.

Example 7-32 UPDATE IMS command syntax for DRD-related functions

```
UPDATE IMS SET(LCLPARM())
```

Important: Before you issue this command to dynamically enable IMS for repository usage, you must add repository definitions to the DFSDFxxx member and RM must already be repository-enabled.

To dynamically disable automatic export for an IMS system, issue the **UPDATE IMS** command with the **LCLPARM(AUTOEXPORT(N))** parameter included. You take this step after migration to the repository has been completed to reduce I/O overhead that occurs with autoexport.

IMS cold start: After automatic export is disabled with this command, an IMS cold start is required to re-enable it.

QUERY IMS command

To determine whether an IMS system is enabled for repository usage, issue the **QUERY IMS** command. You can also use this command to determine whether automatic export is enabled for an IMS system. These enhancements were added to existing **QUERY IMS** functionality, essentially to display the information about the possible capabilities that were added with the **UPDATE IMS** command (dynamically enabling repository usage, automatic export, or both).

Example 7-33 shows the command syntax.

Example 7-33 QUERY IMS command syntax

```
QUERY IMS TYPE(LCLPARM) SHOW()
```

The **SHOW()** parameter can be used to filter output shown in the command response. For example, Example 7-34 shows the **QUERY IMS** command being issued to display whether the IMS systems in an IMSplex are enabled for repository usage in addition to other information about the repository.

Example 7-34 Showing repository attributes using the QUERY IMS command

```
Response for: QUERY IMS TYPE(LCLPARM) SHOW(REPO)
MbrName    CC RepositoryType RepositoryName       LastExportTime
I12A        0 IMSRSC         IMS12XRP
I12B        0 IMSRSC         IMS12XRP
I12C        0 IMSRSC         IMS12XRP
I12D        0 IMSRSC         IMS12XRP             2011.235 09:12:01.56
```

Example 7-35 shows another sample of the **QUERY IMS** command, where the **SHOW()** parameter is specified to display whether automatic export is enabled for the IMS systems.

Example 7-35 Showing the automatic export setting using the QUERY IMS command

```
Response for: QUERY IMS TYPE(LCLPARM) SHOW(AUTOEXPORT)
MbrName    CC AutoExport
I12A        0 Y
I12B        0 Y
I12C        0 Y
I12D        0 Y
```

To display all possible information about the repository, included with other IMS attribute settings, you can specify the **SHOW(ALL)** parameter with the **QUERY IMS** command. For example command output, see *IMS Version 12 Commands, Volume 2: IMS Commands N-V*, SC19-3010.

Tip: After an **UPDATE IMS** command is issued to dynamically enable repository usage, you can confirm that the IMS is now repository-enabled by issuing the **QUERY IMS** command. If IMS cannot be enabled for repository usage, you detect this problem by observing the non-zero **UPDATE** command completion code.

QUERY for resources and descriptors

The **QUERY** command has been enhanced to show IMS resource and descriptor definitions (names and attribute values) in the repository and at each IMS system. The command shows the stored repository and runtime IMS resource definition information. In addition, the **QUERY** command now shows specific IMS IDs that have the resource names defined. Example 7-36 highlights the command syntax for the **QUERY** command.

Example 7-36 Syntax for displaying attribute values for resources or descriptors

```
QUERY rsc-type | desc-type NAME() SHOW()
```

To display both repository and local IMS resource definitions using the **QUERY** command, specify the **SHOW(DEFN)** parameter (Example 7-37). In this example, we filtered the output to display the attribute values indicating the type of access to the database and the local runtime value for the resident option. The repository definitions can be distinguished from the IMS runtime definitions by the presence of a “Y” in the “Repo” column. The generic definitions that apply to all IMS systems have a Y in the Repo column and blank in the IMSid column. The IMS-specific definitions have the IMS ID in the IMSid column both for the repository and runtime definitions.

Example 7-37 Displaying both repository and local IMS definition information with QUERY

```
Response for: QUERY DB NAME(*) SHOW(DEFN,ACCTYPE,RESIDENT)
DBName   MbrName    CC Repo IMSid    TYPE     Acc  LAcc Rsdnt LDRsdnt LRsdnt
AUTODB   I12A        0 Y                     UPD       N
AUTODB   I12A        0      I12A     DL/I          UPD        N
AUTODB   I12B        0      I12B     DL/I          UPD        N
AUTODB   I12C        0      I12C     DL/I          UPD  N
AUTODB   I12D        0      I12D     DL/I          READ               N
DBFSAMD1 I12A        0 Y                     EXCL      N
DBFSAMD1 I12A        0      I12A                   EXCL       Y       N
DBFSAMD1 I12B        0      I12B                   EXCL       Y       N
DBFSAMD1 I12C        0      I12C                   EXCL Y     N
DBFSAMD1 I12D        0      I12D                   EXCL               N
```

To only display IMS resource definitions that are within the repository, include the **SHOW(DEFN,GLOBAL)** parameter in the **QUERY** command (Example 7-38). In the example, we have again chosen to filter the output to display the access type and resident attribute values.

Example 7-38 Displaying only repository IMS definition information with QUERY

```
Response for: QUERY DB NAME(*) SHOW(DEFN,GLOBAL,ACCTYPE,RESIDENT)
DBName   MbrName    CC Repo IMSid    Acc  Rsdnt
AUTODB   I12A        0 Y             UPD  N
DBFSAMD1 I12A        0 Y             EXCL N
```

Alternatively, to display only IMS resource definitions local to IMS, include the **SHOW(DEFN,LOCAL)** parameter in the **QUERY** command (Example 7-39). These definitions are specific to each IMS system shown in the MbrName and IMSid columns in the output. To maintain consistency with the previous two examples, we have again chosen to filter the output to display the access type and resident attribute values.

Example 7-39 Displaying only local IMS definition information with QUERY

```
Response for: QUERY DB NAME(*) SHOW(DEFN,LOCAL,ACCTYPE,RESIDENT)
DBName   AreaName PartName MbrName    CC IMSid    TYPE     LAcc LDRsdnt LRsdnt
AUTODB                    I12A        0 I12A     DL/I     UPD          N
AUTODB                    I12B        0 I12B     DL/I     UPD          N
AUTODB                    I12C        0 I12C     DL/I     UPD          N
AUTODB                    I12D        0 I12D     DL/I     READ         N
DBFSAMD1                  I12A        0 I12A              EXCL Y       N
DBFSAMD1                  I12B        0 I12B              EXCL Y       N
DBFSAMD1                  I12C        0 I12C              EXCL Y       N
DBFSAMD1                  I12D        0 I12D              EXCL         N
```

If you want to see a list of IMS systems that have the resources specified in the command defined to them, include the **SHOW(IMSID)** parameter in the **QUERY** command. Example 7-40 shows a command that includes this filter.

Example 7-40 Displaying a list of IMS systems that have a specific resource defined with QUERY

```
Response for: QUERY DB NAME(AUTODB) SHOW(IMSID)
DBName   MbrName    CC Repo IMSid
AUTODB   I12A        0 Y    I12A
AUTODB   I12A        0 Y    I12B
AUTODB   I12A        0 Y    I12D
AUTODB   I12A        0 Y    I12Z
```

Finally, to display all IMSIDs that have the specified resource defined, a list of the repository resource definitions and any IMS-specific definitions, include the **SHOW(DEFN,IMSID)** parameter as shown in Example 7-41. This example assumes that APAR PM41761 has been applied.

To maintain consistency with the previous three examples, we have again chosen to filter the output to display the access type and resident attribute values. In the example command output, you can see that the AUTODB database is defined in the repository for IMSIDs I12B, I12D, and I12Z as a stored resource definition. It is also defined at active IMS systems I12A, I12B, I12C, and I12D as a runtime resource definition. The AUTODB database is not defined in the repository as a stored definition for IMS systems I12A and I12C even though they have a runtime definition in these systems.

Example 7-41 Displaying repository and local IMS definitions with IMSIDs using QUERY

```
Response for: QUERY DB NAME(AUTODB) SHOW(DEFN,IMSID,ACCTYPE,RESIDENT)
DBName   MbrName    CC Repo IMSid    TYPE     Acc  LAcc Rsdnt LRsdnt
AUTODB   I12A        0 Y                     UPD       N
AUTODB   I12A        0 Y    I12B              UPD       N
AUTODB   I12A        0 Y    I12D              UPD       N
AUTODB   I12A        0 Y    I12Z              UPD       N
AUTODB   I12A        0      I12A     DL/I          UPD        N
AUTODB   I12B        0      I12B     DL/I          UPD        N
AUTODB   I12C        0      I12C     DL/I          UPD        N
AUTODB   I12D        0      I12D     DL/I          UPD        N
```

EXPORT command

Issue the **EXPORT** command when resources or descriptors have been either created or updated, and they need to be hardened to the repository. If hardening changes to offline stored definitions is part of your change management process, use the **EXPORT** command when definitional changes occur or at regular intervals during operations.

Important: In an XRF environment, the XRF active IMS can export its runtime resource definitions to the repository using the **EXPORT** command, where the XRF alternate IMS cannot. The XRF alternate IMS will only be able to export its runtime resource definitions to the repository after it takes over for the active IMS. You can, however, update the XRF active and alternate IMS systems' stored resource definitions within the repository by issuing an **EXPORT** command, specifying both of their IMSIDs on the **SET(IMSID())** parameter.

The **EXPORT** command is processed by a single command master IMS and will write valid resources and descriptors to the repository. Example 7-42 shows the command syntax.

Example 7-42 EXPORT command syntax

```
EXPORT DEFN TARGET(REPO) TYPE() NAME() STARTTIME() ENDTIME() SET(IMSID()) OPTION()
```

The **EXPORT** command can also use data included in **QUERY** command output. If the **QUERY** command is issued with the **SHOW(TIMESTAMP)** parameter included, you can determine the exact time that a resource was created or updated. See the LTimeCreate column header output in Example 7-43.

Example 7-43 Displaying the time a resource was created with QUERY and SHOW(TIMESTAMP)

```
Response for: QUERY PGM NAME(PGMADD) SHOW(TIMESTAMP)
PgmName  MbrName    CC LRgnType LTimeCreate
PGMADD   I12A        0 MPP      2011.242 22:23:13.36
PGMADD   I12B        0 MPP      2011.242 22:23:13.36
PGMADD   I12C        0 MPP      2011.242 22:23:13.36
PGMADD   I12D        0 MPP      2011.242 22:23:13.36
```

You are then able to use those timestamp values for the **EXPORT STARTTIME()** parameter, the ENDTIME() parameter, or both. The **STARTTIME()** and **ENDTIME()** parameters can be as specific as tenths and hundredths of a second, and matches the timestamp granularity displayed in **QUERY SHOW(TIMESTAMP)** command output, so copying the exact values is facilitated in this way. The **STARTTIME()** and **ENDTIME()** parameters are optional.

Example 7-44 shows the **EXPORT** command with the timestamp information shown in Example 7-43 on page 236. This command ensures that all programs that are created after the specified timestamp are exported to the repository.

Example 7-44 Exporting a resource to the repository

```
Response for: EXPORT DEFN TARGET(REPO) TYPE(PGM) NAME(*) STARTTIME(2011.242
22:23:13.36)
Name     Type     MbrName    CC
I12A     LIST     I12A        0
PGMADD   PGM      I12A        0
```

Next, you can indicate which IMS resource lists in the repository should be exported to by listing them on the **SET(IMSID())** parameter. This is an optional parameter and if omitted, the runtime resource definitions of the command master IMSID are exported for the command master IMS only. You can control which IMS is selected as command master by using the ROUTE capability of the OM interface from which you are entering the command.

Wildcards are supported for the IMSID. However, the **EXPORT** command with a wildcard for the IMSID will fail if no IMS resource lists are in the repository that matches the wildcard name. When a specific IMSid is specified, the IMS resource list for the IMS is created if it does not exist and the resource definitions are written to the repository.

When exporting a transaction resource to the repository with a type-2 **EXPORT** command, ensure that the program resource associated with this transaction already exists within the repository. Otherwise, the **EXPORT** command fails with a completion code such as the one shown in Example 7-45.

Example 7-45 Failed export attempt due to a missing program resource

```
Response for: EXPORT DEFN TARGET(REPO) TYPE(TRAN) NAME(TRANINFO)
Name     Type     MbrName    CC CCText
I12A     LIST     I12A      1DO NOT DONE DUE TO ERROR
TRANINFO TRAN     I12A       67 NO PGM() DEFINED
```

If this occurs, determine which program should exist in the repository by querying the transaction with a command such as the **QUERY TRAN** command (Example 7-46).

Example 7-46 Query transaction resource to determine associated program

```
Response for: QUERY TRAN NAME(TRANINFO) SHOW(PGM)
Trancode MbrName    CC LPSBname
TRANINFO I12D        0 PGMINFO
```

Lastly, attempt the **EXPORT** command a second time using a command such as the one shown in Example 7-47.

Example 7-47 Successful export of resources to repository

```
Response for: EXPORT DEFN TARGET(REPO) TYPE(PGM TRAN) NAME(PGMINFO TRANINFO)
Name     Type     MbrName    CC
I12D     LIST     I12D        0
PGMINFO  PGM      I12D        0
TRANINFO TRAN     I12D        0
```

A benefit of using repository DRD is the ability to define the resource definitions for an inactive IMS or a brand-new IMS. When the IMS restarts, it reads these stored definitions that were created while it was inactive.

Lastly, when issuing the **EXPORT** command, you can optionally display a line of output for each successfully exported resource and optionally export only the resources and descriptors that had definitional changes since the last **EXPORT** command was issued. Automatic export is not possible when using DRD with the repository. However, by issuing the **EXPORT** command with the **OPTION(CHANGESONLY)** parameter at regular intervals, you can ensure that definitional changes are captured and hardened to the repository.

The **EXPORT** command writes all of the definitions to the repository as a single unit of work, as is the case with RDDS DRD. In either case (that is, using DRD with the repository or with an RDDS), the export fails if one resource is in error, and no other resources will be exported. The difference between these two DRD types is that, when exporting to the repository, only one command master IMS processes the command. This command master IMS creates and updates the definitions for each IMSID specified in the **SET(IMSID())** parameter. With RDDS DRD, each IMS that receives the command will process it. In this case, the command can succeed on some systems and fail on other systems.

In some cases, resources or descriptors cannot be exported, such as when they are IMS system-defined descriptors or HALDB partitions or have invalid names. Validation is done by IMS before export occurs. Validation of resource attributes between associated resources such as transactions and programs, or transactions and routing codes, or routing codes and programs, is performed by RM before the resource definitions are written to the repository. For example, a transaction cannot be written if the associated program does not exist in the repository.

The **EXPORT** command should be used in different ways depending on whether you have a cloned or non-cloned IMS environment. Specifically, in a cloned environment it is recommended to always specify the **SET(IMSID())** parameter in the **EXPORT** command to ensure that all IMS resource lists are exported to. This keeps the definitions in each of the cloned resource lists for IMS consistent with one another. However, in a non-cloned environment, the IMS systems might have differing attribute values for their resources. Therefore, omit the **SET(IMSID())** parameter so that each IMS resource list can be updated one at a time, separately, and the IMS-specific attribute values can be maintained. When omitting the **SET(IMSID())** parameter, remember to route the command to the correct IMS. Because no IMS-specific information is in the command syntax, you can easily reissue this command without modifying the command itself.

For best performance, export only the resources and descriptors that have been changed since they were last hardened to the repository with an **EXPORT** command. You can more easily pinpoint the changed resource or descriptors by including the **OPTION(CHANGESONLY)** parameter. Another method of minimizing the total number of resources or descriptors to be exporting is including the **STARTTIME()** parameter to target only those that have been created or updated after the specified time.

DELETE DEFN command

Issue the **DELETE DEFN** command to delete stored resource definitions for one or more IMS systems in the repository. If runtime resource definitions have been deleted from an online IMS system with the **DELETE** command, these deletes can be hardened to the repository with the **DELETE DEFN** command. In this situation, make sure that you specify the same resources or descriptors in this command whose runtime definitions were deleted from the online system.

Tip: Only one resource or descriptor type can be specified. Therefore, you might need to issue the command multiple times if multiple resource types, descriptor types, or both were deleted from the online system.

To delete stored definitions for specific IMS systems that have resource definitions defined in the IMSRSC repository, specify the IMSIDs associated with the IMS resource lists with the **FOR(IMSID())** parameter. As mentioned before, it is appropriate to issue this command when you want to harden runtime definition deletes to the repository. It is recommended that you first delete the runtime resource definitions using the **DELETE** commands at the IMS systems before using the **DELETE DEFN** command to delete the resource definitions from the IMSRSC repository. Example 7-48 shows the command syntax.

Example 7-48 DELETE DEFN command syntax

```
DELETE DEFN TARGET(REPO) TYPE() NAME() FOR(IMSID()) OPTION()
```

A series of commands is shown in Example 7-49. Assume that the first three commands shown are routed to IMS1 and IMS2. Looking at the example, a program is first queried to determine whether any work in progress exists for it on either IMS system. Then, the scheduling is stopped for the program to prevent any new work in progress from occurring. The example continues to show that the program is deleted from two online IMS systems with the **DELETE** command, then deleted from the IMS resource lists associated with these two systems in the offline repository with the **DELETE DEFN** command.

Example 7-49 Command sequence for deleting runtime and stored IMS resource definitions

```
QUERY PGM NAME(PGM1) SHOW(WORK)
UPDATE PGM NAME(PGM1) STOP(SCHD)
DELETE PGM NAME(PGM1)
DELETE DEFN TARGET(REPO) TYPE(PGM) NAME(PGM1) FOR(IMSID(IMS1,IMS2)
```

Wildcard support exists for the **FOR(IMSID())** parameter. When issuing the **DELETE DEFN** command with the **NAME(*)** parameter, you can ensure that a line of output is displayed for each resource or descriptor that was processed by including the **OPTION(ALLRSP)** parameter.

Attention: Use the **NAME(*)** parameter with care because it can delete all of the resource definitions in the IMSRSC repository and IMS will be restarted with no resources.

IMPORT command

The **IMPORT** command reads stored definitions that exist in the repository into running IMS systems. This command can be used if an IMS is restarted with no resources defined to populate the control region with runtime resource definitions. Alternatively, if changes were made to the repository offline and you want to roll the changes to the systems in IMSplex, the **IMPORT** command can be used to accomplish this. An example of when this scenario might arise is when you use the “RDDS to Repository” (**CSLURP10**) utility, introduced in 7.8.2, “Offline access through RM utilities” on page 228, to write resource definitions to the IMSRSC repository that have not been read into any IMS system yet.

Example 7-50 shows the **IMPORT** command syntax.

Example 7-50 IMPORT command syntax

```
IMPORT DEFN SOURCE() TYPE() NAME() OPTION() SCOPE()
```

When importing stored definitions from the repository, make sure that the **SOURCE(REPO)** parameter is specified so the repository is the data set that is read. Also, ensure that you indicate which resources should be imported using the **TYPE()** and **NAME()** parameters.

You can control the output displayed by the **IMPORT** command by specifying the **OPTION()** parameter accordingly. The **OPTION(ABORT)** and **OPTION(ALLRSP)** parameters used with RDDS DRD import before IMS 12 are now also used with repository DRD import.

The **OPTION(ABORT)** parameter terminates command processing if an error occurs during import. The **OPTION(ALLRSP)** parameter returns a line of output for each resource that was exported and is valid if the **NAME(*)** parameter was also specified in the command. If individual names are specified for the **NAME()** parameter, a line of output is also returned for each resource in this case.

A new **OPTION(UPDATE)** parameter has been added for the **IMPORT** command. With this parameter, an existing runtime resource definition can be updated with a stored resource definition being imported from either the RDDS or the repository.

Attention: The **OPTION(UPDATE)** parameter is not the default and must be explicitly specified to update a runtime resource definition with a stored resource definition.

The ROUTE capability of the OM API is used to route commands to specific IMS systems. **ROUTE=ALL** is recommended when the **SCOPE(ALL)** parameter is included. If a ROUTE list is specified (other than **ROUTE=ALL**), the command is processed only by the IMS systems in the list that receives the command. Other IMS systems that have the resources defined but are not included in the ROUTE list will not receive the command and therefore will not be synchronized with the repository.

In IMS 12, the **SCOPE(ALL)** and **SCOPE(ACTIVE)** parameters are the same. The **SCOPE(ACTIVE)** parameter applies the import to only the active IMS systems. The definitions of any inactive IMS system are not synchronized with the definitions of the other IMS systems in the IMSplex when it warmstarts or emergency restarts. To reestablish synchronization, you can issue an **IMPORT** command to import the resources that the other active IMS systems imported while it was inactive. If the inactive IMS is restarted, it is synchronized with the other IMS systems because it reads its entire IMS resource list.

Security considerations for commands

If you have set up security in your environment to restrict access to type-2 commands, you know that the RACF OPERCMDS class is used to contain resource profiles representing the commands. When you protect type-2 commands in the OPERCMDS class, the resource profiles have a certain format.

Table 7-1 shows the resource names associated with the new **DELETE DEFN**, **QUERY RM**, and **UPDATE RM** commands that must be added to the RACF OPERCMDS class to prevent unauthorized access. The required RACF permissions are also shown, and the IMSplex name must begin with the characters CSL. For information about restricting access to other elements that are part of the repository environment, see 7.10, “Security considerations” on page 258.

Table 7-1 New type-2 command RACF definitions for OM

Command	Resource keyword	RACF access authority	Resource name
DELETE	DEFN	UPDATE	IMS.CSLplxname.DEL.DEFN
QUERY	RM	READ	IMS.CSLplxname.QRY.RM
UPDATE	RM	UPDATE	IMS.CSLplxname.UPD.RM

Batch ADMIN commands

Batch **ADMIN** commands are available to manage user repositories. The user repository data sets must be defined before the repository is started. The commands provide the ability to add a repository, list repository details such as status, data set names, start and stop repository for operations, rename or delete a repository, update repository-specific attributes, or change the disposition of the data sets of a repository.

As explained in this section, user repositories are defined to the catalog repository using the batch **ADMIN ADD** command and are started with the batch **ADMIN START** command.

Batch **ADMIN** commands focus on managing the individual user repository. In “Repository Server commands issued through z/OS modify interface” on page 248, you see that the z/OS modify interface commands have a similar function, but are geared toward managing the RS.

Batch **ADMIN** commands are available by starting the **FRPBATCH** utility with JCL statements. Table 7-2 summarizes the batch **ADMIN** commands that are available for managing a user repository.

Table 7-2 Batch ADMIN utility commands and their functions

Command	Function
ADD	Add a user repository to the RS catalog
UPDATE	Update a user repository definition in the RS catalog
RENAME	Rename an existing user repository in the RS catalog
DELETE	Remove a user repository from the RS catalog
DSCHANGE	Change data set disposition
LIST	List status information for all user repositories or detailed information for a single user repository
START	Request the RS to start a user repository
STOP	Request the RS to stop a user repository

ADD command

To define an IMSRSC repository to the RS catalog repository, execute the batch **ADMIN ADD** command using the syntax shown in Example 7-51. Here, you must specify the IMSRSC repository name in addition to the names of the IMSRSC repository primary and secondary index and member data sets. The remainder of the parameters are optional. The repository name is converted to uppercase if it is specified in lower or mixed case.

Example 7-51 Syntax for the batch ADMIN utility ADD command

```
ADD REPOSITORY(repository-name)
REPDS1RID(primaryRID-name)
REPDS1RMD(primaryRMD-name)
REPDS2RID(secondaryRID-name)
REPDS2RMD(secondaryRMD-name)
REPDS3RID(NULL | spareRID-name)
REPDS3RMD(NULL | spareRMD-name)
AUTOOPEN(NO | YES)
SECURITYCLASS(NULL | securityclassname)
```

Notice that you can optionally specify the spare repository index and member data set names here. If nothing is specified, there will be no spare because the default is null.

You can also control whether the repository data sets you are specifying with this command are opened when the repository is started (**AUTOOPEN (YES)**), which is the default, or when a user first connects to it (**AUTOOPEN (NO)**).

If you are going to be restricting access to the IMSRSC repository, specify the name of the 8-byte security class that will be used to restrict access here. This class overrides the **SAF_CLASS=** parameter value in the FRPCFG configuration member, if one was specified. Alternatively, if you want to deactivate repository security, you can specify the **SECURITYCLASS(NULL)** parameter on the batch **ADMIN ADD** command to accomplish this. For more information about setting up security for the IMS repository, see 7.10, “Security considerations” on page 258.

We used the JCL shown in Example 7-52 to define a user repository named IMS12XRP to the RS catalog repository.

Example 7-52 JCL to add a user repository to the RS catalog repository

```
//*
//REPOADD  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 ADD REPOSITORY(IMS12XRP)                      +
     REPDSN1RID(IMS12Q.IM12X.REPO.IMSPRI.RID)   +
     REPDSN1RMD(IMS12Q.IM12X.REPO.IMSPRI.RMD)   +
     REPDSN2RID(IMS12Q.IM12X.REPO.IMSSEC.RID)   +
     REPDSN2RMD(IMS12Q.IM12X.REPO.IMSSEC.RMD)   +
     REPDSN3RID(IMS12Q.IM12X.REPO.IMSSPR.RID)   +
     REPDSN3RMD(IMS12Q.IM12X.REPO.IMSSPR.RMD)   +
     AUTOOPEN(YES)
//*
```

UPDATE command

Use the batch **ADMIN UPDATE** command to modify a user repository definition within the RS catalog data sets (specifically, to change the data sets, auto-open option or security class associated with a specific repository). Example 7-53 shows the syntax.

Example 7-53 Syntax for the batch ADMIN utility UPDATE command

```
UPDATE REPOSITORY(repository-name)
REPDS1RID(ds1_rid_dsname | NULL)
REPDS1RMD(ds1_rmd_dsname | NULL)
REPDS2RID(ds2_rid_dsname | NULL)
REPDS2RMD(ds2_rmd_dsname | NULL)
REPDS3RID(ds3_rid_dsname | NULL)
REPDS3RMD(ds3_rmd_dsname | NULL)
AUTOOPEN (YES | NO)
SECURITYCLASS(securityclassname | NULL)
```

The only required parameter for this command is the **REPOSITORY** parameter. The parameters associated with this command have the same meaning as they do when issued with the batch **ADMIN ADD** command, as described in “ADD command” on page 241.

A user repository must be stopped before it can be updated. We used the JCL shown in Example 7-54 to update the primary index and member data set names in the RS catalog repository.

Example 7-54 JCL to update an IMSRSC repository in the RS catalog repository

```
//*
//REPOUPD  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 UPDATE REPOSITORY(IMS12XRP_NEW) -
 REPDSN1RID(IMS12Q.IM12X.REPO.IMSPRI.RID.NEW)  -
 REPDSN1RMD(IMS12Q.IM12X.REPO.IMSPRI.RMD.NEW)  -
 AUTOOPEN(YES)
//*
```

RENAME command

You can use the batch **ADMIN RENAME** command to rename a user repository name defined within the RS catalog repository. Before a user repository can be renamed, you must first stop the repository.

Example 7-55 shows the **RENAME** command syntax.

Example 7-55 Syntax for the batch ADMIN utility RENAME command

```
RENAME REPOSITORY(repository-name) REPOSITORYNEW(repository-newname)
```

If you rename the IMSRSC repository at the RS, and you have one or more RM systems enabled with the repository, modify the RM to refer to the repository by the new name.

To modify the RM to refer to the repository by the new name, complete the following steps:

1. Disable RM from using the repository:

   ```
   UPDATE RM TYPE(REPO) REPOTYPE(IMSRSC) SET(REPO(N))
   ```

2. Ensure that all RMs are disabled from using the repository:

   ```
   QUERY RM TYPE(REPO) SHOW(ALL)
   ```

3. Modify the CSLRIxxx member of the IMS PROCLIB data set at all RMs to have the new repository name.
4. Enable RM to use the repository:

   ```
   UPDATE RM TYPE(REPO) REPO(TYPE(IMSRSC)) SET(REPO(Y))
   ```

To test this command in our environment, we used the JCL shown in Example 7-56.

Example 7-56 JCL to stop and rename a user repository in the RS catalog repository

```
//*
//REPOSRN  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 STOP   REPOSITORY(IMS12XRP)
 RENAME REPOSITORY(IMS12XRP) REPOSITORYNEW(IMS12XRP_NEW)
//*
```

DELETE command

Use the batch **ADMIN DELETE** command to remove a user repository from the RS catalog repository. After you delete the user repository, you must delete its associated physical data sets in a separate step using the IDCAMS utility or similar method. Example 7-57 shows the **DELETE** command syntax.

Example 7-57 Syntax for the batch ADMIN utility DELETE command

```
DELETE REPOSITORY(repository-name)
```

To test this command in our environment, we used the JCL shown in Example 7-58.

Example 7-58 JCL to delete a user repository from the RS catalog repository

```
//*
//REPODEL  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 DELETE REPOSITORY(IMS12XRP_NEW)
```

DSCHANGE command

At certain times it is appropriate to change the disposition of a repository data set (RDS) to either SPARE or DISCARD, which can be done using the batch ADMIN **DSCHANGE** command.

If an error occurs on the primary or secondary RDS, recovery is driven by the RS automatically if a spare RDS is present. When this occurs, the user must then allocate and define a new RDS to replace the one that had the failure. Designate this new RDS as the spare RDS, which you can do by using the batch **ADMIN DSCHANGE** command with the **ACTION(SPARE)** parameter specified (see Example 7-59 for the **DSCHANGE** command syntax). This command changes the disposition of a RDS pair to SPARE.

Example 7-59 Syntax for the batch ADMIN DSCHANGE command

```
DSCHANGE REPOSITORY(repository-name) RDS(1 | 2 | 3) ACTION(SPARE | DISCARD)
```

If you want to replace an existing RDS with a different RDS, you must first stop the repository and change the disposition or status of the RDS to DISCARD. This can be done by issuing the batch **ADMIN DSCHANGE** command with the **ACTION(DISCARD)** parameter specified. When an RDS has a disposition of DISCARD, it can be replaced with a newly defined data set.

Consider the following example scenario that begins with three RDSs that each have different dispositions or statuses of COPY1 (primary RDS), COPY2 (secondary RDS), and SPARE (spare RDS). A write error then occurs on the primary RDS and the following events ensue:

- The RS changes the disposition of the primary data set from COPY1 to DISCARD.
- The RS copies the definitions of the secondary data set to the spare data set.
- The RS changes the disposition of the spare data set to the disposition of the previous primary by changing its disposition from SPARE to COPY1.
- The user issues a command to determine which RDS has been discarded (using either the batch **ADMIN LIST** command or the z/OS modify interface **ADMIN,DISPLAY** command).
- The user deletes the discarded data set that was previously the primary data set.
- The user defines a new data set to replace the previous spare, making the new spare larger than the previous spare as this is a best practice.

- The user changes the disposition of this new data set to SPARE using either of the following commands:
  - Batch **ADMIN** command:

    ```
    DSCHANGE REPOSITORY(REPO1) RDS((1) ACTION(SPARE))
    ```

  - z/OS modify interface command:

    ```
    F REPOSVR1,ADMIN DSCHANGE (REPO1,S,1)
    ```

    Value of 1: In each of these example commands, 1 is specified. In our example scenario, the primary data set failed. Therefore, 1, representing the old primary data set, is specified to set its disposition to SPARE.

LIST command

Use the batch **ADMIN LIST** command to display all user repositories and their associated statuses, or the details of a single repository. The statuses that will be shown are listed here:

- User repository name
- User repository status
- Date of last update
- USERID that last updated user repository
- Data set disposition for each RDS

Example 7-60 shows the syntax for the **LIST** command.

Example 7-60 Syntax for the batch ADMIN utility LIST command

```
LIST REPOSITORY(repository-name) | STATUS
```

In our test environment, we issued the **LIST STATUS** command using the JCL shown in Example 7-61 to display all user repositories along with information about them.

Example 7-61 JCL to show user repository details defined to the RS

```
//*
//REPOSTA  EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//STEPLIB  DD DISP=SHR,DSN=IMS12Q.SDFSRESL
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 LIST STATUS
//*
```

In our case, we only had a single user repository defined. Therefore, it is the only one shown in the output generated from the batch **ADMIN** utility **LIST STATUS** command; see Example 7-62. If additional user repositories were defined in our environment, they might have been included in the output for this command.

Example 7-62 Output from the batch ADMIN utility LIST STATUS command

```
LIST STATUS
Repository                                 Status   Changed    ID       RDS1     RDS2     RDS3
-----------------------------------------  -------- ---------- -------- -------- -------- ---------
IMS12XRP                                   OPEN     2011/07/26 IMSR3    COPY1    COPY2    SPARE

FRP4750I - LIST command processing completed successfully
```

To only display details associated with a single repository, include the repository name on the **LIST** command instead of STATUS. Example 7-63 shows sample output that might be received from a batch **ADMIN LIST** command when a user repository name is specified. Notice that you can see detailed information about this user repository, such as its status, its auto-open value, and the different RDSs that it contains and their statuses (dispositions).

Example 7-63 Output from the batch ADMIN utility LIST command when a user repository is specified

```
LIST REPOSITORY(IM12XRP)
Repository Name . : IM12XRP

 Last updated date/time  : 2011/07/27 00:52:46  USRT001
 Status  . . . . . . . . : STOPPED
 Auto-open . . . . . . . : YES
 Security Class  . . . . : NOT DEFINED

Repository Data Set pair 1
 Index (RID) . . : IMS12Q.IM12X.REPO.IMSPRI.RID
 Member (RMD)  . : IMS12Q.IM12X.REPO.IMSPRI.RMD
 Status  . . . . : COPY1

Repository Data Set pair 2
 Index (RID) . . : IMS12Q.IM12X.REPO.IMSSEC.RID
 Member (RMD)  . : IMS12Q.IM12X.REPO.IMSSEC.RMD
 Status  . . . . : COPY2

Repository Data Set pair 3
 Index (RID) . . : IMS12Q.IM12X.REPO.IMSSPR.RID
 Member (RMD)  . : IMS12Q.IM12X.REPO.IMSSPR.RMD
 Status  . . . . : SPARE

FRP4750I - LIST command processing completed successfully
```

START command

Use the batch **ADMIN START** command to start a specific user repository, for example after it has been defined to the RS catalog repository with the batch **ADMIN ADD** command. Example 7-64 shows the command syntax.

Example 7-64 Syntax for the batch ADMIN utility START command

```
START REPOSITORY(repository-name) OPEN(YES | NO)
MAXWAIT(seconds,IGNORE | CONTINUE | ABORT)
```

With the optional **OPEN()** parameter, you can override the **AUTOOPEN=** parameter value that was originally specified when the repository was added to or last updated in the RS catalog (with batch **ADMIN ADD** or **UPDATE** commands, respectively). This parameter value indicates whether the RDSs of the user repository will be open when it starts (with **OPEN(YES)**), or when a user first connects to it (with **OPEN(NO)**). You can only override the **AUTOOPEN=** parameter if it was originally specified as **AUTOOPEN=NO**.

You can optionally include the **MAXWAIT** parameter to indicate how many seconds should elapse before a particular action that you also specify is taken. You can specify a wait time of up to 9999 seconds and opt to have the command continue processing with a return code of either 0 or 4, or opt to have it terminate with a return code of 8. By default, if 5 seconds has elapsed after this command has been issued, the command will continue processing and will give a return code of 4.

The syntax of the **MAXWAIT()** parameter has the following values:

- Seconds will fall between a range of 0-9999.
- IGNORE will continue command processing and set rc=0.
- CONTINUE will continue command processing and set rc=4.
- ABORT will terminate command processing and set rc=8.

In our test environment, we started our user repository at the time that we defined it to the RS with the batch **ADMIN** utility **ADD** command, which is shown in Example 7-52 on page 242.

STOP command

Use the batch **ADMIN STOP** command to stop a specific user repository that is defined to the RS catalog. A stopped repository will reject user connection attempts. The command also results in the repository being closed and deallocated by the RS. Example 7-65 shows the command syntax. This command has the same **MAXWAIT()** parameter value as the batch **ADMIN START** command.

Example 7-65 Syntax for the batch ADMIN utility STOP command

```
STOP REPOSITORY(repository-name)
MAXWAIT(seconds,IGNORE | CONTINUE | ABORT)
```

Much like a **/DBR** command that prevents programs and transactions from accessing a database, the batch **ADMIN STOP** command, when issued with **MAXWAIT(xx,IGNORE)** or **MAXWAIT(xx,CONTINUE)**, can continue processing after xx seconds have elapsed. At this point, the command continues processing (just like the **/DBR** command) and a specific return code is received, determined by whether IGNORE (rc=0) or CONTINUE (rc=4) was specified. Of course, if **ABORT** was specified instead of IGNORE or CONTINUE, the command terminates processing and a rc=8 is received when xx seconds has elapsed.

In our test environment, we issued the batch **ADMIN** utility **STOP** command at the time that we tested the **RENAME** command, because a user repository must be stopped before it can be renamed. A sample of the JCL that we used is shown in Example 7-56 on page 243.

Summary of batch ADMIN utility commands

To summarize all of the batch **ADMIN** commands, see Example 7-66. This job issues each command that has been explained in this section.

Example 7-66 Sequence showcasing each batch ADMIN command

```
//FRPBAT   EXEC PGM=FRPBATCH,PARM='XCFGROUP=IM12XREP'
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
//*
ADD REPOSITORY(IMS12XRP) -
     REPDSN1RID(IMS12Q.IM12X.REPO.IMSPRI.RID) -
     REPDSN1RMD(IMS12Q.IM12X.REPO.IMSPRI.RMD) -
     REPDSN2RID(IMS12Q.IM12X.REPO.IMSSEC.RID) -
     REPDSN2RMD(IMS12Q.IM12X.REPO.IMSSEC.RMD) -
     REPDSN3RID(IMS12Q.IM12X.REPO.IMSSPR.RID) -
     REPDSN3RMD(IMS12Q.IM12X.REPO.IMSSPR.RMD) -
     AUTOOPEN(YES)
//*
START REPOSITORY(IMS12XRP) MAXWAIT(30,CONTINUE)
//*
LIST REPOSITORY(IMS12XRP)
//*
```

```
STOP REPOSITORY(IMS12XRP) MAXWAIT(30,CONTINUE)
//*
RENAME REPOSITORY(IMS12XRP) REPOSITORYNEW(IMS12XRP_PROD)
//*
UPDATE REPOSITORY (IMS12XRP_PROD) -
REPDSN1RID(IMS12Q.IM12XPROD.REPO.IMSPRI.RID)   -
REPDSN1RMD(IMS12Q.IM12XPROD.REPO.IMSPRI.RMD)   -
AUTOOPEN(NO)
//*
DELETE REPOSITORY(IMS12XRP_PROD)
```

The following section highlights the RS z/OS modify interface commands.

Repository Server commands issued through z/OS modify interface

RS parameters can be displayed and dynamically updated by using z/OS modify interface commands. Therefore, by using these commands, you can administer the repository from the z/OS console. Although there is some overlap with the batch **ADMIN** utility, these commands are issued from the perspective of the RS rather than that of the individual user repository.

Table 7-3 summarizes the different z/OS modify interface commands that are available to administer the user repositories, again from the RS perspective.

Table 7-3 Summary of RS command functions

Command	Function
ADMIN	Administrative functions such as change data set disposition, display data sets, start and stop repositories
AUDIT	Dynamically change audit level
SECURITY	Refresh RACF profile definitions
SHUTDOWN	Shut down one or more RS address spaces
STOP	Stop or shut down a specific RS

The following sections explore the details of each command.

ADMIN command

Use the z/OS modify interface **ADMIN** command to perform various administrative tasks. The syntax is shown in Example 7-67.

Example 7-67 Syntax for the z/OS modify interface ADMIN command

```
F reposervername,ADMIN
DSCHANGE(repositoryname, S|D, 1|2|3)
DISPLAY(repositoryname | <blank>)
START(repositoryname)
STOP(repositoryname)
```

Use the **ADMIN** command with the **DSCHANGE** parameter to change the disposition of a data set contained in a repository to DISCARD or SPARE status. For details about the circumstances under which this situation is appropriate, see “DSCHANGE command” on page 244.

When changing the disposition of a repository data set pair, specify the name of the repository that contains the target data set pair and the new disposition with either of the following values:

S A new disposition of SPARE
D A new disposition of DISCARD

The target repository data set pair is indicated by any of the following values:

1 Primary (also known as COPY1)
2 Secondary (also known as COPY2)
3 Spare

Next, you can use the **ADMIN** command with the **DISPLAY** parameter to display a list of user repository names defined to the RS catalog. If a repository name is specified for the **DISPLAY()** parameter, other details such as the RDS names and statuses will be shown. This command is similar to the batch **ADMIN LIST STATUS** command. Sample output for the z/OS modify interface **ADMIN,DISPLAY** command when a user repository name is specified this command is shown in Example 7-68.

Example 7-68 Output from the z/OS modify interface ADMIN,DISPLAY command

```
/* Display the IMSRSC_REPOSITORY via the ADMIN cmd                    */
/* FRP2100I - ADMIN DISPLAY repository IMSRSC_REPOSITORY              */
/*          - Last updated date/time  : USRT001                       */
/*          - Status  . . . . . . . . : OPEN                          */
/*          - Auto-open . . . . . . . : YES                           */
/*          - Security Class  . . . . : NOT DEFINED                   */
/* FRP2101I - ADMIN DISPLAY repository RDS1:                          */
/*          - Index (RID) . . : IMSTESTS.FRP1.IMSPRI.RID              */
/*          - Member (RMD)  . : IMSTESTS.FRP1.IMSPRI.RMD              */
/*          - Status  . . . . : COPY1                                 */
/* FRP2101I - ADMIN DISPLAY repository RDS2:                          */
/*          - Index (RID) . . : IMSTESTS.FRP1.IMSSEC.RID              */
/*          - Member (RMD)  . : IMSTESTS.FRP1.IMSSEC.RMD              */
/*          - Status  . . . . : COPY2                                 */
/* FRP2101I - ADMIN DISPLAY repository RDS3:                          */
/*          - Index (RID) . . :                                       */
/*          - Member (RMD)  . :                                       */
/*          - Status  . . . . : NONE                                  */
```

Notice that detailed information about this user repository is displayed, such as its status, its auto-open value, and the different RDSs that it contains and their statuses (dispositions).

Lastly, you can use the **ADMIN** command with the **START** or **STOP** parameters to start and stop a repository, respectively.

AUDIT command

Use the **AUDIT** command to dynamically change the audit level setting specified on the **AUDIT_LEVEL** parameter in the FRPCFG configuration member, following the syntax shown in Example 7-69.

Example 7-69 Syntax for the z/OS modify interface AUDIT command

```
F reposervername,AUDIT LEVEL(NONE|HIGH) | RESTART
```

To activate the writing of log records, specify **LEVEL(HIGH)**. To deactivate the writing of logs, specify **LEVEL(NONE)**.

When the RS is starting and attempting to connect to the log stream, an error can occur. Depending on what value you specified for **AUDIT_FAIL** in the FRPCFG member, the RS can either continue starting or can terminate. If you specify **AUDIT_FAIL=CONTINUE**, logging is suspended in the event that the RS encounters an error while attempting to connect to the log stream. You can later activate the logging of records by issuing the z/OS modify interface **AUDIT** command with **RESTART** included.

SECURITY command

For repository security, if you need to make changes to your RACF (or System Authorization Facility (SAF) equivalent) definitions, they are only active if you refresh the RACF in-storage profiles. Use the z/OS modify interface **SECURITY** command to accomplish this. The command results in refreshing the RACF profiles in storage to reflect the updated profile definitions. Example 7-70 shows the command syntax.

Example 7-70 Syntax for the z/OS modify interface SECURITY command

```
F reposervername,SECURITY REFRESH
```

When the z/OS modify interface **SECURITY** command is issued, the RACF in-storage profiles are refreshed, but neither the FRPCFG member or the repository definitions are reread.

SHUTDOWN command

To shut down one or more RSs, issue the z/OS modify interface **SHUTDOWN** command. Including the optional **ALL** keyword targets all RSs in the same XCF group. Omitting the **ALL** keyword simply targets the specified RS for shutdown. If the master RS is shut down, one of the subordinate servers becomes the new master. Example 7-71 shows the command syntax.

Example 7-71 Syntax for the z/OS modify interface SHUTDOWN command

```
F reposervername,SHUTDOWN ALL
```

STOP command

The z/OS modify interface **STOP** command is also available to shut down a single RS. Here again, if the master RS is shut down, one of the subordinate servers will become the new master. The syntax is **P reposervername**.

Repository commands comparison

For clarity, Table 7-4 displays all batch **ADMIN** commands and RS commands and, if applicable, their equivalents.

Table 7-4 Comparison of the batch ADMIN utility commands to the RS commands

Batch ADMIN utility commands	Repository Server z/OS modify interface commands
ADD	
LIST	**ADMIN DISPLAY**
START	**ADMIN START**
STOP	**ADMIN STOP** (repository, not RS)
RENAME	

Batch ADMIN utility commands	Repository Server z/OS modify interface commands
DELETE	
DSCHANGE	**ADMIN DSCHANGE**
UPDATE	
	AUDIT (change audit level)
	SECURITY
	SHUTDOWN
	STOP (stops RS)

The following section compares RDDS DRD with repository DRD and examines their similarities and differences.

7.9.2 Comparison of DRD use with RDDS versus repository

When using DRD with the new repository instead of the RDDS, you must account for certain considerations especially in the areas of deleting, updating, importing, or exporting resources. This section explores each of these areas.

Deleting resources

To delete a resource with RDDS DRD, the runtime definition is deleted with a **DELETE** command. This deletion is hardened to the system RDDS of IMS at system checkpoint by using automatic export (if it is enabled) or with an **EXPORT** command including the **OPTION(OVERWRITE)** parameter. The resource is then removed from the stored resource definitions of the system RDDS.

With repository DRD, the runtime resource definition is also deleted with the **DELETE** command, just as with RDDS DRD. However, because automatic export is not supported with repository DRD and the **EXPORT** command cannot be used to harden deletions to the repository, a different step needs to be taken to accomplish this. The **DELETE DEFN** command must be used to remove stored resource definitions from the IMS resource list associated with the runtime resource deletions that occurred in the running system.

First delete the runtime resource definitions at the IMS system using the **DELETE** command, and then use the **DELETE DEFN** command to delete the resource definitions from the IMSRSC repository.

Importing resources

When you issue an **IMPORT** command in an RDDS DRD environment by using the **IMPORT DEFN SOURCE(RDDS)** command, each IMS system that receives the command reads the stored resource definitions from the specified RDDS into the control region, where they become runtime resource definitions.

With repository DRD, each IMS that receives the **IMPORT DEFN SOURCE(REPO)** command reads the stored resources definitions from the repository into the control region, where they become runtime resource definitions.

Both RDDS DRD and repository DRD can create new and update existing runtime resource definitions using an **IMPORT** command.

The ability to refresh runtime resource definitions in an IMS system with stored resource definitions contained in an RDDS or repository is new in IMS 12. This action is taken when the **IMPORT** command is issued with the **OPTION(UPDATE)** parameter included. This applies to all of the resources and descriptors being imported. They do not exist as a runtime definition. Instead, the stored resource definition will be created in the running system.

For clarity, Table 7-5 summarizes all possible results for an **IMPORT DEFN** command.

Table 7-5 Potential results for IMPORT DEFN command when OPTION(UPDATE) is specified

Existing runtime definition exists?	OPTION(UPDATE) specified?	IMPORT DEFN result
No	No	Runtime definition created
Yes	No	IMPORT DEFN fails
No	Yes	Runtime definition created
Yes	Yes	Runtime definition updated

If the imported definition is for a resource or descriptor that is unknown to IMS, IMS creates the runtime definition for the resource, regardless of whether the **OPTION(UPDATE)** parameter is specified.

If the imported definition is for a resource or descriptor for which IMS already has a runtime definition (the resource or descriptor already exists in IMS) and the **OPTION(UPDATE)** parameter is not specified, the definition is not imported and the command fails.

If the imported definition is for a resource or descriptor for which IMS already has a runtime definition and the **OPTION(UPDATE)** parameter is specified, the existing runtime definition is updated with the attributes from the imported definition.

Use case scenario for the IMPORT command

This section shows how the **IMPORT** command can be useful when issued with the **UPDATE** option specified. This scenario illustrates the flexibility of the command in that it can create or update runtime resource definitions depending on whether or not a runtime definition exists for a resource being imported. In the example, a repository is being used instead of an RDDS.

The following scenario illustrates the use of the **IMPORT DEFN** command when the **OPTION(UPDATE)** parameter is included.

An IMS application program exists on a test IMS (IMST) and on a development IMS (IMSD) that are in the same IMSplex. Changes are made to this application program, requiring new or changed resource definitions on both IMS systems. Testing is required on the test IMS system before definitions are ported to the development IMS.

- On the test IMS system:
  a. Dynamically add new resources with the **DRD CREATE** command.
  b. Dynamically update existing resources with the **DRD UPDATE** command.
  c. Export these changes to a repository:

```
EXPORT DEFN TARGET(REPO) NAME(rsc-names) SET(IMSID(IMST,IMSD))
```

After successful testing, the definitions can be ported to the development IMS. Issue the following command to the development IMS:

```
IMPORT DEFN SOURCE(REPO) NAME(rsc-names) OPTION(UPDATE)
```

New runtime resource definitions are added to the development IMS. In addition, existing runtime resource definitions are updated in the development IMS.

Notice that the **EXPORT** command specifies the resource definitions that are written to the repository, targeting the test (IMST) and development (IMSD) IMS systems. When the export occurs, the following two actions occur:

- New resources names and types are added to the IMS resource lists of IMST and IMSD within the repository.
- New stored resource definitions are either added to or updated within the repository.

The **EXPORT** command hardens the runtime definitional additions and changes made on IMST to its stored definitions contained in the repository, and updates its IMS resource list. It does the same for IMSD; that is, the stored resource definitions and IMS resource list of IMSD are updated in preparation for a later import after successful testing has been completed on IMST. Another use for the **EXPORT** command is to ensure that a user repository is not empty.

IMPORT command considerations

When using the **IMPORT** command with the UPDATE option, a runtime definition is created if one does not already exist and an existing runtime definition is updated with the new attributes.

In most cases, when updating an existing runtime resource definition, the resource cannot be in use or the **IMPORT** fails. However, the following transaction attributes can be updated even if the transaction is in use: CLASS, LCT, LPRI, NPRI, MAXRGN, PARLIM, PLCT, PLCTTIME, SEGNO, SEGSZ, and TRANSTAT. The TRANSTAT program attribute can be updated while the program is in use.

If a database definition is to be updated by the **IMPORT** command, access to the database must be stopped before the import is done. This applies to changing the resident value and to changing the access type. When updating the resident value with the **UPDATE DB** command, you must stop access to the database before you issue the command. However, you do not have to stop access to the database when using the **UPDATE DB** command to update the access type. With the **IMPORT** command, you must always stop access to the database before a database definition is to be updated, even if the import is simply updating the access type.

When the **IMPORT** command is issued with the **UPDATE** option, all existing resources affected by the update are quiesced. For example, if the import is updating a transaction definition, the transaction and the associated program are quiesced. While quiesced, a resource cannot be updated or deleted, and in most cases work cannot be run against the resource, which means the resource cannot be scheduled. Certain latches are held during the import process that prevent work from being done. No resources can be scheduled while the resources to be updated are being quiesced. A system checkpoint is not allowed while an import is in progress.

Exporting resources

Exporting resource definitions to an RDDS is handled differently than exporting to a repository.

Exporting to RDDS

When exporting in an RDDS DRD environment, resources that have been newly created, changed, or deleted can all be hardened to the RDDS by using automatic export if it is enabled. They can also be hardened to the RDDS by issuing an **EXPORT** command, which can either overwrite the entire contents of an RDDS or append to it.

With RDDS DRD, each IMS system has its own dedicated pair of system RDDSs that contain the entire collection of MODBLKS definitions for the system. When an **EXPORT** command is issued in a cloned environment, it should be routed to all of the IMS systems in the IMSplex so that their system RDDSs remain synchronized with the same set of definitions. In this case,

each IMS system that receives the command will process it and perform export. There is potential here for one IMS system to fail the **EXPORT** command, where others can succeed. This requires the user to manually resynchronize the system RDDSs by correcting the error and reissuing the **EXPORT** on the IMS that failed. Manual coordination is not always straightforward and is not recommended because it requires more effort on the part of the user.

Finally, RDDS DRD exporting only applies to active IMS systems, and there is no way for the stored resource definitions of an inactive IMS to be updated. In IMS 12, several of these limitations are alleviated when DRD is used with the repository instead of the RDDS.

Exporting to the repository

With repository DRD exporting, only added and changed resources or descriptors can be written to the repository. As previously mentioned, automatic export is not supported with this type of DRD. To export to a specific IMS resource list within the repository, an **EXPORT** command is required. To export the runtime resources definitions of the IMS that have been added or changed since the previous **EXPORT** command was issued, include the **OPTION(CHANGESONLY)** parameter omitting the **SET(IMSID())** parameter so only the targeted IMS's resource definitions in the repository are updated with the changes. If any runtime resource definitions were deleted from the IMS, issue a **DELETE DEFN** command with the correct **FOR(IMSID())** parameter to remove the associated stored resource definitions from the repository.

With repository DRD, instead of each IMS having its own set of system RDDSs, each IMS has its own IMS resource list that contains the resource names and resource types defined for the IMS. The repository also has resource definitions for each resource defined to the repository.

When an **EXPORT** command is issued in a repository DRD environment, the resource definitions are written to the repository. The **SET(IMSID())** parameter determines which IMS stored resource definitions and IMS resource lists to update in the repository. Unlike RDDS DRD, where each IMS that receives the **EXPORT** command processes it, a repository DRD **EXPORT** is only processed by one command master IMS. Because the command is processed as a single unit of work, all of the specified resource definitions and IMS resource lists are updated by the export, or none of them are updated if an error occurs.

The possibility is eliminated that the stored resource definitions of some IMS instances might be different from others because only one IMS is processing the command as a single unit of work, writing to the shared repository. RDDS DRD export also processes the command as a single unit of work, but the difference is that multiple IMSs are each processing the command separately, updating different RDDSs, which as previously stated can succeed or fail at the different systems resulting in desynchronization.

Repository DRD export can update the stored definitions of an IMS that is inactive, unlike RDDS DRD export. These updated stored definitions can be applied when the IMS restarts, but remember, export does not handle resource deletions. It only handles additions or changes. To deleted stored resource definitions from the repository, a **DELETE DEFN** command is required.

Parameters specific to DRD type

Certain **EXPORT** command parameters only apply to a specific type of DRD. For example, the following parameters only apply to repository DRD:

- **STARTTIME()**
- **ENDTIME()**
- **OPTION(CHANGESONLY)**

The following parameters only apply to RDDS DRD:

- **OPTION(APPEND)**
- **OPTION(OVERWRITE)**

7.9.3 Using DRD with the IMS repository in an online environment

This section explores a few repository DRD usage scenarios that occur in an online environment, including a closer look at the following areas:

- Handling indoubt work in progress when an import or export is interrupted
- Maintaining unique attribute values for specific IMS resources within the repository
- Exporting resources that are dynamically created with the DFSINSX0 user exit

Indoubt work in progress

It is possible that IMS, RM, or the RS can unexpectedly terminate during **IMPORT** or **EXPORT** command processing. In this case, it is uncertain whether the unit of work (UOW) command processing completed, making it “indoubt work.”

The point of failure is important in determining whether the command needs to be reissued. Use the **QUERY SHOW(DEFN)** command to determine when the resources or descriptors involved in the import or export were last created, updated, or imported and compare these timestamps to the point of failure. Look for the resource data under the following command output column headers:

- TimeCreate
- TimeUpdate
- TimeImport

This should indicate whether the **IMPORT** or **EXPORT** command should be issued again.

Use case scenarios: Indoubt

The following event sequence illustrates a scenario in which **EXPORT** command processing becomes indoubt. Then we explain how to resolve this situation.

1. You enter the following command:

   ```
   EXPORT DEFN TARGET(REPO) TYPE(TRAN) NAME(TRANA,TRANB)
   ```

2. IMS terminates during command processing.
3. Work in progress of the **EXPORT** command is indoubt.
4. You enter the **QUERY TRAN** command:

   ```
   QUERY TRAN NAME(TRANA,TRANB) SHOW(DEFN,TIMESTAMP)
   ```

5. You check the TimeCreate or TimeUpdate column in command response data.

Next, we show another event sequence that illustrates a scenario in which **IMPORT** command processing becomes indoubt. Then we explain how to resolve this situation.

1. You enter the following command:

   ```
   IMPORT DEFN SOURCE (REPO) TYPE(TRAN) NAME(TRANA,TRANB)
   ```

2. IMS terminates during command processing.
3. Work in progress of the **IMPORT** command is indoubt.
4. You enter the following command:

   ```
   QUERY TRAN NAME(TRANA,TRANB) SHOW(DEFN,TIMESTAMP)
   ```

5. You check the TimeImport column in the command response data.

In both of these scenarios, if a **QUERY** command response indicates that work in progress was not committed, reissue the **IMPORT/EXPORT** command.

Resources with unique attribute values in repository

In an MSC environment, each IMS system must have unique SIDR and SIDL values for remote transactions and transaction descriptors. To modify these SIDR and SIDL values, the **EXPORT** command with the appropriate IMSID must be specified on the **SET(IMSID)** parameter. If the **SET(IMSID())** parameter is omitted, the command must be routed to the specific IMS whose SIDR and SIDL definitional values are to be exported. In either case, the resource definitions of the IMS system are updated with the new values.

Important: When **EXPORT** is issued with the **SET(IMSID(*))** parameter, every attribute value *except* for SIDR/SIDL is written to the stored resource definitions of each IMS system, because these values must always be unique to a particular IMS system.

For local transactions and transaction descriptors, the SIDR and SIDL values are saved as 0 in the repository for each IMS. When the stored resource definition is imported from the repository either during AUTOIMPORT processing or during processing of the **IMPORT** command, the SIDR and SIDL values are set to the lowest local SID value of the IMS system where the runtime resource definition is created.

Exporting resources created with the DFSINSX0 user exit to repository

The Destination Creation (DFSINSX0) user exit can be used to dynamically create transaction resources that will process messages that come into IMS with an unknown destination. To export these dynamically created transactions to the repository, set **TRNQ_FC_EXPORT=1** on the exit input parameter list and issue the **EXPORT DEFN TARGET(REPO)** command. When exporting, include either the NAME() parameter specifying names of dynamically created transactions. If the resource names are unknown, use the **STARTTIME()** and **ENDTIME()** parameters to encompass the timeframe in which the exit dynamically created the transaction resources.

Keep in mind that when using DRD with the repository, no automatic export will occur at system checkpoint, unlike as is the case with RDDS DRD. To harden transactions that are dynamically created with the DFSINSX0 user exit to the repository, the only option is to export with an **EXPORT** command.

7.9.4 Managing the IMS repository in an offline batch environment

This section provides scenarios in which the repository can be managed in an offline environment, namely for security updates and recovery procedures.

Updating security settings

The use case scenarios in this section illustrate the use of both batch **ADMIN** and z/OS modify interface commands being used to specify security settings.

If you are going to restrict access to a user repository defined in the RS catalog, you typically designate the SAF class name to be used in the FRPCFG configuration member during initial setup. However, if no security class was specified in the member at that time, you can update it later on using the batch **ADMIN UPDATE** command.

A sample batch **ADMIN UPDATE** command is shown in Example 7-72. In the example, the security class XFACILIT is designated for use in restricting access to a repository named REPO1.

Example 7-72 Using the batch ADMIN UPDATE command to designate a SAF security class

```
UPDATE REPOSITORY(REPO1) SECURITYCLASS(XFACILIT)
```

After the SAF security class is designated, you can update your RACF definitions to protect your user repository (Example 7-73).

Example 7-73 Making RACF definitional changes after the security class has been designated

```
RDEFINE XFACILIT FRPREP.REPO1 UACC(NONE)
PERMIT FRPREP.REPO1 CLASS(XFACILIT) ID(ANGIE) ACCESS(READ)
```

Here, you can see that the SAF class `XFACILIT` that we just designated for use in Example 7-72 is specified in the RACF definitions to prevent unauthorized user access to the REPO1 repository. A user ID named ANGIE is then permitted to read it within these RACF definitions.

After the definitional RACF changes are made, the in-storage RACF profiles must be refreshed to reflect these updates. Use the z/OS modify interface **SECURITY** command to accomplish this task (Example 7-74).

Example 7-74 Refreshing RACF in-storage profiles with z/OS modify interface SECURITY command

```
F REPOSVR1,SECURITY REFRESH
```

Important: The z/OS modify interface **SECURITY** command must be used any time the RACF definitions are updated.

For more information about implementing repository security, see 7.10, “Security considerations” on page 258.

Recovery activities

A repository data set pair (hereafter referred to as RDS) that is identified by the server as having lost integrity is *discarded*. At this time, the disposition of the RDS will be changed to DISCARD. If an RDS is discarded due to a write error, then the repository will be stopped at this time to enable recovery. In this event, the RS drives recovery automatically if a spare RDS is available and the only task of the user is to allocate and define a new spare data set, assigning it to SPARE disposition with a **DSCHANGE** command. If no spare RDS is available, the user repository is stopped and administrator intervention is required to restart the user repository.

Read errors: Only *read* errors are handled by using the other valid copy (primary or secondary) to access the needed data; there is no spare switching. This is an improvement for reads compared to previous IMS releases, because neither the RDDS nor MODBLKS have a second data set.

Use-case scenario: Recovery

Consider a scenario in which a repository named REPO1 contains a primary, a secondary, and a spare data set with dispositions of COPY1, COPY2, and SPARE, respectively. A write

error occurs on the primary data set. The RS will then drive recovery in the following event sequence:

1. The primary data set is automatically changed to the disposition of DISCARD.
2. Definitions of the secondary data set are copied to the spare.
3. Repository Server changes the spare to primary.

The RS changes the disposition of the primary RDS from COPY1 to DISCARD and copies the contents of the secondary RDS to the spare RDS automatically (if a spare is available). At this point, the existing spare becomes the new primary data set that replaces the repository data set that failed.

At this point in the recovery process, the user must take the following actions:

1. Issue either a batch **ADMIN LIST** or z/OS modify interface **ADMIN,DISPLAY** command to determine which RDS has been discarded.
2. Delete and define the discarded primary data sets to replace the old spare.
3. Change the disposition of this new data set to SPARE.

The batch **ADMIN LIST** command or z/OS modify interface command **F xx,ADMIN DISPLAY()** command can be issued to show the dispositions, or statuses, of each repository data set. You must then delete the bad repository data set whose disposition is now DISCARD. Allocate and define a new repository data set (ideally, the size should be larger than the previous spare) and assign a disposition of SPARE to this new data set using either the batch **ADMIN** or z/OS modify interface commands shown in Example 7-75 and Example 7-76. Notice that in each command, 1 is specified. In our sample scenario, the primary data set failed and so a 1 representing the old primary data set is specified to set its disposition to SPARE.

Example 7-75 shows the format of the batch **ADMIN DSCHANGE** command.

Example 7-75 A batch ADMIN DSCHANGE command setting RDS1 to SPARE disposition

```
DSCHANGE REPOSITORY(REPO1) RDS((1) ACTION(SPARE))
```

Example 7-76 shows the format of the z/OS modify interface command.

Example 7-76 A z/OS modify interface command setting RDS1 to SPARE disposition

```
F REPOSVR1,ADMIN DSCHANGE (REPO1,S,1)
```

7.10 Security considerations

In securing access to RS resources, you must consider the following areas as explained in this section:

- Repository access
- Types of repository security
- Repository security implementation

7.10.1 Repository access

Access to a user repository can be gained either through RM or directly.

Access by using RM

A user repository can be accessed either through RM or directly. If going through RM, the caller will be considered either “authorized” or “non-authorized”. IMS is an authorized caller and therefore so long as RM is authorized, it has access to all repository contents by using commands such as the following examples:

- **EXPORT TARGET(REPO)**
- **IMPORT SOURCE(REPO)**
- **DELETE DEFN**
- **QUERY** with **SHOW(DEFN)**

Important: Another layer of security can be put in place to prevent an unauthorized user from issuing any new repository-specific commands. For information about how to restrict access to these commands, see “Security considerations for commands” on page 240.

However, the RM utilities **CSLURP10** (RDDS to Repository RM utility) and **CSLURP20** (Repository to RDDS RM utility) are non-authorized RM callers. In this case, the utilities do not automatically have authorization for repository access just because RM is authorized, as is the case with IMS. Therefore, the RM utilities require separate authorization to access the repository.

Direct access

Access to a RS can be gained directly (without going through RM) by both the batch **ADMIN** utility or through the z/OS modify interface. As previously mentioned, the batch **ADMIN** utility runs as a JCL job. Therefore, the user ID specified in the JCL can be used for authorization checking to determine whether repository access is allowed. Security for commands entered through the z/OS modify interface can be implemented using standard console security.

7.10.2 Types of repository security

Repository security can be at the connection level or the member level.

Connection security

Connection security is used when a caller attempts to connect to the user repository. This concept applies to both authorized and non-authorized RM callers, which are the IMS and RM utilities (respectively). In either case, the caller must specify a user ID in the JCL, which is checked in RACF to determine whether access to the repository is allowed. For the RM utilities, this user ID is also used for SCI registration.

Member-level security

Security can also be implemented at the member level within a user repository, which only applies to the RM utilities. In this case, you can restrict access to individual members, and separately authorize the user ID associated with the RM utility (again, specified in the JCL) being used to access these members.

Use member-level security if you want to restrict the RM utilities to accessing only certain resources. After you protect the individual resources in a RACF class, permit the user ID specified in the JCL of the utility to access these resources accordingly. For example, the **CSLURP20** utility reads repository resources and copies them to an RDDS. If you want to

prevent the utility from reading certain resources from the repository and then copying them to the RDDS, restrict access to them and only permit the utility to access (read/copy) the desired resources.

7.10.3 Repository security implementation

RS resources, including the following examples, can be restricted from unauthorized access:

- User repository
- Catalog repository
- Members within a user repository
- Audit levels associated with an individual repository

First, choose a class that your RS resources will be protected in. Use either the `FACILITY` class or your own user-defined class. Use member-level security due to the 39-character profile name length restriction of `FACILITY` class.

Tip: To define a new user-defined class to RACF, add the new class to the RACF Class Descriptor Table (ICHRRCDE) and then update the RACF Router Table (ICHRFR01) with the new class.

The next steps are to protect your resources by defining general resource profiles, and then to grant access to users that have been protected in those resource profiles.

Protecting Repository Server resources

This section shows how to restrict access to RS resources to authorized users by defining profiles for them. All examples specify a user-defined RACF class named `XFACILIT`. As previously mentioned, use a user-defined class when defining resource profiles in RACF.

To protect a user repository, define a profile using the format **`FRPREP.repositoryname`**. For example, if you want to protect a user repository named REPO1, define a resource profile for it using the format shown in Example 7-77.

Example 7-77 Restricting access to a user repository by defining a profile for it in RACF

```
RDEFINE XFACILIT FRPREP.REPO1 UACC(NONE)
```

Notice that we have specified that the user repository is protected in the `XFACILIT` class. Also, by designating a universal access of none with **`UACC(NONE)`**, explicit permission must be granted in RACF for any user ID to access this user repository.

To protect all user repositories in your environment, define a profile using the format **`FRPREP.*`** (see Example 7-78).

Example 7-78 Restricting access to all user repositories by defining a catch-all profile in RACF

```
RDEFINE XFACILIT FRPREP.* UACC(NONE)
```

To restrict access to the RS catalog repository, use the **`FRPREP.CATALOG`** format when defining a resource profile for it. Keep in mind that a user can access or update the RS catalog repository by using batch **`ADMIN`** commands, for example when adding a new user repository to it during initial setup.

Example 7-79 shows a RACF statement that restricts access to the catalog repository in the XFACILIT class, with a universal access of none.

Example 7-79 Restricting access to the RS catalog repository by defining a profile for it in RACF

```
RDEFINE XFACILIT FRPREP.CATALOG UACC(NONE)
```

Individual members within a repository can also be restricted from unauthorized access by the RM utilities **CSLURP10** (RDDS to Repository RM utility) and **CSLURP20** (Repository to RDDS RM utility). To define a resource profile for an individual repository member, use the following format:

```
FRPMEM.repositoryname.DFS.RSC.membername
```

The membername referenced in the required format must consist of the IMSplex name, followed by the resource name and resource type. For example, a transaction named PART that exists in an IMSplex named IMSPLEX1 can be defined in a profile such as the one shown in Example 7-80.

Example 7-80 Restricting access to an individual member by defining a profile for it in RACF

```
RDEFINE XFACILIT FRPMEM.REPO1.DFS.RSC.IMSPLEX1.TRAN.PART UACC(NONE)
```

Lastly, you can restrict unauthorized users from modifying audit levels associated with an individual repository. Define a resource profile in RACF using the following format:

```
FRPAUD.repositoryname.DFS.RSC.TYPE
```

Example 7-81 shows a RACF profile definition that restricts the audit level associated with a user repository named REPO1. By designating a universal access of none with UACC(NONE), explicit permission must be granted to a user ID in RACF for that user ID to access modifying the audit level for this user repository.

Example 7-81 Restricting access to modifying audit levels by defining a profile for it in RACF

```
RDEFINE XFACILIT FRPAUD.REPO1.DFS.RSC.TYPE UACC(NONE)
```

Granting user access to Repository Server resources

After defining resource profiles to protect your RS resources from unauthorized access, the next step involves granting access to the appropriate users. For each resource, use the appropriate format shown in “Protecting Repository Server resources” on page 260.

To grant user authorization to a repository after having restricted access to it (such as in Example 7-77 on page 260), use RACF PERMIT statements such as the ones shown in Example 7-82 on page 261. In the example, we grant read access to a user ID named VIEWER1 and alter access to a user ID named ADMIN1.

Example 7-82 Granting different levels of repository access to user IDs

```
PERMIT FRPREP.REPO1 CLASS(XFACILIT) ID(VIEWER1) ACCESS(READ)
PERMIT FRPREP.REPO1 CLASS(XFACILIT) ID(ADMIN1) ACCESS(ALTER)
```

To grant user authorization to a RS repository catalog after having restricted access to it (such as in Example 7-79), use a RACF PERMIT statement such as the one shown in Example 7-83. In the example, we grant alter access to a user ID named ADMIN1 so that it can update the contents of the RS catalog repository.

Example 7-83 Granting alter access to the ADMIN1 user ID

```
PERMIT FRPREP.CATALOG CLASS(XFACILIT) ID(ADMIN1) ACCESS(ALTER)
```

To grant access to individual members that have been protected in RACF (such as in Example 7-80), use a PERMIT statement such as the one shown in Example 7-84. In the example, notice that we grant update access to a user ID named USRUTL10 so that it can update a transaction named PART, which exists in the REPO1 user repository within the IMSPLEX1 IMSplex.

Example 7-84 Granting update access to the USRUTL10 user ID for an individual resource

```
PERMIT FRPMEM.REPO1.DFS.RSC.IMSPLEX1.TRAN.PART CLASS(XFACILIT) ID(USRUTL10) ACCESS(UPDATE)
```

To grant access to all members that have been protected in RACF, use a catch-all PERMIT statement such as the one shown in Example 7-85. In this example, we grant read access to user ID USRUTL20 for all resources that have been protected in the `XFACILIT` class.

Example 7-85 Granting read access to the USRUTL20 user ID for all resources

```
PERMIT FRPMEM.*.*.*.*.*.** CLASS(XFACILIT) ID(USRUTL20) ACCESS(READ)
```

Finally, if you have restricted access to the audit level of your user repository (such as in Example 7-81), you can grant access to specific user IDs to allow the user to modify the audit level.

Important: If a user ID needs RACF UPDATE access for individual members that have been restricted from unauthorized access, the user ID also needs RACF UPDATE access for the actual user repository that these members are contained in. Therefore a separate RACF PERMIT statement is required to ensure this access.

To do so, use a RACF PERMIT statement such as the one shown in Example 7-86. In the example, access to modify the audit level of user repository REPO1 is granted to a user ID named USRZOSMI.

Example 7-86 Granting update access to the USRZOSMI user ID to modify the audit level of REPO1

```
PERMIT FRPAUD.REPO1.DFS.RSC.TYPE CLASS(XFACILIT) ID(USRZOSMI) ACCESS(UPDATE)
```

Tip: You can group several user IDs together for higher efficiency when defining resource profiles and granting access to them. In this case, PERMITs reference RACF group rather than each individual user ID. The following example illustrates this concept in a series of RACF statements that protect a user repository named REPO1 in the `XFACILIT` class and subsequently grant access to them:

- `RDEFINE XFACILIT FRPREP.REPO1 UACC(NONE)`
- `ADDGROUP FRPVIEW`
- `ADDGROUP FRPEDIT`
- `PERMIT FRPREP.REPO1 CLASS(XFACILIT) ID(FRPVIEW) ACCESS(READ)`
- `PERMIT FRPREP.REPO1 CLASS(XFACILIT) ID(FRPEDIT) ACCESS(UPDATE)`
- `CONNECT <VIEWER1> GROUP(FRPVIEW)`
- `CONNECT <VIEWER2> GROUP(FRPVIEW)`
- `CONNECT <VIEWER3> GROUP(FRPVIEW)`
- `CONNECT <UPDATER4> GROUP(FRPEDIT)`
- `CONNECT <UPDATER5> GROUP(FRPEDIT)`

7.11 DRD user interface enhancements

All new and enhanced DRD commands in IMS 12 were incorporated into the DRD user interface (UI). The DRD UI is an ISPF panel-driven interface that assists you in entering various DRD commands. It is in the IMS application called *Manage Resources* (MR), which can be invoked from the IMS Application Menu.

New panels were added to the DRD UI for the following commands:

- **EXPORT DEFN** (in the initial TARGET panel)
- **EXPORT DEFN TARGET(REPO)**
- **IMPORT DEFN** (in the initial SOURCE panel)
- **IMPORT DEFN SOURCE(REPO)**
- **DELETE DEFN**

In addition, existing panels were enhanced for the following existing commands:

- **IMPORT DEFN SOURCE(RDDS)**
- **QUERY DB**
- **QUERY TRAN**
- **QUERY TRAN DESC**
- **QUERY DBDESC**
- **QUERY PGM**
- **QUERY PGMDESC**
- **QUERY RTC**
- **QUERY RTCDESC**

This section shows several example panels for various commands in “list view” unless otherwise noted. This view provides the greatest level of assistance to the user. The alternative view is “syntax view” for more experienced IMS users who are familiar with command format. This section includes only the new panels and panels that were enhanced with additional parameter information. Panels that were not changed, but that now apply to repository DRD (in addition to RDDS DRD), are not shown.

To start the Manage Resources application, follow these steps:

1. Invoke the IMS Application Menu using the following TSO command:

   ```
   ex 'ims12q.sdfsexec(dfsappl)' 'hlq(ims12q)'
   ```

2. In the IMS Application Menu panel (Figure 7-4 on page 264), select option **2** to invoke the Manage Resources application.

```
 Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
                              IMS Application Menu
 Command ===>

 Select an application and press Enter.


         1   Single Point of Control (SPOC)
         2   Manage resources
         3   Reserved for future use
         4   HALDB Partition Definition Utility (PDU)
         5   Syntax Checker for IMS parameters (SC)
         6   Installation Verification Program (IVP)
         7   IVP Export Utility (IVPEX)
         8   IPCS with IMS Dump Formatter (IPCS)
         9   Abend Search and Notification (ASN)


  To exit the application, press F3.

  F1=Help   F12=Cancel
```

Figure 7-4 The IMS Application Menu

The IMS Manage Resources panel (Figure 7-5) opens.

```
 Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 IM12X                        IMS Manage Resources

 Command ===>

 Select an action and press Enter.


 * Action . . . . . .    1. Create new resources
                         2. Delete resources
                         3. Query resources
                         4. Update resources
                         5. Export resources
                         6. Import resources
                         7. Manage RDDS


  F1=Help   F12=Cancel
```

Figure 7-5 The IMS Manage Resources application menu

Several panels for the **EXPORT** command have been enhanced or added to accommodate the IMS repository function.

In the initial EXPORT panel (Figure 7-6), select the target data set for export. In our test environment, we selected option **2**.

```
File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X                            IMS Export

Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Select a source. Press Enter to continue.


* TARGET  . . . . . . . . . . 2  1. RDDS
                                 2. REPO




 F1=Help   F12=Cancel
```

Figure 7-6 Enhanced EXPORT panel in the MR application for target data set selection

In the IMS Export Resource panel (Figure 7-7), which is new in IMS 12, you can set all **EXPORT** command parameter values.

Tip: When navigating through the MR application panels, ensure that your cursor is always placed on the field in which data needs to be entered before pressing Enter. If your cursor is elsewhere on the panel, when you press Enter you might receive an error message.

```
File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X                        IMS Export Resources

Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Press Enter to continue.

                                                                   More:   -
Target . . . . . . . . : REPO

Resource name  . . . . .

Set IMSid  . . . . . . .

STARTTIME  . . . . . . .                       YYYY.DDD HH:MM:SS.TH
ENDTIME  . . . . . . . .                       YYYY.DDD HH:MM:SS.TH

Resource type
  Enter "/" to select types
     ALL     All RSCs & DESCs
     ALLRSC  All resources             ALLDESC  All descriptors
     DB      Database resource         DBDESC   Database descriptor
     PGM     Program resource          PGMDESC  Program descriptor
     RTC     Routing code resource     RTCDESC  Routing code descriptor
     TRAN    Transaction resource      TRANDESC Transaction descriptor

OPTION
  Enter "/" to select options
     ALLRSP  Show all responses        CHANGESONLY Export changes only to REPO
 F1=Help   F12=Cancel
```

Figure 7-7 New EXPORT panel in the MR application for setting parameters (list view)

Figure 7-7 shows the panel in list view, which provides the most assistance to the user. The equivalent panel is shown in Figure 7-8 on page 267, but in syntax view. This view assumes the user is already familiar with command format and parameter values.

```
File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X                       IMS Export Repository

Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Press Enter to continue.



EXPORT DEFN TARGET(REPO)
  NAME(                                                )
  SET(IMSID(                                       ))
  STARTTIME (                        ) YYYY.DDD HH:MM:SS.TH
  ENDTIME (                         ) YYYY.DDD HH:MM:SS.TH
  TYPE(                                                                )
  OPTION(



 F1=Help   F12=Cancel
```

Figure 7-8 New EXPORT panel in the MR application for setting parameters (syntax view)

Several panels for the **IMPORT** command have been enhanced or added to accommodate the IMS repository function. Figure 7-9 shows the initial IMPORT panel that designates the source data set for import.

In the IMS Import panel (Figure 7-9), select a source. In our test environment, we selected option **2**.

```
File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X                             IMS Import

Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Select a source. Press Enter to continue.


* SOURCE  . . . . . .    1. RDDS
                          2. REPO



 F1=Help   F12=Cancel
```

Figure 7-9 Enhanced IMPORT panel in the MR application for source data set selection

In the IMS Import Repository panel (Figure 7-10), which is new in IMS 12, you can set all the **IMPORT** command parameter values.

```
File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X                       IMS Import Repository

Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Press Enter to continue.

                                                                   More:   -
Source . . . . . . . . : REPO

Resource name  . . . . .

Resource type
  Enter "/" to select types
     ALL     All RSCs & DESCs
     ALLRSC  All resources             ALLDESC  All descriptors
     DB      Database resource         DBDESC   Database descriptor
     PGM     Program resource          PGMDESC  Program descriptor
     RTC     Routing code resource     RTCDESC  Routing code descriptor
     TRAN    Transaction resource      TRANDESC Transaction descriptor

OPTION
  Enter "/" to select options
     ABORT   Abort import if error     ALLRSP   Show all responses
     UPDATE  Update runtime defs

SCOPE
  Where to apply update  . . . . . .     1.  All
                                         2.  Active
 F1=Help   F12=Cancel
```

Figure 7-10 New IMPORT panel in the MR application for setting parameters (list view)

Figure 7-10 shows the panel in list view, which provides the most assistance to the user.

The equivalent panel is shown in Figure 7-11, but in syntax view. This view assumes the user is already familiar with command format and parameter values.

```
 File  Action  Manage resources  SPOC  View  Options  Help
 ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 IM12X                       IMS Import Repository

 Command ===>

  sssssssssssssssssssss   Plex . .        Route . .            Wait . .
 Press Enter to continue.


 IMPORT DEFN SOURCE(REPO)
   NAME(                                                 )
   TYPE(                                                                  )
   OPTION(                       )
   SCOPE(             )

F1=Help   F12=Cancel
```

Figure 7-11 New IMPORT panel in the MR application for setting parameters (syntax view)

The panel for the **IMPORT** command that uses the RDDS as a source was also enhanced in IMS 12. It now includes the new **OPTION(UPDATE)** parameter to refresh runtime resource definitions with stored resource definitions residing in the RDDS (Figure 7-12).

```
 File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 IM12X                        IMS Import Resources

 Command ===>

  sssssssssssssssssssss   Plex . .        Route . .            Wait . .
 Press Enter to continue.


 Source . . . . . . . . : RDDS

 Source RDDS data set . .

 Resource type
   Enter "/" to select types
      ALL     All RSCs & DESCs
      ALLRSC  All resources             ALLDESC  All descriptors
      DB      Database resource         DBDESC   Database descriptor
      PGM     Program resource          PGMDESC  Program descriptor
      RTC     Routing code resource     RTCDESC  Routing code descriptor
      TRAN    Transaction resource      TRANDESC Transaction descriptor

 OPTION
   Enter "/" to select options
      ABORT   Abort import if error     ALLRSP   Show all responses
      UPDATE  Update runtime defs

  F1=Help   F12=Cancel
```

Figure 7-12 Enhanced IMPORT panel including the new OPTION(UPDATE) parameter

The first MR application panel for the **DELETE** command was also enhanced to account for the new **DELETE DEFN** command, and is shown in Figure 7-13.

In the IMS Delete panel, select a source. In our test environment, we selected option **2**.

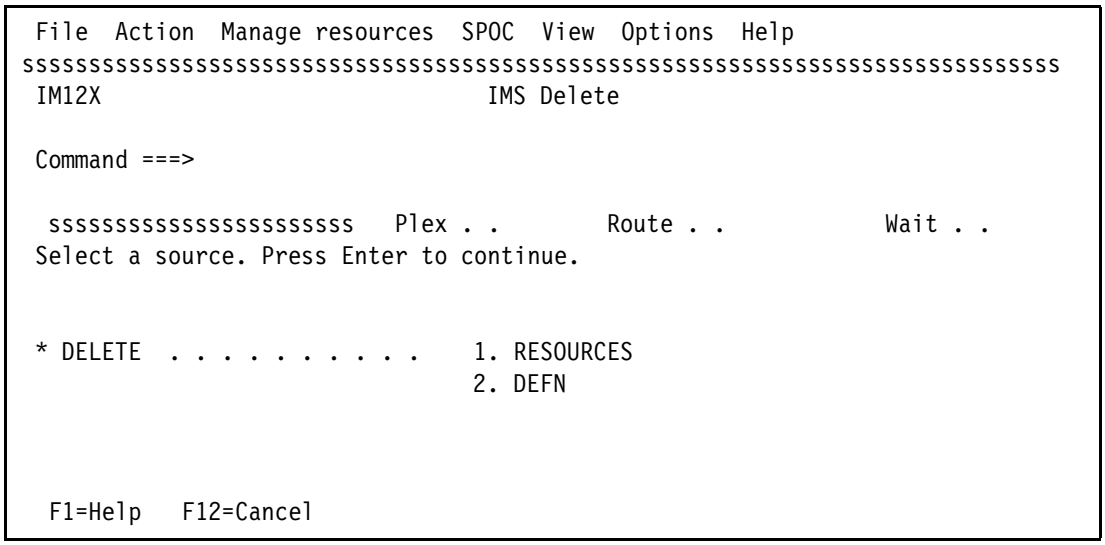

Figure 7-13 Enhanced DELETE panel in the MR application showing the new DEFN keyword

We then arrived at the new panel that was added to the MR application for the **DELETE DEFN** command, which is shown in Figure 7-14.

```
 File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 IM12X                          IMS Delete DEFN

 Command ===>

  sssssssssssssssssssss   Plex . .        Route . .            Wait . .
 Press Enter to continue.



 Target . . . . . : REPO

 Resource name  . . . . .

 For IMSID  . . . . . .

 Resource type
      DB      Database resource         DBDESC   Database descriptor
      PGM     Program resource          PGMDESC  Program descriptor
      RTC     Routing code resource     RTCDESC  Routing code descriptor
      TRAN    Transaction resource      TRANDESC Transaction descriptor

 OPTION
   Enter "/" to select options
      ALLRSP  Show all responses

  F1=Help   F12=Cancel
```

Figure 7-14 New DELETE DEFN panel in the MR application (list view)

The list view panel for the **DELETE DEFN** command is shown in Figure 7-14. The equivalent panel in syntax view is shown in Figure 7-15 on page 273.

```
 File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
 IM12X                       IMS Delete Repository

 Command ===>

  sssssssssssssssssssss   Plex . .        Route . .            Wait . .
 Press Enter to continue.



 DELETE DEFN TARGET(REPO)
   NAME(                                                 )
   IMSID(                                                 )
   TYPE(                                                                  )
   OPTION(                                  )


  F1=Help   F12=Cancel
```

Figure 7-15 New DELETE DEFN panel in the MR application (syntax view)

Lastly, the **QUERY** command panels in the MR application were enhanced to account for the new repository-specific parameter values of **SHOW(DEFN)** and **SHOW(IMSID)**. In our test environment, we used the MR application to query our databases, and took note of these new parameter values shown in Figure 7-16.

```
File  Action  Manage resources  SPOC  View  Options  Help
ssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X              IMS Query Databases by Attribute
Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Press Enter to continue
                                                                More:   -
     OFR       Online forward recovery       STOUPDS   Updates are stopped

TYPE    Filter list by database type
  Enter "/" to select option
     DEDB      Data entry DB                 PHDAM     Master of part. HDAM
     DLI       Full function                 PHIDAM    Master of part. HIDAM
     MSDB      Main storage DB               PSINDEX   Part. secondary index
     PART      HALDB partition

SHOW    Show these columns in the report
  Enter "/" to select option
     ALL       All information            /  IMSID     Resource defs by IMSid
     ACCTYPE   Type of access                LOCAL     LOCAL value
     DEFAULT   Descriptor only               MODEL     Model information
  /  DEFN      Resource definitions          RESIDENT  Resident option
     DEFNTYPE  Definition type               STATUS    Local database status
     GLOBAL    Global value                  TIMESTAMP Various timestamps



 F1=Help      F3=Exit      F4=Showlog   F6=Expand    F9=Swap     F12=Cancel
```

Figure 7-16 Enhanced QUERY panel in the MR application (list view) showing new parameter values

The **QUERY** command panel equivalent to what is shown in Figure 7-16 can be seen in Figure 7-17 in syntax view.

```
File  Action  Manage resources  SPOC  View  Options  Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
IM12X              IMS Query Databases by Attribute               Top of data
Command ===>

 sssssssssssssssssssss   Plex . .        Route . .            Wait . .
Press Enter to continue

QUERY DB NAME(                                                 )
  SHOW( ALL, ACCTYPE, DEFN, DEFNTYPE, GLOBAL, IMSID, LOCAL, MODEL
        RESIDENT, STATUS, TIMESTAMP                                  )
  STATUS( ALLOCF, ALLOCS, BACKOUT, EEQE, LOCK, NOTINIT, NOTOPEN
          OFR, OLR, OPEN, RECALL, RECOV, RNL, STOACC, STOSCHD
          STOUPDS                                                     )
  TYPE( DEDB, DLI, MSDB, PART, PHDAM, PHIDAM, PSINDEX                )



 F1=Help      F3=Exit      F4=Showlog   F6=Expand    F9=Swap     F12=Cancel
```

Figure 7-17 Enhanced QUERY panel in MR application (syntax view) showing new parameter values

7.12 IVP enhancements for repository

This section explains how the IMS IVP application was enhanced to support the IMS repository function.

Several new jobs and tasks, including the following examples, were added to the IVP for repository DRD:

- Creation of the RS catalog data sets and the user repository
- Creation of the RS configuration file
- Execution of the RS startup procedure
- JCL to execute the actions:
  - Start an RS
  - Add a user repository to the RS catalog
  - List user repository status information
  - Populate a user repository
  - Rename a user repository in the RS catalog
  - List detailed information for a single user repository
  - Modify and update user repository definitions
  - Delete a user repository in the RS catalog
  - Delete actual RS catalog and user repository data sets

We used the IVP to set up the required elements for our test environment. Figure 7-18 shows a list of repository-specific jobs and tasks within the IVP.

```
Help
sssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssss
                      Execution (LST Mode) - DBT        Row 266 to 282 of 282
Command ===>                                                 Scroll ===> CSR

Action Codes: Brm Doc Edm eNt eXe Ftl spR
      JOB/Task    Step  Title.........................................
      IV3U101T    U1    NOTE - Intro - IMS Repository Usage For DRD Resour
      IV3U101J    U1    JOB  - Allocate Data Sets
      IV3U102J    U1    JOB  - Start SCI
      IV3U103J    U1    JOB  - Start OM
      IV3U104J    U1    JOB  - Start the Repository Server (RS)
      IV3U105J    U2    JOB  - Add an IMSRSC Repository to the RS Catalog
     IV3U106J   U1   JOB  - Start RM                          ory
      IV3U205J    U2    JOB  - Stop and Rename the IMSRSC Repository
      IV3U206J    U2    JOB  - List Detail Information For a Single Reposi
      IV3U207J    U2    JOB  - Modify / Update Definitions For a Reposit
      IV3U208J    U2    JOB  - Delete a Repository In The RS Catalog Repos
      IV3U209J    U2    JOB  - Request the Repository Server To Start A De
      IV3U401T    U4    z/OS - Shutdown SCI, OM, RM and Repository Server
      IV3U402J    U4    z/OS - Scratch Data Sets
      IV3Z001T    Z0    NOTE - Step Introduction - INDEX to PDS Members
****************************** Bottom of data ******************************



 F1=Help      F3=Exit      F7=Backward  F8=Forward  F10=Actions
```

Figure 7-18 The U-series of steps in the IVP related to the IMS repository function

7.13 Value of using the IMS repository with DRD

The value of using the IMS repository with DRD is clearly shown with its full support for populating, managing, storing, sharing, and retrieving a *consistent* set of DRD stored resource definitions for multiple-IMS IMSplexes and single-IMS IMSplexes all in a centralized location. You will have improved data availability due to the duplexing of stored resource definitions with the ability to have a spare. Migrating to repository DRD is simple because it can be accomplished with commands. An IMS outage is not required to enable or disable the repository function.

When repository DRD is used, operational functionality and flexibility for managing resources across an IMSplex are improved with the following functions:

- Generic resource definition is available along with IMS-specific resource definitions.
- The **EXPORT** process is a single unit or work for an entire IMSplex (all succeeds or all fails).
- The **EXPORT** process is controlled by the user (no **AUTOEXPORT**).
- You can select CHANGESONLY or by time periods.
- Deleting stored resource definitions is controlled by the user.
- You can update by using **IMPORT** on an existing runtime.

- **EXPORT** is reflected in all IMSs in an IMSplex, whether they are up or down at the time.
- **IMPORT SCOPE(ALL)** allows IMSs that are down to be aware of changed definitions at the next restart.
- You can use **QUERY** to show the stored resource definitions from a repository.
- The **DFSINSX0** user exit supports export to a repository.

The IMS repository is considered a strategic IMS architectural direction. Because all stored resource definitions exist in a single, shared data set, consistency is ensured while eliminating your need to maintain and coordinate multiple sets of RDDSs in a multiple-IMS IMSplex. The architecture of the repository ensures consistency and integrity of data without the need for additional controls.

8

Installation and migration considerations

This chapter explains the installation and migration tasks to consider if you are migrating from a supported IBM Information Management System (IMS) release to IMS 12.

This chapter includes the following topics:

- Prerequisites and coexistence
- Fix Category HOLDDATA
- Coexistence with IMS 12
- General coexistence considerations
- Installation Verification Program
- Syntax Checker
- Installation and migration tasks
- Review of migration considerations

8.1 Prerequisites and coexistence

This section describes the prerequisites and coexistence for IMS 12. For detailed information, see *IMS Version 12 Release Planning*, GC19-3019.

8.1.1 Preventive Service Planning

Before you begin installing IMS 12, review the current Preventive Service Planning (PSP) information. The PSP buckets maintain current lists (which have been identified since the package was created) of any recommended or required service for the installation of this package. This service includes software PSP information that contains HIPER and required program temporary fixes (PTFs) against the base release.

If you obtained IMS 12 as part of a Custom-built Product Delivery Option (CBPDO), HOLDDATA is included.

If the CBPDO for IMS 12 is older than two weeks by the time you install the product materials, contact the IBM Support Center or use S/390® SoftwareXcel to obtain the latest PSP bucket information.

You can also obtain the latest PSP bucket information by going to the Preventive Service Planning bucket page at:

`http://www14.software.ibm.com/webapp/set2/psearch/search?domain=psp`

For program support, go to the Software Support website at:

`http://www.ibm.com/software/support/`

Upgrades and Subsets

PSP buckets are identified by Upgrades, which specify product levels, and Subsets, which specify the FMIDs for a product level.

Table 8-1 shows the Upgrade and Subset values for IMS 12.

Table 8-1 IMS 12 PSP Upgrade and Subset ID

Upgrade	Subset or subsets	Description
IMS1200	HMK1200	IMS V12.01.00 System Services
IMS1200	JMK1201	IMS V12.01.00 Database Manager
IMS1200	JMK1202	IMS V12.01.00 Transaction Manager
IMS1200	JMK1203	IMS V12.01.00 Extended Terminal Option
IMS1200	JMK1204	IMS V12.01.00 Recovery Level Tracking
IMS1200	JMK1205	IMS V12.01.00 DB Level Tracking
IMS1200	JMK1206	IMS V12.01.00 Java On Demand features
IMS1200	HIR2220/1020	Internal Resource Lock Manager (IRLM) V2.2
IMS1200	HIR2230 HIR2230/1031	Internal Resource Lock Manager (IRLM) V2.3

8.1.2 Support procedures

Table 8-2 identifies the function modification IDs (FMID) and component IDs (COMPID) for IMS 12 for use when you have to report any problems to your IBM Support Center.

Table 8-2 IMS 12 component IDs

FMID	COMPID	Component name	IBM RETAIN® release
HMK1200	5635A0300	System Services	200
JMK1201	5635A0300	Database Manager	201
JMK1202	5635A0300	Transaction Manager	202
JMK1203	5635A0300	Extended Terminal Option	203
JMK1204	5635A0300	Recovery Level Tracking	204
JMK1205	5635A0300	DB Level Tracking	205
JMK1206	5635A0300	IMS Java On Demand features	206
HIR2220	569516401	Internal Resource Lock Manager V02.02.00	220
HIR2230	569516401	Internal Resource Lock Manager V02.03.00	230

8.2 Fix Category HOLDDATA

SMP/E for z/OS has been extended to help simplify the task of verifying that required software fixes identified in PSP buckets are installed. PSP buckets identify required software fixes for new hardware devices, toleration and coexistence of new software releases, and for enabling new functions. IBM consolidates the lists of required fixes from PSP buckets and produces new Fix Category (FIXCAT) HOLDDATA to identify those fixes.

IMS is now providing fix category data. Examples of IMS 12 categories include IBM.Coexistence.IMS.V12 and IBM.TargetSystem-RequiredService.IMS.V12.

SMP/E uses the new type of ++HOLD statement to identify APARs and their fix categories, and the PTF that resolves the APAR.

The following list is an example of the sequence of events to determine what IMS 12 coexistence service has not been applied:

1. Download the current Enhanced Holddata.
2. Issue the SMP/E **RECEIVE** command on the current Enhanced Holddata.
3. Run the SMP/E **REPORT MISSINGFIX** command (Example 8-1).

Example 8-1 The MISSINGFIX command

```
SET BOUNDARY(GLOBAL) /* IMS Global zone */.
REPORT MISSINGFIX ZONES(targetzone)
FIXCAT(IBM.Coexistence.IMS.V12).
```

The FIXCAT operand can also be used on the **APPLY** and **ACCEPT** commands. Example 8-2 shows the **APPLY** specification. On the **APPLY** command, we use the fix category as the SOURCEID value. SMP/E then applies any PTFs that are included in that fix category.

Example 8-2 Using FIXCAT as part of an APPLY command

```
SET BOUNDARY(targetzone).
APPLY SOURCEID(IBM.Coexistence.IMS.V12) CHECK.
```

8.2.1 IMS-specific fix categories

To enhance the identification of cross-product dependency fixes needed for IMS, the following fix categories have been added to IMS APARs and PTFs:

IBM.Coexistence.IMS.V10
Fixes that allow IMS 8 and 9 to coexist with, and fall back from, IMS 10.

IBM.Coexistence.IMS.V11
Fixes that allow IMS 9 and 10 to coexist with, and fall back from, IMS 11.

IBM.Coexistence.IMS.V12
Fixes that allow IMS 10 and 11 to coexist with, and fall back from, IMS 12.

IBM.TargetSystem-RequiredService.IMS.V10
Fixes required on other IBM products to allow them to run with IMS 10.

IBM.TargetSystem-RequiredService.IMS.V11
Fixes required on other IBM products so that they can run with IMS 11.

IBM.TargetSystem-RequiredService.IMS.V12
Fixes required on other IBM products so that they can run with IMS 12.

8.2.2 Examples of non-IMS-specific fix categories

Another use of fix categories is to identify APARs/PTFs that have been flagged as HIPER.

- IBM.ProductInstall-RequiredService

Other products running on z/OS also include fix categories such as the following examples, which we can use to resolve cross-product dependencies with IMS:

- IBM.Coexistence.z/OS.V1R11
- IBM.Function.SYSPLEXDataSharing
- IBM.Device.Server.z9-EC-2094.zAAP
- IBM.Device.Disk.DS8000-2107

Again, we can use the SMP/E **REPORT MISSING FIX** command used to identify IMS 12 service not installed that has a cross-product dependency with these categories.

For a complete list of FIXCATs, see the IBM Fix category values and descriptions page at:

http://www.ibm.com/systems/z/os/zos/smpe/fixcategory.html

8.3 Coexistence with IMS 12

IMS 12 can coexist with previous versions of IMS. In some cases, migration and coexistence APARs and related PTFs need to be applied to the previous version. See Table B-1 on page 455.

8.4 General coexistence considerations

IMS 12 can coexist with previous versions, so that existing applications and data can be used without change.

Keep in mind the following general coexistence considerations:

- A full build of all application controls blocks (ACBs) for all existing program specification blocks (PSBs) and database descriptor (DBDs) must be run before starting IMS.
- A stage1 and stage2 ALL gen must be run. You must restart online systems with the FORMAT ALL operand.
- If you are installing multiple copies of IMS systems at different release levels sharing the same logical partition (LPAR), all systems must use the latest version of the IMS type-2 and Database Recovery Control (DBRC) type 4-SVCs.
- If you are still using IMS 10, the IMS 12 copy of DFSAFMD0 must be installed.
- The Offline Dump Formatter from IMS 12, IMS 11, or IMS 10 works without modification if the appropriate formatter library is used.
- You must restart and complete or otherwise recover any failed applications before migrating to IMS 12.

Restriction: You cannot restart a failed application with extended restart across different releases of IMS.

8.4.1 DBRC coexistence considerations

Both IMS 10 and IMS 11 need small programming enhancement (SPE) fixes applied to DBRC to support migration to IMS 12 and coexistence with an IMS 12 recovery control (RECON):

- IMS 11 to IMS 12

  IMS 11 DBRC can coexist with IMS 12 if PM05244/UK62971 is applied to IMS 11.
- IMS 10 to IMS 12

  IMS 10 DBRC can coexist with IMS 12 if PM05243/UK62970 is applied to IMS 10.

In both cases, you need to upgrade the RECONs to IMS 12.

UPGRADE RECON

IMS 10 and IMS11 RECONs can be upgraded to IMS 12 by executing the DBRC utility (**DSPURX00**) and using the **CHANGE.RECON UPGRADE** command with an IMS 12 SDFSRESL library.

After the RECON data set has been upgraded, the SPE allows DBRC to convert records to the appropriate release format depending on whether the record is being written or read. This way, IMS 10 and IMS 11 can use the RECONs after they have been upgraded to IMS 12.

However, the SPE does not allow the downlevel DBRC to use the new function.

Restriction: After a RECON data set has been upgraded to the IMS 12 level, it is not accessible to any IMS 10 or IMS 11 systems that does not have the DBRC Coexistence SPE applied.

8.4.2 Exit routine coexistence considerations

The Standard User Exit Parameter List (SXPL) changed with IMS 11. Users who are migrating from IMS 10 to IMS 12 must reassemble any exits that are sensitive to the version of the SXPL.

The user exit enhancements in IMS 11 introduced version 6 of the list (SPXPLVER6). Users migrating from IMS 11 to IMS 12 do not need to make any changes to their exits.

The IMS Connect exit parameter list (HWSEXPRM) was changed in IMS 11. Users migrating to IMS 12 from IMS 10 must reassemble and rebind any IMS Connect user exits that use HWSEXPRM to pick up the changes.

The TM and MSC Message Routing and Control user exit from IMS 10 works without modification with IMS 12, but the routine must be reassembled.

8.4.3 Fast Database Recovery coexistence considerations

A Fast Database Recovery (FDBR) region must be at the same release level as the IMS system it is tracking.

The MODBLKSA, MODBLKSB and MODSTAT data sets are no longer used by FDBR. (The information about MODBLKS is read from the IMS checkpoint log records.) Remove those DD statements from the FDBR job control language (JCL).

8.4.4 Common Queue Server coexistence

The following general coexistence considerations exist for Common Queue Server (CQS):

- A control region at version “n” can register with a CQS at version n, n+1, or n+2.

  A control region cannot register with an earlier CQS.
- A CQS at version “n” can connect to the same CF structure as a CQS at any of the following versions: n-2, n-1, n, n+1, n+2.
- Any supported version of CQS can run on the same central processor complex (CPC).

8.4.5 IMSplex coexistence considerations

This section lists coexistence considerations for IMSplexes.

Common Service Layer coexistence

You can have some Structured Call Interface (SCI), Operations Manager (OM), Resource Manager (RM) and IMS subsystems on IMS 12 while other subsystems are on IMS 10 or IMS 11. IMS 10 and IMS 11 require some coexistence SPEs to work with IMS 12 RM. The recommendation is to use IMS 12 Common Service Layer (CSL) address spaces if any IMS subsystem is running with IMS 12.

Resource management

APAR/PTF PM32951/UK68883 and PM19025/UK63960 are required on IMS 10 if a CSL RM version 1.3 is being used.

APAR/PTF PM32766/UK68882 and PM19026/UK63964 are required on IMS 11 if a CSL RM version 1.4 is being used.

8.4.6 Program specification blocks changes

IMS 12 includes changes to the database descriptor vector table and the PSB prefix. For an IMS 10 or IMS 11 DLIBATCH or ACBGEN job to use a PSB generated with the IMS 12 macros, you need to apply APAR/PTF PM23840/UK64012 to IMS 10 and APAR/PTF PM23843/UK64013 to IMS 11.

8.4.7 Generalized sequential access method changes

If a PSB that uses a generalized sequential access method (GSAM) database is generated by using IMS 12 macros and ACBGENed is generated by using IMS 11 or IMS 10, you must apply APAR/PTF PM32548/UK65496 to IMS 10 and apply APAR/PTF PM32390/UK65495 to IMS 11 for coexistence.

8.4.8 Log records

If you have any application programs that process IMS log records, determine whether the programs are affected by the changes to the log records.

You can assemble DSECTs for IMS log records by using the ILOGREC macro.

Table 8-3 shows the log records that are new or changed with IMS 12.

Table 8-3 New or changed log records for IMS 12

Type	Action	Description
x'22'	Changed	New subcodes x'0D' for recoverable **UPDATE POOL** command, and x'0E' for recoverable **UPDATE** IMS command.
x'4507'	Changed	New logger statistics for OLDS and write-ahead data set (WADS).
x'4513'	Changed	New MSC statistics for TCP/IP links.
x'6701'	Changed	Macro DFSL6701 changed to bilingual.
x'67D0'	Changed	Added subtype x'1B' for long lock timeout, subtype x'15-01' internal processing errors, and DFSBCB section for subtype x'02'.
x'9904'	Changed	RACF user ID is added when they are produced by batch (DLI or DBB) jobs.

8.4.9 MSC coexistence considerations

IMS 10 and later systems support IMS Multiple Systems Coupling (MSC) and shared-queue networks of mixed IMS releases.

The TM and MSC Message Routing and Control user exit routine (DFSMSCE0) from IMS 10 and IMS 11 works without modification with IMS 12, but the exit must be reassembled.

New function is added to the IMS 12 sample DFSMSCE0 exit for XCF/AOS.

8.4.10 Syntax Checker coexistence considerations

The IMS 12 Syntax Checker supports IMS 10, IMS 11, and IMS 12. Ensure that the version shown is correct when using Syntax Checker to check parameters from earlier versions of IMS.

8.4.11 IMS utilities coexistence considerations

The Batch Backout, Log Archive, Log Recovery, Log Merge, and Log Analysis utilities function properly only when they process data that was created by an IMS subsystem or batch application program that is at the same release level as the utility program.

The IMS 12 Database Recovery (**DFSURDB0**) utility accepts log, image copy, HISAM unload, and change accumulation (CA) data sets from IMS 10, IMS 11, or IMS 12.

The IMS 12 Database Change Accumulation (**DFSUCUM0**) utility accepts log and CA data sets from IMS 10, IMS 11, or IMS 12.

Therefore, you must use the following tools:

- Use DBRC with all Database Change Accumulation and Database Recovery jobs, especially during migration and coexistence.
- Use the IMS 12 utilities when the input data contains logs, image copies, or CA data sets created by the IMS 12 system.

8.4.12 IMS Tools migration and coexistence

The IBM DB2 and IMS Tools enhance the performance of IMS and DB2. These tools have been upgraded and enhanced to work with IMS 12.

For complete information about these tools, including the IMS versions that they support, see the DB2 and IMS Tools for System z page at:

http://www.ibm.com/software/data/db2imstools

8.4.13 IBM Information Center

The IBM Information Management Software for z/OS Solutions Information Center has been updated to include information about IMS 12. You can find the information center at:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

8.5 Installation Verification Program

The Installation Verification Program (IVP) process provides materials that you can use as a guide to working with your own IMS systems. The IVP process includes:

- Data set allocation
- Post-installation activities on target libraries
- System definition activities
- SVC considerations
- Authorization considerations
- IMS system preparation activities
- IMS system and application execution activities

8.5.1 Enhancements overview

The IVP is enhanced to add support for the IMSRSC Repository.

In IMS 10 and later, the Variable Export utility can be directly accessed as an option from the IVP Phase Selection panel. With this utility, you can build a data set on IMS 10 or IMS 11 to import into the IVP for IMS 12.

To export IVP variables from IMS 11 and import them into IMS 12, complete the following steps starting with the IVP for IMS 11:

1. In the IVP Environment Options panel (Figure 8-1), select option **3**.

```
Help
 ..............................................................................
       IVP            IVP Environment Options            IMS 11.1
 Command ===>

 Select the desired option and pr··· Enter.

 Option . . 3
              IVP Environments

              1. DBB - Database Management (Batch)

              2. DBC - Database Management (DBCTL)

              3. DBT - Database and Transaction Management (DB/DC)

              4. XRF - DB/DC with Extended Recovery Facility (DB/DC with XRF)

              5. DCC - Transaction Management (DCCTL)


   ..................................................................
   · DFSIX023: DFSIXX01 - Prior session completed successfully for "DBT" ·
   ..................................................................
```

Figure 8-1 Starting the IMS 11 IVP dialog

2. Start the IMS 11 IVP dialog the normal way by selecting option **6** of ISPF or from the IMS 11 DFSAPPL panel (Figure 8-2). You can go directly to the variable export function from the IMS 11 DFSAPPL menu. You then run the export process starting from the IVP Variable Export Utility panel (Figure 8-6 on page 291).

```
 Help
.------------------------------------------------------------------------.
                          IMS Application Menu
  Command ===>

  Select an application and press Enter.

           1   Single Point of Control (SPOC)
           2   Manage resources
           3   Knowledge-Based Log Analysis (KBLA)
           4   HALDB Partition Definition Utility (PDU)
           5  Syntax Checker for IMS parameters (SC)
           6   Installation Verification Program (IVP)
           7   IVP Export Utility (IVPEX)
           8   IPCS with IMS Dump Formatter (IPCS)
           9   Abend Search and Notification (ASN)

To exit the application, press F3.

            .--------------------------------------------.
            · Copyright IBM Corp. 2003. All rights reserved.  ·
            '--------------------------------------------'
```

Figure 8-2 IMS 11 DFSAPPL menu

3. After the IVP starts, in the Sub-Option Selection - DBT panel (Figure 8-3), select the suboptions that you normally use for IMS 11. The IMS 11 IVP uses your existing INSTALIB and INSTATBL data sets. The only function that we are accessing from the IVP at this time is the export variables option. Therefore, on the Sub-Option Selection panel, press Enter.

```
Help
 ..............................................................................
 IVP                Sub-Option Selection - DBT                IMS 11.1
 Command ===>

 Select the desired Sub-Options and press ENTER

    IRLM - Use IRLM in IVP Applications
 /  FP   - Use Fast Path in IVP Applications
 /  ETO  - Use Extended Terminal Option
    CQS  - Add CQS to CSL Applications
 /  RACF - Use RACF Security
 /  JAVA - Use JAVA Applications
    PRA  - Use Parallel RECON Access
 /  ICON - Use IMS Connect
 /  OPDB - Use Open Database Sample

   Note: Your Sub-Option selection affects the user variables, jobs, and tasks
   that will be presented.  If you later change your selection, you must redo
   the IVP Table Merge, Variable Gathering, File Tailoring, and Execution
   processes. RACF is required when Java sub-option is selected.
```

Figure 8-3 Selecting the suboptions

4. In the Table Merge Request - DBT panel (Figure 8-4), choose option **2**, Use existing tables. Press Enter.

```
Help
 ..............................................................................
  IVP               Table Merge Request - DBT               IMS 11.1
 Command ===>


 The IVP Dialog is driven from a set of ISPF tables which contain information
 about the variables, JOBs, TASKs and sequence of presentation you will need to
 perform the verifications.

 Since the tables will be updated by the dialog, working copies must be made
 the first time you use the dialog.

 If service is applied to your IMS system, or if you decide to use the IVP
 dialog to build a different environment, then either the existing copies must
 be updated or new copies created.

 Please indicate whether you wish to perform Table Merge/Create:

 2  1. YES - Create / Update working tables from master tables.
    2. NO  - Use existing tables.
```

Figure 8-4 Selecting the Use existing tables option

5. In the IMS 11 IVP Phase Selection panel (Figure 8-5), choose option **A**, and then press Enter.

```
Help
 ..............................................................................
      IVP             IVP Phase Selection - DBT             IMS 11.1
 Command ===>


 Select the desired Phase and positioning option and press ENTER
 A   A.  Variable Export Utility (Export variables to a data set)

     VG s Variable Gathering s (Define user values for variables)
     1.  VG1 Start/Restart from the beginning of the phase
     2.  VG2 Start/Restart from the last known position within the phase

     FT s File Tailoring s (Create customized INSTALIB members)
     3.  FT1 Start/Restart from the beginning of the phase
     4.  FT2 Start/Restart from the last known position within the phase
     5.  FT3 Start/Restart from the beginning of a selected step

     EX s Execution s (Run the IVP jobs)
     6.  EX1 Start/Restart from the beginning of the phase
     7.  EX2 Start/Restart from the last known position within the phase
     8.  EX3 Start/Restart from the beginning of a selected step
```

Figure 8-5 Choosing option A for variable export

6. In the IVP Variable Export Utility panel (Figure 8-6), complete these steps:
   a. Choose the type of IVP to be exported.
   b. Enter the HLQ value for the INSTATBL data set and the name of the data set that you will use to hold the exported variables.

      The export function writes the current value as XML. The export data set is a simple flat file (or PDS/PDSE member) and can be edited, with care, to globally change values as needed before import. For example, change any occurrences of a high level qualifier that has IMS version as part of its name before running the import. This approach saves time when you run the import and variable gathering phases in the IMS 12 IVP dialog.

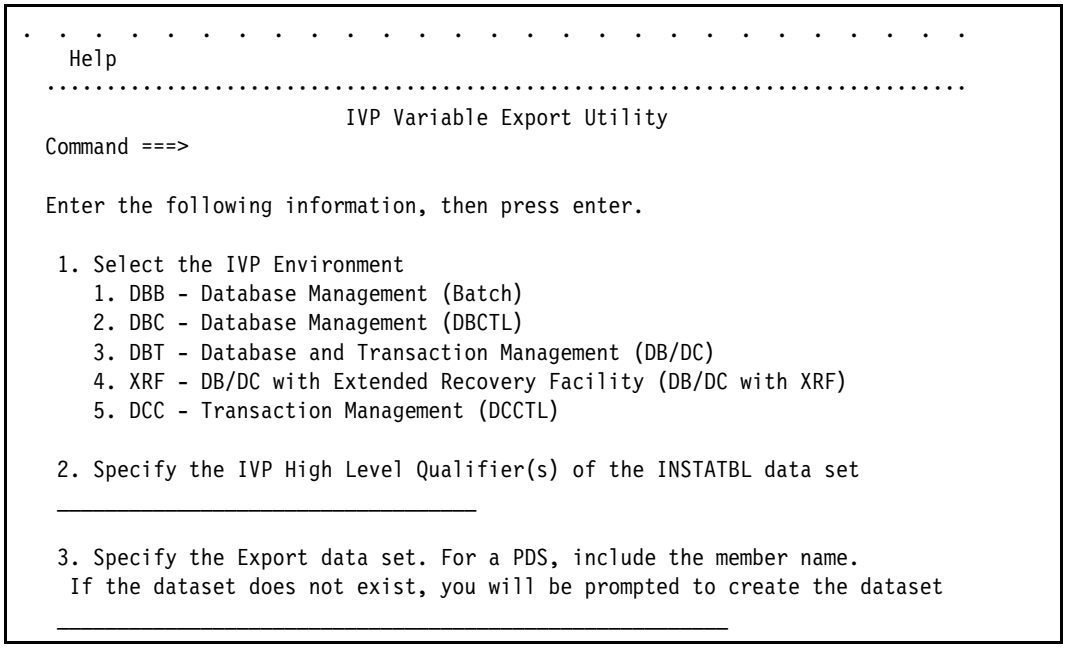

Figure 8-6 Entering the INSTATBL and export data set names

To avoid the need to change JES to add the IMS 12 PROCLIB so that the IMS cataloged procedures can be executed without JCL error, you can update these two variables in the export data set (Example 8-3).

Example 8-3 XML variables in the IVP Export file

```
<var>IXUJESC3</var> <val>// JCLLIB ORDER=IMS12Q.PROCLIB</val>
<var>IXUJESC2</var> <val>/*JOBPARM S=*</val>
```

Updating the variables ensures that all JCL created by the file tailoring phase 3 (FT3) process for IMS 12 includes the statements in Example 8-4. This way, all jobs submitted on any z/OS in your sysplex can find cataloged procedures from your IMS 12 PROCLIB data set.

Example 8-4 Additional JCL generated by the IVP file tailoring process

```
/*JOBPARM S=*
// JCLLIB ORDER=IMS12Q.PROCLIB
```

7. Start the IMS 12 IVP dialog for the first time, either from option **6** by directly running the IVP program (DFSIXC01), or from the IMS 12 DFSAPPL menu program. Figure 8-7 shows how to start the IVP dialog directly.

```
Menu  List  Mode  Functions  Utilities  Help
 ..............................................................................
                              ISPF Command Shell
 Enter TSO or Workstation commands below:

 ===> ex 'ims12q.sdfsclst(dfsixc01)' 'hlq(ims12q)'



 Place cursor on choice and press enter to Retrieve command

 => ex 'ims12q.sdfsexec(dfsappl)' 'hlq(ims12q)'
 =>
 =>
 =>
 =>
 =>
 =>
 =>
 =>
 =>
```

Figure 8-7 Invoke the IVP dialog from ISPF

8. In the logo panel (Figure 8-8), which is displayed the first time you run the IMS 12 IVP, press Enter to close it. On subsequent runs, you start at the environment selection panel (Figure 8-10 on page 293).

```
                    ==== ===       ===  ==== ==
                    ==== ====     ==== ========
                     ==   ====   ====   ===  ==
                     ==   ===== =====     ===
                     ==   == ===== ==       ===
                     ==   ==  ===  ==  ==    ===
                    ==== ===  ===  === =========
                    ==== ===   =   === == =====


                Information Management System  (IMS)


                           IVP  Dialog
                              for
                          IMS Version 12.1


                   ENTER to continue or  END to exit
```

Figure 8-8 The IMS 12 IVP logo panel

9. In the IMS notices panel (Figure 8-9), which is only displayed the first time you access the system, press Enter.

```
                  Information Management System (IMS) Version 12.1

                  Licensed Materials - Property of IBM


                   Restricted Materials of IBM


                  5635-A03     Copyright IBM Corp. 1974,2010
                  All Rights Reserved.

                  US Government Users Restricted Rights -
                  Use, duplication or disclosure restricted by
                  GSA ADP schedule contract with IBM Corp.
```

Figure 8-9 IMS 12 IVP Notices pane (presented the first time only)

10. In the IMS 12 IVP Environment Options panel (Figure 8-10), choose the type of IMS system that will be built by the IMS 12 IVP. Most likely your choice is the same type used to start the IMS 11 IVP dialog (Figure 8-1 on page 287) or to export the IMS 11 IVP variables shown in Figure 8-6 on page 291.

```
Help
 ..............................................................................
       IVP            IVP Environment Options            IMS 12.1
 Command ===>

 Select the desired option and press Enter.


 Option . .
              IVP Environments

              1. DBB - Database Management (Batch)

              2. DBC - Database Management (DBCTL)

              3. DBT - Database and Transaction Management (DB/DC)

              4. XRF - DB/DC with Extended Recovery Facility (DB/DC with XRF)

              5. DCC - Transaction Management (DCCTL)
```

Figure 8-10 Choosing the IMS system environment

11. In the Sub-Option Selection panel (Figure 8-11), select the suboptions to use for the IMS 12 IVP. Ensure that your selections in this panel include the same options as used on IMS 11 plus any additional options you want to use on IMS 12. For more information, see Figure 8-3 on page 289. Then press Enter.

```
Help
 ..............................................................................
 IVP                 Sub-Option Selection -                   IMS 12.1
 Command ===>


 Select the desired Sub-Options and press ENTER

 /  IRLM - Use IRLM in IVP Applications
 /  FP   - Use Fast Path in IVP Applications
 /  ETO  - Use Extended Terminal Option
    CQS  - Add CQS to CSL Applications
    RACF - Use RACF Security
    JAVA - Use JAVA Applications and Open Database
    PRA  - Use Parallel RECON Access
    ICON - Use IMS Connect
    REPO - Use IMSRSC Repository
    COUT - Use Callout Applications

   Note: Your Sub-Option selection affects the user variables, jobs, and tasks
   that will be presented.  If you later change your selection, you must redo
   the IVP Table Merge, Variable Gathering, File Tailoring, and Execution
   processes. RACF is required when Java sub-option is selected.
```

Figure 8-11 Choosing the IVP suboptions

12. In the Sub-Option Change Verification panel (Figure 8-12), confirm your selections and then press Enter if the list is correct.

```
Help
 ------------------------------------------------------------------------
                  Sub-Option Change Verification - DBT
 Command ===>


   The Sub-Options you have just chosen are not the same as the Sub-Options
   which were last active. If you change Sub-Options, Table Merge and the three
   Dialog Phases must be re-run from the beginning.

   From To
   Y    Y   - IRLM - Use IRLM in IVP Applications (not available for DCCTL)
   Y    Y   - FP - Use Fast Path in IVP Applications (not available for DCCTL)
   Y    Y   - ETO - Use ETO (not available for Batch and DBCTL)
   N    Y   - CQS - Add CQS Applications (not available for Batch and DBCTL)
   N    Y   - RACF - Use RACF Security (not available for Batch)
   N    Y   - JAVA - Use JAVA Applications and Open Database
   N    N   - PRA - Use Parallel RECON Access (not available for Batch)
   N    Y   - ICON - Use IMS Connect
   N    Y   - REPO - Use IMS Repository
   N    Y   - COUT - Use Callout Applications

   To confirm your change of Sub-Options: Press ENTER
   To return to the Sub-Option Selection menu: Press END
```

Figure 8-12 Confirming your suboption selections

13. In the Table Merge Request panel (Figure 8-13), accept the default selection of option **1**, and then press Enter to begin the table merging process.

```
Help
 ------------------------------------------------------------------------
  IVP               Table Merge Request - DBT               IMS 12.1
 Command ===>


 The IVP Dialog is driven from a set of ISPF tables which contain information
 about the variables, JOBs, TASKs and sequence of presentation you will need to
 perform the verifications.

 Since the tables will be updated by the dialog, working copies must be made
 the first time you use the dialog.

 If service is applied to your IMS system, or if you decide to use the IVP
 dialog to build a different environment, then either the existing copies must
 be updated or new copies created.

 Please indicate whether you wish to perform Table Merge/Create:

 1  1. YES - Create / Update working tables from master tables.
    2. NO  - Use existing tables.
```

Figure 8-13 Choosing to create or update the working tables

Figure 8-14 shows table merge running. No actions are required on this panel.

```
IVP            VG Table Merge In Progress - DBT            IMS 12.1


                      Table Merge Progress Indicator

                  Variable Gathering Table . . : DFSIXBV3
                     Current Row . . . . . . . : IXUMBKA
                     Percent completed . . . . : 59

                  File Tailoring Table . . . . : DFSIXBF3
                     Current Row . . . . . . . : Patience
                     Percent completed . . . . : 000

                  Execution Table  . . . . . . : DFSIXBE3
                     Current Row . . . . . . . : Patience
                     Percent completed . . . . : 000


                  Please do not interrupt this process.
```

Figure 8-14 Variable Gathering Table Merge runs as normal

While the table merge process runs, your panel shows an update of the progress. Do not interrupt that variable gathering table merge process.

14. When table merge is complete and the completion panel (Figure 8-15) is displayed, press Enter.

    When variable gathering table merge is complete the Phase Complete flags are reset, which forces you to revisit the Variable Gathering phase 1 (VG1) and File Tailoring phase 3 (FT3) phases before moving to the Execution phase 6 (EX6) phase. In Phase VG1, you can import the variables that have been exported from IMS 11.

```
Help
 ..............................................................................
 IVP             Table Merge has completed - DBT              IMS 12.1
 Command ===>


 The Table Merge process has completed and the Phase Complete flags have
 been turned off for all phases.

 If Table Merge has just been performed for the first time for this option,
 then the resetting of Phase Complete flags is of no special interest.

 If Table Merge has been performed for some other reason, then the resetting
 of Phase Complete flags will force you to revisit each of the phases in
 sequence (Variable Gathering, File Tailoring, and Execution).  Make use of
 this opportunity to examine the tables for changes (the "!" indicator will
 be set in the action field for items which have been added or changed by
 service).  Your position in each phase has been retained so that you may
 return to your last position after you have browsed for changes.

 Press ENTER to continue.
```

Figure 8-15 Table Merge process completed

15. In the IVP Phase Selection panel (Figure 8-16), accept the preselected option of VG 1 and then press Enter to start the Variable Gathering phase 1.

```
Help
 ...............................................................................
      IVP             IVP Phase Selection - DBT             IMS 12.1
 Command ===>


 Select the desired Phase and positioning option and press ENTER
 1   A.  Variable Export Utility (Export variables to a data set)

     VG s Variable Gathering s (Define user values for variables)
     1.  VG1 Start/Restart from the beginning of the phase
     2.  VG2 Start/Restart from the last known position within the phase

     FT s File Tailoring s (Create customized INSTALIB members)
     3.  FT1 Start/Restart from the beginning of the phase
     4.  FT2 Start/Restart from the last known position within the phase
     5.  FT3 Start/Restart from the beginning of a selected step

     EX s Execution s (Run the IVP jobs)
     6.  EX1 Start/Restart from the beginning of the phase
     7.  EX2 Start/Restart from the last known position within the phase
     8.  EX3 Start/Restart from the beginning of a selected step
```

Figure 8-16 Choosing the Variable Gathering phase 1

16. In the Variable Gathering (LST Mode) - DBT panel (Figure 8-17), enter the special “IMP” action code to start the variable gathering import process. Ignore any variable values that you see prefilled in this panel. The import process replaces them.

```
Help
 ..............................................................................
 IVP          Variable Gathering (LST Mode) - DBT          .. Row 1 to 9 of 207
 Command ===>                                                 Scroll ===>

   Action Codes: Chg Doc eNt Rfr Imp Exp -- CHG is default if item modified
       Variable  =  Value.............................................
           Var-Title..................................................
 IMP   IXUIVPHQ  =  IMS12Q
           IVP - High level DSNAME qualifier for IVP (IVP) data sets
 !     IXURLMHQ  =  IVPRLM11
           IVP - High level DSNAME qualifier for IRLM (RLM) data sets
 *     IXUDLBHQ  =  IMS12Q
           IVP - High level DSNAME qualifier for IMS DLIB (DLB) data sets
 *     IXUSYSHQ  =  IMS12Q
           IVP - High level DSNAME qualifier for IMS System (SYS) data sets
 !     IXUEXEHQ  =  IVPEXE11
           IVP - High level DSNAME qualifier for Execution (EXE) data sets
 !     IXUUTLHQ  =  IVPUTL11
           IVP - High level DSNAME qualifier for Utility (UTL) data sets
 !     IXUVSMHQ  =  IVPVSM11
           IVP - High level DSNAME qualifier for VSAM (VSM) data sets
 !     IXUSSCLS  =
           SMS - Storage Class
 !     IXUSMCLS  =
           SMS - Management Class
```

Figure 8-17 Entering the special IMP action code

17. After starting the variable import function, in the IVP Export File Name panel (Figure 8-18), enter the name of the XML data set exported from IMS 11.

```
                    IVP Export File Name
 Command ===>

 Enter the name of the IVP Export Dataset, then press
 enter:

  Export Dataset:
  ____________________________________________
```

Figure 8-18 Entering the IVP Variables Export data set from IMS 11

18. Enter the name of the data set (or PDS/PDSE member) that contains the variables that you have exported from IMS 11 then press Enter.

While each variable is read and updated from the XML file being imported, a progress panel (Figure 8-19) is displayed to show the status of the process.

```
IVP          Variable global change In Progress - DBT          IMS 12.1




                Global update in progress for  . . : IXUMBKB


                   Please do not interrupt this process.
```

Figure 8-19 All variable are now updated from the IMS 11 exported data

The variable gathering process has a progress indicator to show which variables have been updated using the data from IMS 11. Do not interrupt this variable update process.

Now that the variable import process is complete, we return to variable gathering phase 1 but with the values read from the IMS 11 system (Figure 8-20).

```
Help
 ..............................................................................
 IVP          Variable Gathering (LST Mode) - DBT          .. Row 1 to 9 of 207
 Command ===>                                                 Scroll ===> PAGE

   Action Codes: Chg Doc eNt Rfr Imp Exp -- CHG is default if item modified
       Variable  =  Value.............................................
           Var-Title..................................................
 *     IXUIVPHQ  =  IMS11B
           IVP - High level DSNAME qualifier for IVP (IVP) data sets
 !     IXURLMHQ  =  IVPRLM11
           IVP - High level DSNAME qualifier for IRLM (RLM) data sets
 *     IXUDLBHQ  =  IMS11B
           IVP - High level DSNAME qualifier for IMS DLIB (DLB) data sets
 *     IXUSYSHQ  =  IMS11B
           IVP - High level DSNAME qualifier for IMS System (SYS) data sets
 *     IXUEXEHQ  =  IMS11B.IMS11D
           IVP - High level DSNAME qualifier for Execution (EXE) data sets
 *     IXUUTLHQ  =  IMS11B
           IVP - High level DSNAME qualifier for Utility (UTL) data sets
 *     IXUVSMHQ  =  IMS11B.IVPVSM11
           IVP - High level DSNAME qualifier for VSAM (VSM) data sets
 !     IXUSSCLS  =
           SMS  ..............................................
 !     IXUSMCLS · Import of Variables completed Successfully ·
           SMS  ..............................................
```

Figure 8-20 Changing the variables as needed from the IMS 11 values

You have now imported the variables from IMS 11. Review all the imported values and change them as needed for the new IMS 12 system.

8.5.2 File tailoring

After the variable gathering is complete, press End to terminate the process and to move on to the file tailoring phase 3 (FT3) process.

8.5.3 IVP jobs and tasks

The jobs and tasks that are presented in groups by the IVP dialog are determined by your choice of environment option and distribution media.

The last group listed, Steps Zx for index of additional PDS members, does not identify jobs or tasks in the IVP process. It identifies the members of DFSSLIB and DFSISRC libraries that support the IVP process.

Figure 8-21 shows a sample of the initials jobs and tasks presented by the IVP dialog.

```
Help
 ________________________________________________________________________________
                        Execution (LST Mode) - DBT           Row 1 to 20 of 282
 Command ===>                                                  Scroll ===> PAGE

 Action Codes: Brm Doc Edm eNt eXe Ftl spR
       JOB/Task    Step  Title.....................................
 !     IV3A001T    A0    NOTE - Introduction - Dialog Set-up
 !     IV3A301N    A3    CLIST - Offline Formatted Dump - IVP1/2/3/4
 !     IV3A302N    A3    CLIST - Offline Dump Formatter - BATCH
 !     IV3A303N    A3    CNTRL - MSDB Load Cntrl Stmts - DBFSAMD1/DBFSAMD2
 !     IV3C001T    C0    NOTE - Introduction - System Definition
 !     IV3C101J    C1    JOB  - Alloc SYSDEF Data Sets
 !     IV3C105J    C1    JOB  - Assembly/Bind RACF Security Exits
 !     IV3C201T    C2    TASK - Browse the STAGE1 Source Deck
 !     IV3C202J    C2    JOB  - Run SYSDEF Preprocessor
 !     IV3C203J    C2    JOB  - Run SYSDEF STAGE1
 !     IV3C301J    C3    JOB  - Run SYSDEF STAGE2      >>> SEE DESCRIPTION
 !     IV3C401J    C4    JOB  - Run SMP/E JCLIN
 !     IV3C405T    C4    TASK - Edit IMS PROCLIB Members
 !     IV3D001T    D0    NOTE - Introduction - z/OS and VTAM Interface
 !     IV3D101T    D1    XMPL - Allocate Interface Data Sets
 !     IV3D200T    D2    XMPL - Update JESx Procedure
 !     IV3D201T    D2    XMPL - Update IEAAPFxx or PROGxx - Authorized DSN
 !     IV3D202T    D2    XMPL - Update IEALPAxx - MLPA Modules
 !     IV3D206T    D2    XMPL - Update IEFSSNxx - RLM Subsystem Names
 !     IV3D207T    D2    XMPL - Update IEASVCxx - SVC Numbers
```

Figure 8-21 Execution phase 6 of the IMS 12 IVP

You can print additional documentation for the IVP jobs, tasks, and variables by using the DOC action during the file-tailoring phase or the execution phase of the IVP dialog. Use the IVP dialog to obtain current information regarding IVP jobs and tasks. In these lists, the jobs and tasks are presented in the same sequence that is used by the IVP dialog.

Table 8-4 lists the naming convention used for jobs and tasks presented as `IV_ssnnt`.

Table 8-4 IVP naming convention for jobs and tasks

IV_*ssnnt*	**Meaning**	**Description**
_	Underscore	The environment that you selected on the first panel: 1: DBB - Batch 2: DBC - DBCTL 3: DBT - DB/DC 4: XRF - DB/DC with XRF 5: DCC - DCCTL
ss	Step	IVP step
nn	Number	The number of the item within the step
t	Item type	**J (JOB)** A PDS member with the same name is placed into INSTALIB during the file-tailoring phase. Items of type J are intended to be submitted for execution. **T (Task)** Tasks represent items of work that must be prepared by the user. For some tasks, an example is provided in the INSTALIB data set. These examples are not intended for execution. **N (Supporting materials)** The INSTALIB data set can also contains members that support other jobs such as CLISTs and control statements.

8.5.4 Executing IVP tailored jobs and tasks

The IVP provides a set of example JCL that you can tailor to your environment in the variable gathering phase. It is normal to run through each of the steps sequentially. This process builds your IVP system and runs each function that you selected on the Sub-Option Selection panel (Figure 8-11 on page 294).

To run the IVP jobs and tasks, complete the following steps:

1. In the IVP Phase Selection panel, select option **6**, **7**, or **8**. Each selection within a phase provides a different positioning option.
2. Open each job or task. To view the instructions for each job and task, use the **ENT** action command.

   For IVP jobs you can browse, edit, or submit the job. Some items are nonexecutable examples, but the browse and edit actions are available to create an executable version of nonexecutable items.

   For IVP tasks, you are provided a scrollable description to assist you in performing the task.
3. Press End or PF3 when you are done.
4. Press Enter again if you completed the execution of all jobs and tasks, or press End to save your work if you want to complete the execution phase later.

8.5.5 Changes to the IVP for IMS 12

IMS 12 has added an IVP for the IMS Repository.

Prerequisite jobs and tasks for the IMS Repository

Before executing the IMS Repository IVP, complete the following steps:

- Cx system definition (SYSDEF) steps

  The C series of steps includes the jobs needed to build the SDFSRESL with a stage1 and stage2 system generation.

- Ex Build IVP Appl/System steps

  The E series of steps includes the jobs needed to compile and bind application programs and the steps that add sample control statements to the IMS PROCLIB data set.

IVP IMS Repository jobs and tasks

Figure 8-22 shows the new jobs and tasks that are file tailored when you choose the **REPO - Use IMSRSC Repository** option in the Sub-Option Selection panel (Figure 8-11 on page 294).

```
Help
 ______________________________________________________________________________
                        Execution (LST Mode) - DBT        Row 266 to 282 of 282
 Command ===>                                                 Scroll ===> PAGE

 Action Codes: Brm Doc Edm eNt eXe Ftl spR
       JOB/Task    Step  Title.....................................
 !     IV3U101T    U1    NOTE - Intro - IMS Repository Usage For DRD Resour
 !     IV3U101J    U1    JOB  - Allocate Data Sets
 !     IV3U102J    U1    JOB  - Start SCI
 !     IV3U103J    U1    JOB  - Start OM
 !     IV3U104J    U1    JOB  - Start the Repository Server (RS)
 !     IV3U105J    U2    JOB  - Add an IMSRSC Repository to the RS Catalog
 !     IV3U106J    U1    JOB  - Start RM
 *     IV3U202J    U2    JOB  - List Status Information For All Repositorie
 !     IV3U204J    U2    JOB  - Populate the IMSRSC Repository
 !     IV3U205J    U2    JOB  - Stop and Rename the IMSRSC Repository
 !     IV3U206J    U2    JOB  - List Detail Information For a Single Reposi
 !     IV3U207J    U2    JOB  - Modify / Update Definitions For a Reposit
 !     IV3U208J    U2    JOB  - Delete a Repository In The RS Catalog Repos
 !     IV3U209J    U2    JOB  - Request the Repository Server To Start A De
 !     IV3U401T    U4    z/OS - Shutdown SCI, OM, RM and Repository Server
 !     IV3U402J    U4    z/OS - Scratch Data Sets
 !     IV3Z001T    Z0    NOTE - Step Introduction - INDEX to PDS Members
 ******************************* Bottom of data ********************************
```

Figure 8-22 IMS 12 IVP Phase U: IMS Repository Usage For DRD Resources

Three of these steps are familiar if you have run any of the IVP steps that use the CSL functions. The RM cannot be started before the repository is running. Other new steps are listed here:

- IV_U101J scratches and reallocates the data sets needed to perform the Repository usage for DRD resources.
- IV_U104J starts the repository server address space.
- IV_U105J adds an IMSRSC repository to the repository server's catalog and then starts it.

- IV_U202J lists status information for all repositories.
- IV_U204J populates data into the IMS repository:
  a. It converts the data in MODBLKS into the RDDS format.
  b. It copies data from RDDS data set to the IMS repository.
- IV_U205J renames the IMS repository in the repository catalog.
- IV_U206J lists detailed status information for a single repository. See Example 8-5 for sample output.

Example 8-5 Example of output from job IV_U206J

```
LIST REPOSITORY(IMS12XRP)
Repository Name . : IMS12XRP

 Last updated date/time  : 2011/07/26 01:44:31  IMSR3
 Status  . . . . . . . . : OPEN
 Auto-open . . . . . . . : YES
 Security Class  . . . . : NOT DEFINED

Repository Data Set pair 1
 Index (RID) . . : IMS12Q.IMS12X.REPO.IMSPRI.RID
 Member (RMD)  . : IMS12Q.IMS12X.REPO.IMSPRI.RMD
 Status  . . . . : COPY1

Repository Data Set pair 2
 Index (RID) . . : IMS12Q.IMS12X.REPO.IMSSEC.RID
 Member (RMD)  . : IMS12Q.IMS12X.REPO.IMSSEC.RMD
 Status  . . . . : COPY2

Repository Data Set pair 3
 Index (RID) . . : IMS12Q.IMS12X.REPO.IMSSPR.RID
 Member (RMD)  . : IMS12Q.IMS12X.REPO.IMSSPR.RMD
 Status  . . . . : SPARE

FRP4750I - LIST command processing completed successfully
```

- IV_U207J updates the definitions for a repository.
- IV_U208J deletes a repository in the catalog.
- IV_U209J tries to start a repository that has already been deleted.
- Task IV_U401T and job IV_U402J closes everything down and scratches the data sets created for this step of the IVP.

8.6 Syntax Checker

Syntax Checker is an ISPF application that helps you define, verify, and validate parameters and their values in the members of the PROCLIB data set. Online Help is available at the parameter level and provides assistance in moving to a new IMS release by identifying new parameters and any obsolete parameters from the previous release.

Syntax Checker saves the parameters to appropriate PROCLIB members in the correct format. You can also use the Syntax Checker to migrate your configuration members to IMS 11.

8.6.1 Starting Syntax Checker

Start IMS Syntax Checker by using either of the following two methods:

- Issue the following command in ISPF option 6, where HLQ is the high-level qualifier of the IMS data sets:

  ```
  EXEC 'hlq.SDFSEXEC(DFSSCSRT)' 'HLQ(hlq)
  ```

- In the IMS Application Menu panel (Figure 8-23), select option **5**.

```
 Help
.------------------------------------------------------------------------.
                             IMS Application Menu
  Command ===> 5

  Select an application and press Enter.


          1   Single Point of Control (SPOC)
          2   Manage resources
          3   Reserved for future use
          4   HALDB Partition Definition Utility (PDU)
          5   Syntax Checker for IMS parameters (SC)
          6   Installation Verification Program (IVP)
          7   IVP Export Utility (IVPEX)
          8   IPCS with IMS Dump Formatter (IPCS)
          9   Abend Search and Notification (ASN)


   To exit the application, press F3.



          .-------------------------------------------.
          · Copyright IBM Corp. 2003. All rights reserved. ·
          '-------------------------------------------'
```

Figure 8-23 IMS Application Menu

8.6.2 Using Syntax Checker

After you start Syntax Checker, the IMS Parameter Syntax Checker panel (Figure 8-24) is displayed. Here, you can enter the PROCLIB data set name and the name of the member to be processed. If you do not enter the member name, a member list is displayed. Select the member you want to process from the list.

```
 File  Help
.------------------------------------------------------------------------.
                          IMS Parameter Syntax Checker
  Command ===>

  Enter the name of the IMS proclib dataset and press enter.


   ISPF Library:
      Project  . .
      Group  . . .
      Type . . . .
      Member . . .           (Blank for member list)



   Other Partitioned Data Set:
      Data Set Name  . .
      Volume Serial  . .           (If not cataloged)




             .-------------------------------------------.
             · Copyright IBM Corp. 2000. All rights reserved. ·
             '-------------------------------------------'
```

Figure 8-24 Syntax Checker entry panel

When you press Enter from the main panel, Syntax Checker reads the input file and tries to determine the IMS release and type of control region.

If Syntax Checker cannot determine this information, one of the following entry panels opens:

- IMS Release and Control Region Type entry panel
- IMS Release entry panel

If Syntax Checker can determine the information it requires from comments in the member, the Syntax Checker Keyword Display panel is shown (Figure 8-26 on page 307).

8.6.3 IMS Release and Control Region Type entry panel

The “IMS Release and Control Region Type” entry panel shown in Figure 8-25 provides Syntax Checker with IMS release and control region information that is required to process the member correctly.

```
 File  Help
_______________________________________________________________________________
                          IMS Parameter Syntax Checker
 Command ===>

 Enter the following information and press enter.

 IMS Release  . . . . . . . . _  1. IMS 12.1
                                 2. IMS 11.1
                                 3. IMS 10.1


 Type of Control Region . . . _  1. DBCTL Control Region
                                 2. DCCTL Control Region
                                 3. DB/DC Control Region
                                 4. FDBR Region
                                 5. DLI/DBB Batch
```

Figure 8-25 IMS Release and Control Region Type entry panel

When Syntax Checker saves the member, it adds comment lines to the top of the member saving this information. The next time Syntax Checker processes the member, this panel does not display.

After you type in the data and press Enter, the Syntax Checker Keyword Display panel opens.

8.6.4 Keyword Display panel

The Keyword Display panel (Figure 8-26) of IMS Syntax Checker displays the keywords and their values, and indicates whether any syntax errors exist.

```
 File  Edit  View  Help

.....................................................................
                    IMS 12.1 Parameters for DB/DC
  Command ===>

  Press enter (without other input) to check for errors.

  Data Set Name  . . : INSTALIB(DFSPBV11)
  IMS Release  . . . : 12.1

    Sel Codes: C = Comment D = Delete I = Insert P = Process / = Select


   Sel Keyword    Value            Description             More:  +
    _  ALOT = 60                   ETO Auto Logon Off Time
    _  AOIP = ______               AOI Pool Upper Limit
    _  AOIS = N                    ICMD Security Option
    _  APPC = _                    Activate APPC/IMS (Y|N)
    _  APPLID1 = SCSIMSBB          VTAM Applid of Active IMS System
    _  APPLID2 = ________          VTAM Applid of XRF Alternate System
    _  APPLID3 = ________          VTAM Applid of RSR Tracking System
    _  ARC = 01                    Automatic Archive: 1-99, 0 - NOT Autom.
    _  ARMRST = N                  Allow MVS ARM to Restart (Y|N)
    _ AS ..........................................................
    _  AU · Member DFSPBV11 will be processed under IMS 12.1 (DB/DC ) ·
    _ BS ..........................................................
     _ CIOP = ______               CIOP Pool Upper Limit
```

Figure 8-26 Keyword Display panel

If you select **Display new** from the View menu, Syntax Checker lists only those parameters that are new in the IMS version you have selected.

To display the default values for parameters, press the F6 function key; press the key again to toggle between displaying and not displaying defaults. The default values are displayed in the description field of the parameter.

After modifying the member, press the Enter key without making any other modifications. Syntax-value checking is performed.

If errors exist, the first keyword with an error moves to the top of the display and an error message is displayed. When all errors are resolved and you have modified the member as required, you can save the member to the originally selected PROCLIB and member or to a different PROCLIB and member.

8.6.5 Exiting Syntax Checker

When you exit Syntax Checker, it prompts you to save any unsaved changes.

8.7 Installation and migration tasks

This section provides an overview of the tasks needed to migrate to IMS 12.

8.7.1 Migration considerations

This section describes practices that are useful for a general migration of current IMS installations in regard to the following tasks:

- Preparation tasks
- Installation tasks
- Validation tasks

Preparation tasks

Perform the following tasks before the migration:

- Contact IBM Software Support for current installation, migration, and problem-resolution information; ask for PSP for IMS.

  Before you install IMS 12, check with your IBM Support Center or use Information/Access or Service Link to determine whether additional PSP information is available that you must be aware of.

  The PSP upgrade name for IMS 12 is IMS1200.

  An alternative to using PSP is to use fix category hold data (see 8.2, “Fix Category HOLDDATA” on page 281).
- Read *IMS Version 12 Program Directory,* GI10-8843, for the most current hardware requirements, software requirements, prerequisites, and installation information.
- Review the IMS installation overview in *IMS Version 12 Installation,* GC19-3017.
- Review the service that has been applied to your current system. Determine if critical service has been included in the new IMS release. If not, acquire the appropriate service for the new IMS release. Again the new fix categories process will help you to do that.
- Review the functions and enhancements in *IMS Version 12 Release Planning,* GC19-3019. In particular, review the changes to the following areas:
  - SMP/E, distribution, and system data sets
  - System definition macros
  - Log records
  - RECON records
  - Exit routines
  - Cataloged procedures
  - Control statement members in the PROCLIB data set
  - Utilities
  - Operator commands
  - Operating procedures
  - Messages and abend codes
- Review the z/OS interface considerations in *IMS Version 12 System Administration*, SC19-3020, which explains SVCs and the SYS1.PARMLIB updates.
- Install prerequisite software and maintenance.
- Determine the availability of updates to IBM IMS Tools, aids, and related products. You can find the latest information on the Installation page at:

  http://www.ibm.com/support/entry/portal/Installation/Software/Information_Management/IMS_Tools

- Apply coexistence PTFs to your existing lower-level IMS systems that will operate with IMS 12. For a list of these PTFs, see Appendix B, “Recent maintenance: IMS 12 APARs” on page 455.
- Examine Hardware Data Compression (HDC) dictionaries to determine if they incorporate IMS versions that are now out of service.

  Although rebinding dictionaries is not required when migrating to a new version of IMS, a gradual refresh of these dictionaries to a current release is a good practice.
- Evaluate and update IMS exit routines. If you use a RECON I/O Exit Routine (DSPCEXT0), examine it for required changes because of the change in RECON records.
- The DFSMSCE0 exit must be reassembled for use with IMS 11.
- Similarly, all locally modified IMS Connect exit routines must be reassembled when migrating IMS Connect to IMS 12.

  The IMS Connect HWSIMSO0 and HWSIMSO1 exit routines are not included with IMS 12. The HWSSMPL0 and HWSSMPL1 exit routines provide enhanced functionality and are delivered as source code and object modules with IMS 12. Previous versions only supplied the source code. Use them in place of HWSIMSO0 and HWSIMSO1.

Installation tasks

To install IMS 12, complete these tasks:

1. Install IMS 12 by using the SMP/E installation process.
2. Use CBPDO or ServerPac:
   - The CBPDO product package consists of one logical tape (multiple volumes). A CBPDO package that includes IMS can also include other products in the same System Release (SREL). CBPDO also provides service for the products included with the product order. The service includes all PTFs available within one week of order fulfillment. All PTFs are identified by one or more SOURCEIDs, including PUTyymm, RSUyymm, SMCREC, and SMCCOR.
   - ServerPac is a software delivery package. It consists of products and service for which IBM has performed the SMP/E installation steps and some of the post-SMP/E installation steps. To install the package on your system and complete the installation of the software it includes, use the CustomPac Installation Dialog, which is the same dialog used for all CustomPac offerings, including IBM SystemPac® (dump-by-data-set format), IBM ProductPac®, and RefreshPac.

     For IMS, ServerPac allocates, catalogs, and loads all the data sets; sets up the SMP/E environment; supplies a job to update PARMLIB (IEFSSNxx, PROGxx, IEASVCxx, and SCHEDxx); and directs you to start the IVP.
3. Validate your system definition stage1 source. Consider merging some elements from the IVP source with your source.

   Run the IVP. The IMS IVP is used after the installation of a new IMS system; it is used to verify the installation, and can be used sporadically afterwards.

   The IVP Variable Export utility makes the migration of IVP variables between releases easier.

   Running the IVP is optional, but is a good practice. All required installation tasks are done outside the IVP. The IVP verifies that the installation is correct.
4. Install the system prerequisites and your new IMS system (including the pre-generation service).

   The complete set of IMS 12 modules that are necessary for execution are built by a combination of SMP/E processing and running a stage1 or stage2 ALL system definition

process. Most system definition statements from previous IMS releases are compatible with IMS 12.

If necessary, you can use the SMP/E **GENERATE** command to generate the JCL for jobs that will build the modules that are not built during the system definition process.

5. Install required service that was not included in the pre-generation service.
6. Install any required updates to IBM IMS and DB2 tools, aids, and related products.
7. Install the IMS 12 Type 2 and Type 4 SVC modules created by system generation.

   A z/OS IPL is not required. The SVCs can be installed by running the **DFSUSVC0** utility specifying **SVCTYPE=(2,4)**. The utility must be rerun after every z/OS IPL. Therefore, permanently install them at the next scheduled z/OS IPL.
8. Review the IMS Abend Formatting Module considerations in *IMS Version 12 System Administration*, SC19-3020.

   IMS 12 installs the abend formatting routine (module DFSAFMX0) dynamically. No user setup is required to install DFSAFMD0 on the host z/OS system for IMS 12 as part of the IMS installation.
9. Upgrade the RECON data set by using the **CHANGE.RECON UPGRADE** command with the IMS 12 DBRC utility.
10. Build application control blocks with a full ACBGEN.

Restriction: It is not possible to run IMS 12 with an ACB library built using IMS 10 or IMS 11. It is not possible to run IMS 10 or IMS 11 with an IMS 12 ACB library. The IMS system will fail to load DBDs and PSBs because they are not compatible.

Validation tasks

Perform the following validation tasks:

1. Validate users' cataloged procedures.
2. Validate user-created members of the PROCLIB data set.

   Use IMS 12 Syntax Checker to convert members from IMS 10 or IMS 11 where appropriate.
3. Validate, reassemble, and rebind exit routines and user modifications, especially IMS Connect exit routines and code that uses IMS control blocks, such as database randomizers.

   Check your exit routines before reassembling.
4. Validate, reassemble, and rebind user programs that process log records.

   Some log record formats have changed.
5. Validate and update operating procedures.

   This refers to recovery, backup, and restart procedures.
6. Review the various execution parameters in the DFSPBxxx member of the PROCLIB data set that can affect performance and migration.

   Review and set the appropriate values for the **AOIP**, **CMDP**, **DYNP**, **EMHB**, **FPWP**, **HIOP**, **LUMC**, and **LUMP** parameters to specify an upper limit on the amount of storage a pool can acquire.

   You can also use Syntax Checker to validate the values for the DFSPBxxx parameters.
7. When using MSC to connect IMS systems with different releases, consider all message types and the prefix sizes that accompany them. Such message types include Intersystem

Communication (ISC), Advanced Program-to-program Communication (APPC), and Open Transaction Manager Access (OTMA).

When message queue data sets are used, make the MSGQ LRECL and block sizes are identical across all IMS MSC systems.

A problem can occur when an IMS system is migrated to a new release that uses messages with larger prefix sizes and new prefix segment types.

Messages that contain these new and larger prefixes are sent to an earlier release of IMS because the new and larger prefixes might not fit the message queues of the earlier release of IMS.

8. Consider other products that can be affected by migration. Any product that depends on the format and contents of the IMS log or the RECON data set is potentially affected. Examples include the following products or utilities:
   - IMS Statistical Analysis utility
   - IMS Fast Path Log Analysis utility
   - IMS Log Transaction Analysis utility
   - IMS MSC Log Merge utility
   - CICS
   - Non-IBM products, including user modifications
9. Stop your pre-version 12 system.
10. Restart your IMS 12.
11. Test your IMS 12 system.

8.7.2 Discontinued support in IMS

Support is discontinued for various utilities, exit routines, and functions, which are listed in this section.

IMS 10 was the last release of IMS to support the z/OS-based batch DLIModel utility. It is not supported with IMS 11. If you are using this function, you should migrate to the DLIModel utility Eclipse plug-in which is part of the IBM IMS Enterprise Suite.

The JCA 1.0 resource adapter, one of the Java connectors in the IMS DB distributed resource adapter, is stabilized and is no longer being enhanced. You should switch to using the IMS Universal DB resource adapter that is delivered in IMS 11.

IBM has discontinued support for IBM Enterprise Workload Manager™ (EWLM). Therefore, IMS can no longer offer this support. IBM is providing a transition for EWLM 2.1 clients to an IBM STG Lab Services offering. This new offering provides enhanced capabilities over the EWLM 2.1 product.

IMS 10 was the final version of IMS in which the IMS information is delivered in the IBM BookManager® format.

8.7.3 Fallback considerations

IMS does not generally support downward compatibility in any major function between releases.

Consider the following steps when preparing your migration fallback plan. This information is intended as a guide to understanding fallback inhibitors, and should not be considered complete.

For each IMS that you are falling back, complete the following steps:

1. Ensure that the status of all databases updated by IMS 12 is correct.

   Establish a new recovery point for these databases by image copying them before allowing updates in the fallback release.

2. Resolve DBRC issues. See 8.7.4, “DBRC fallback considerations” on page 312.

   Make sure you have the correct DBRC Coexistence PTF applied to the older IMS (PK61583 and PK61582).

3. Shut down IMS 12.
4. Install the old version of IMS.

   You must rebuild your ACB library at the IMS version to which you are falling back.

5. Restart IMS.

You can use the IBM IMS Queue Control Facility for z/OS (QCF) to requeue IMS 12 messages to IMS 10 or IMS 11 message queues.

8.7.4 DBRC fallback considerations

Certain steps must be taken to revert DBRC to an IMS 10 or IMS 11 level.

Base Primitive Environment-based DBRC

If you have started to use Base Primitive Environment (BPE)-based DBRC and must fall back to IMS 10, complete these steps:

1. Shut down the IMS control region that is associated with the BPE-based DBRC address space.
2. Modify the DBRC procedure to use JCL appropriate for a non-BPE based DBRC region.
3. Restart IMS with DBRCNM referring to the non-BPE DBRC region startup JCL.

You might have to revert either or both of the following exits to older versions if you have changed these to *not* be compatible with the old calling interface:

- DSPCEXT0
- DSPDCAX0

Database Change Accumulation Utility (DFSUCUM0)

If you fall back from IMS 12 and you have change-accumulation data sets created by IMS 12, the logs in these data sets are not recoverable because the older utilities cannot process them. Invalidate the IMS 12 change-accumulation data sets by running an image copy of the affected databases at the older level.

Lowering the minimum version value

Do not change **MINVERS** to '12.1' until you are sure that you do not have to fall back to a lower IMS version. However, if such a fallback becomes necessary, you can reduce **MINVERS** by completing these steps:

1. Shut down all IMS 12 subsystems.

   Confirm that IMS 12 subsystem records have been removed from the RECON data set. Use the **LIST.SUBSYS** command to see the subsystem records in the RECON data set. If IMS 12 subsystems remain in the RECON, take the necessary recover actions.

2. Determine the status of your databases.

If the databases need recovery with IMS 12 logs, perform those recoveries with IMS 12. If the databases need recoveries to a time before the IMS 12 updates, perform those recoveries with either the IMS 12 or the older version.

3. Use the following commands to delete all IMS 12 log records and all the allocation records on those logs from the RECON data set:

   ```
   DELETE.LOG
   DELETE.ALLOC
   ```

4. Reset the **MINVERS** value by issuing a **CHANGE.RECON MINVERS** command using IMS 12.

   If you receive message DSP1205E (meaning that the database quiesce flags are active), use the **CHANGE.DB** or **CHANGE.DBDS** command to turn off the flags. After the flags are turned off, reissue the **CHANGE.RECON MINVERS** command.

5. Establish new recovery points for all databases updated by IMS 12 by taking image copies of those databases using the older version of IMS.

For more information about the DBRC commands, see *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011.

8.8 Review of migration considerations

When migrating to a more recent release of IMS, review the following release planning guides that span your specific migration path:

- *IMS Version 12 Release Planning,* GC19-3019
- *IMS Version 11 Release Planning*, GC19-2442
- *IMS Version 10: Release Planning Guide*, GC18-9717

8.8.1 Migrating to IMS 12 Database Manager

Specific migration considerations apply when you are migrating from IMS 10 Database Manager to the IMS 12 Database Manager.

Database quiesce migration considerations

To use the database quiesce function, the **MINVERS** field in the RECON data sets must be set to '12.1'.

DBRC API applications that interrogate the output from Query TYPE=DB, TYPE=DBDS, and TYPE=PART requests do not have to be modified if they do not want to access the fields added with the IMS 11 database quiesce enhancement.

Applications that want to get the new output must map to the new output fields and ensure that the DSPAPQHD block returned by DBRC has a minimum version of 3.0.

Fast Path 64-bit buffer manager

If your IMS installation did not use 64-bit storage before IMS 12, you have to make 64-bit storage available to use the Fast Path 64-bit buffer manager.

Fast Path usability and serviceability enhancements

If you have automated operations that are triggered when messages DFS2555I or DFS2716I are issued because no main storage databases (MSDBs) are defined, you must modify them because these messages are not issued any more.

Open database enhancements migration considerations

You can migrate existing Open Database Access (ODBA) application servers to use the Open Database Manager (ODBM) delivered with IMS 11, and migrate existing IMS DB resource adapter applications to use the new IMS Universal DB resource adapter, as follows:

1. Apply the appropriate coexistence APAR.
2. Add the **IMSPLEX** parameter and optionally the **ODBMNAME** parameter to the DFSPRP macro.
3. Reassemble and rebind the DFS*xxxx*0 load module (where *xxxx* is the DRA startup table name specified on the APSB call in the AIBRSNM2 field of the AIB).
4. After performing these tasks, you can simplify the ODBA applications by replacing multiple CIMS **INIT** commands with a single CIMS **CONNECT** command.

You can optionally migrate application programs that use the existing IMS DB resource adapter, which supports the JCA 1.0 architecture, to the new type-2 interface IMS Universal DB resource adapter, which supports the JCA 1.5 architecture.

WebSphere Application Server for z/OS applications that want to use the Open Database enhancements must deploy the new type-2 interface IMS Universal DB resource adapter.

After you set up ODBM, you can start to use the type-4 interface of the IMS Universal DB drivers.

8.8.2 Migrating to IMS 12 Transaction Manager

When migrating from IMS 10 Transaction Manager to IMS 12 Transaction Manager, keep in mind the IMS considerations as explained in this section.

APPC enhancements

Migrate all IMS systems that participate in a particular shared-queues environment to IMS 12 before attempting to use the APPC enhancements, even though the APPC local logical unit (LU) functions do not have any explicit migration considerations for IMS 12.

OTMA migration considerations

Migration considerations for OTMA involve compatibility with the message control function, OTMA transaction monitoring, and IMS destination routing descriptors.

OTMA transaction monitoring

IMS 12 can perform only limited OTMA transaction monitoring for OTMA clients that do not specify the transaction expiration time in the OTMA prefix or do not exploit the OTMA resources monitoring (such as IMS Connect in IMS 10 without the expiration PTFs).

In these cases, you can activate transaction expiration (but not message-level expiration) by specifying the EXPRTIME parameter in the TRANSACT macro or by issuing either of the following commands:

```
CREATE TRAN
UPDATE TRAN SET(EXPRTIME(seconds))
```

OTMA protocol messages regarding OTMA resource information are ignored by IMS Connect and other OTMA clients that have not taken advantage of OTMA resource monitoring.

IMS destination routing descriptors

In IMS 12, type-2 commands can be used to dynamically define destination routing descriptors. The OTMA descriptors can also be defined in the DFSYDTx PROCLIB member and are processed when IMS is restarted. Both types can coexist.

In IMS 10, the definition of the destination routing descriptors in DFSYDTx must be entered from the most specific to the most generic destination routing descriptor name. Any destination with a masked character of asterisk (*) has to occur *after* the group of names that the asterisk is masking. For example, following the order from most specific to most generic, you must list the contents in DFSYDTx as DEST1234, DEST12*, and DEST*.

In IMS 12, this restriction is lifted and the user creating the descriptor entries no longer must be aware of the order. For example, the entries in DFSYDTx can be in any order, such as DEST*, DESTT1234, and DEST12*. OTMA automatically rearranges this internally from most specific to most generic.

8.8.3 Migrating to the IMS 12 system

When migrating from IMS 10 systems to IMS 12 systems, keep in mind the IMS considerations as explained in the following sections.

Migration tasks for ACB library enhancements

The migration tasks in the following sections are associated with the ACB library enhancements.

Caching ACBs into 64-bit storage

To migrate to ACBLIB members in 64-bit memory, complete the following steps:

1. Specify the **ACBIN64** parameter in the DATABASE section of the DFSDFxxx PROCLIB member.
2. Stop IMS.
3. Restart IMS.

Migrating ACB libraries to use dynamic allocation

To migrate ACB libraries to use dynamic allocation, complete the following steps:

1. Create DFSMDA members for the ACBLIBA and ACBLIBB data sets.

   You can place DFSMDA members in a data set specified in either the IMS STEPLIB concatenation or the IMSDALIB concatenation.

   Remove the IMSACBA and IMSACBB DD statements from the IMS and DL/I JCL procedures.
2. Stop IMS.
3. Restart IMS with the DFSMDA members.

CQS migration

Migrate CQS and its control region (or regions) on the z/OS image at the same time. If this is not possible, CQS must be migrated before any of the control regions are migrated.

DBRC migration considerations

These topics describe the considerations and tasks for migrating DBRC to IMS 12.

Base Primitive Environment-based DBRC migration considerations

To start a BPE-based DBRC address space, create new DBRC JCL and update the IMS EXEC parameter, DBRCNM=, to specify the new member name.

If you are going to use your existing DBRC exit routines, there are no migration considerations.

If you want your DBRC exit routines to use the functionality of BPE, you must create new exits (which are based on current exits) that handle the BPE interface. The new exits must have unique names and must be added to the BPE user exit PROCLIB member.

Changes to the RECON data set

Certain records in the RECON data set are new or changed from the records in IMS 10. The following RECON records have increased in size and have new or changed fields as of IMS 12:

- DSPRCNRC: increased in size by 48 bytes
- DSPCHGRC: increased in size by 16 bytes
- DSPDBHRC: increased by 20 bytes

For information about RECON record types, see *IMS Version 12 Diagnosis,* GC19-3015.

Parallel RECON Access

If you are migrating to IMS 12 from IMS 10 and parallel RECON access (PRA) is in effect, you must ensure that there is no shunted I/O when the upgrade begins. The upgrade process begins with a quiesce close and a check for shunted I/O. The RECON data sets are closed and reopened in LSR mode. The records are upgraded as they are for non-PRA. This includes upgrading the records in COPY1 and then upgrading the records COPY2. After the upgrade completes, the RECON data sets are reopened in PRA mode and the quiesce is ended.

For information about the RECON I/O exit routine (DSPCEXT0), see *IMS Version 12 Exit Routines*, SC19-3016.

Unconditional deletion of PRILOG or change accumulation information

If you plan to use this function, modify your DBRC security to include the new **CLEANUP.RECON** resource.

You might have to modify your procedures for maintaining the RECON data set because of the **CLEANUP.RECON** command.

Consider modifying your automated programs or tools that issue DBRC commands.

Upgrading the RECON data set

To upgrade an IMS 10 or IMS 11 RECON data set, follow these steps:

1. Apply the IMS 12 coexistence SPEs to all IMS 10 and IMS 11 systems before you attempt to upgrade the RECON data set. For information about recent maintenance, see Appendix B, “Recent maintenance: IMS 12 APARs” on page 455.

   Jobs that access the RECON data set and do not create subsystem records, such as the Database Change Accumulation utility (**DFSUCUM0**) and the DBRC utility (**DSPURX00**), are not protected from having the RECON data set upgraded while they are running on a version of IMS that does not have the appropriate migration and coexistence SPE applied.

When these types of jobs access the RECON data set after the upgrade, the results might be unpredictable. Make sure that no such jobs are running when you upgrade the RECON data set.

2. Make sure you have two active RECON data sets (COPY1 and COPY2) and a spare data set when you attempt to upgrade the RECON data sets while other jobs are accessing them.
3. Issue the **CHANGE.RECON UPGRADE** command. This command performs the following actions:
   - It upgrades the RECON data set without shutting down all IMS activity.
   - It uses the DBRC I/O recovery algorithms to recover from any failures during upgrade, thereby relieving you of the need to make a backup of the RECON data set before upgrade and restoring it in case of a failure.

   You must issue this command by using either the IMS 12 DBRC utility (**DSPURX00**) or the IMS 12 DBRC Command API request. If you use DBRC command authorization, consider setting the RECON qualifier as part of your migration process. You can set the RECON qualifier either at the time of upgrade by adding **CMDAUTH()** parameters to the **CHANGE.RECON UPGRADE** command, or after the RECON has been upgraded by issuing a **CHANGE.RECON CMDAUTH()** command.

   Consider using RECON command authorization if you use the **CLEANUP.RECON** command.

   When you are sure that a fallback to a previous IMS version is unlikely and all systems that access the RECON data set are IMS 12, update the minimum version value to `'12.1'`.

   You are not required to change the **MINVERS** value to `'12.1'` unless you have to use new function that requires this value. The change.recon upgrade process will set `'10.1'` as a minimum level.

   After you set the **MINVERS** level for an IMS system, system signon fails for earlier versions of IMS for online environments. All other jobs accessing the RECON data set fail DBRC initialization if the version of IMS being used is lower than the **MINVERS** level.

Exit routine migration considerations

Any user migrating from IMS 10 to IMS 12 must consider the changes to the SXPL made in IMS 11.

The user exit enhancements in IMS 11 introduce version 6 of the list (SXPLVER6). Exit routines that run in multiple versions of IMS must be sensitive to the version of the SXPL. The version number was SXPLVER5 in IMS 10.

The following exit routines can use the new fields:

- Build Security Environment exit routine (DFSBSEX0)
- Early Initialization exit routine (EINIT)
- Logger exit routine (DFSFLGX0)
- IMS CQS Event exit routine (ICQSEVNT)
- IMS CQS Structure Event exit routine (ICQSSTEV)
- Non-discardable Messages exit routine (DFSNDMX0)
- OTMA Destination Resolution exit routine (DFSYPRX0)
- OTMA Input/Output Edit exit routine (DFSYIOE0)
- OTMA User Data Formatting exit routine (DFSYDRU0)
- Partner Product exit routine (DFSPPUE0)
- Resource Access Security exit routine (DFSRAS00)
- Restart exit (user-specified)
- Type 2 Automated Operator exit routine (DFSAOE00)

Exit routines that do not have exit point or interface changes and are supported in the **EXITDEF** parameter of the USER_EXITS section of the DFSDFxxx member can be enabled for the command functions introduced in IMS 11 by using the new version of the SXPL (SXPLVER6).

The IMS Connect exit parameter list (HWSEXPRM) is changed for IMS 11. You must reassemble and rebind the IMS Connect exit routines that use HWSEXPRM to pick up the changes.

File system paths changes

The file system paths changed in IMS 11. The changes affect IMS 10 users who are migrating to IMS 12.

The file system paths must be more efficient during the migration process. Table 8-5 shows how the file system paths differ between IMS 10 and IMS 12.

Table 8-5 IMS 10 and IMS 12 file system paths changes

DDNAME	IMS 10 path name	IMS 12 path name
SDFSIC4J	/usr/lpp/ims/ico101/IBM/	/usr/lpp/ims/ims12/ico/IBM/
SDFSJHFS	/usr/lpp/ims/imsjava10/IBM/	/usr/lpp/ims/ims12/imsjava/IBM/
SDFSJRAR		/usr/lpp/ims/ims12/imsjava/rar/IBM/
SDFSJCIC	/usr/lpp/ims/imsjava10/cics/IBM/	/usr/lpp/ims/ims12/imsjava/classic/cics/IBM/
SDFSJCPI		/usr/lpp/ims/ims12/imsjava/classic/IBM/
SDFSJTOL	/usr/lpp/ims/imsjava10/dlimodel/IBM/	/usr/lpp/ims/ims12/imsjava/classic/dlimodel/IBM/
SDFSJSAM	/usr/lpp/ims/imsjava10/samples/IBM	/usr/lpp/ims/ims12/imsjava/ivp/IBM/
SDFSJCPS		/usr/lpp/ims/ims12/imsjava/classic/ivp/IBM/
SDFSJXQY	/usr/lpp/ims/imsjava10/IBM/	

The following file system paths, which were created and used by previous releases of IMS, are no longer used in IMS 12. You can delete these obsolete file system paths after you delete the previous release from your system.

- /usr/lpp/imsico/
- /usr/lpp/IMSICO/
- /usr/lpp/ims/imsjava91/IBM/
- /usr/lpp/ims/ico91/IBM/
- /usr/lpp/ims/imsjava91/samples/IBM/
- /usr/lpp/ims/imsjava91/cics/IBM/
- /usr/lpp/ims/imsjava91/lib/IBM/
- /usr/lpp/ims/imsjava91/dlimodel/IBM/

For installation instructions, see *IMS Version 12 Program Directory*, GI10-8843.

IMSplex migration considerations

Migrating an IMSplex from one version of IMS to another is a complex process because of the many factors involved and the different configurations that are possible.

Although running a mixed IMSplex is possible, it is desirable to upgrade all your CSL components to IMS 12 if any control region is at IMS 12. Control regions are limited as to

which version of CQS they can connect to. For a listing of the rules, see 8.4.4, “Common Queue Server coexistence” on page 284.

If you are running multiple LPARs, migrate one LPAR at a time. If you are running multiple IMS systems on one LPAR, migrate one IMS at a time.

IMS Connect migration considerations

In previous releases, you specified multiple SSL ports even though only one active port at a time was supported. If a second port was opened, unpredictable results, including an abend, occurred, which was clearly undesirable.

In IMS 12, IMS Connect initialization fails if you specify multiple SSL ports. If you are migrating from IMS 10, you must modify the HWSCFGxx member to specify only one SSL port. An alternative option is to use application transparent-transaction layer security (AT-TLS).

Several new specifications are in the HWS, TCPIP, DATASTORE, MSC and RMTIMSCON statements of the HWSCFGxx configuration file. These specifications appear in the display output of commands such as **VIEWHWS**, **VIEWPORT**, and **VIEWDS**. Modify the automation programs and master terminal operator (MTO) documentation to recognize these new fields.

Automation programs that read the output of IMS Connect displays or query the HWSP1410W message must be aware of the new information and fields that have been added by the IMS 12 enhancements. Similarly, MTOs that issue IMS Connect commands should understand that additional information is provided.

Message HWSX0908W is issued if the old exits HWSIMSO0 and HWSIMSO1 continue to be specified in the IMS Connect configuration member. Those exits must be replaced with HWSSMPL0 and HWSSMPL1.

If WARNSOC and WARNINC are specified in the TCPIP HWSCFGxx statement, new messages are issued when the warning level is reached (HWSS0772W) and when the number of sockets falls below the warning level (HWS0773I).

Because the HWSEXPRM macro has been expanded, IMS Connect exit routines that invoke the macro must be re-assembled. Remember also that the XIBDS (exit interface block data store entry) has also been expanded.

With the TCP/IP automatic reconnect capability, new code in the terminate port thread process of IMS Connect automatically issues an internal **OPENPORT** command on a timer basis. Operator commands or automation that are issued to ensure that IMS Connect reestablishes connectivity with a TCP/IP network are no longer needed.

To benefit from the Generated Client ID function, the IMS TM resource adapter must be replaced with the new version.

The new BPE trace capability is enabled only when the old function is disabled by removing or commenting out the HWSRCORD DD statement in the IMS Connect startup procedure. After the new function has been enabled, new RCTR entries in the BPE external trace data sets will be introduced as variable length trace entries.

IMS 12 adds the following records for the sending or receiving TCP/IP and XCF:

- ICONTR – TCP/IP Receive
- ICONTS – TCP/IP Send
- ICONIR – IMS OTMA Receive
- ICONIS – IMS OTMA Send

These records are only written to the BPE External trace because the new trace points can generate a significant amount of data. For more information, see 6.3.1, “IMS Connect Recorder Trace” on page 188.

RACF mixed-case password support

The default values for **PSWDC** and **PSWDMC** are different in IMS 12 than they were in IMS 10. The new default values are **PSWDC=R** and **PSWDMC=R** (use the Resource Access Control Facility (RACF) specification).

IMS 10 can process mixed-case passwords, but to enable this function, you must specify **PSWDC=M** for IMS and **PSWDMC=Y** for IMS Connect. The default values for IMS 10 are **PSWDC=U** (uppercase) and **PSWDMC=N** (not mixed case).

The **PSWDC** and **PSWDMC** parameters are enhanced in IMS 12 with the “R” specification, which means that IMS and IMS Connect should handle passwords in the same manner as specified in RACF.

Remote Site Recovery migration

The migration of systems using Remote Site Recovery (RSR) is similar to migrations for previous releases.

IMS 12 tracking systems can process logs produced by lower releases.

The IMS 12 isolated log sender (ILS) function of the Transport Manager System (TMS) can process logs created by earlier releases, with the following exceptions:

- IMS 11 and IMS 10 tracking systems cannot accept logs produced by IMS 12.
- IMS 11 and IMS 10 ILSs cannot accept logs produced by IMS 12.

Although you can migrate all of the RSR components at the same time, you are more likely to migrate them in stages. The tracking system must be migrated before or at the same time as the ILS at the active site. The ILS at the active site must be migrated before or at the same time as the active IMS system.

The RECONs must be upgraded to IMS 12 before the systems that use them are migrated to IMS 12.

Migration steps

Perform the following migration steps:

1. Upgrade the RSR tracking system RECONs to IMS 12.
2. Migrate the RSR tracking system to IMS 12.
3. Upgrade the active system RECONs to IMS 12.
4. Migrate the active TMS running the ILS to IMS 12.
5. Migrate the active IMS to IMS 12.

Serviceability enhancements

To benefit from serviceability enhancements when you migrate to IMS 12, you might have to increase storage or modify automated tools or procedures.

Because the number of address spaces included in the system dump is limited by the amount of storage specified by the **MAXSPACE** parameter of the z/OS **CHNGDUMP** command, you might have to increase the amount of storage to accommodate the additional address spaces. However, IMS does not exceed the **MAXSPACE** value.

You might have to modify your automated operations tools or procedures if they are dependent on the format of the DFS064I or DFS065 messages.

Syntax Checker migration considerations

Syntax Checker assists with IMS release-to-release migrations by providing the ability to convert supported PROCLIB members from one release to the other. When using Syntax Checker to check parameters for earlier releases of IMS, you must verify that the correct release number is displayed.

Syntax Checker is a stand-alone, offline component, and it can fall back by installing the previous release of Syntax Checker. Always maintain a copy of your previous-version PROCLIB members to enable fallback.

9

IMS Enterprise Suite V2.1

The IBM Information Management System (IMS) Enterprise Suite, part of the IMS SOA Integration Suite, is a set of components that support open integration technologies to enable new application development and extend access to IMS transactions and data. The IMS Enterprise Suite provides standard interfaces, simplifies IMS metadata generation, and enables IMS business event data and monitoring. The IMS Enterprise Suite also eases and expands IMS development (including Java and XML), administration, and access. Graphical user interfaces (GUIs) and standards-based programming models are provided through tooling support from the IBM WebSphere and Rational® product families.

For more information, see the IMS Enterprise Suite website at:

https://www14.software.ibm.com/webapp/iwm/web/preLogin.do?source=swg-imsentersuite

This chapter explains the functions (components) that are part of the IMS Enterprise Suite V2.1. It highlights the functionality and enhancements of each component from Enterprise Suite V1.1 to V2.1.

This chapter includes the following sections:

- Enterprise Suite V2.1 contents
- Enhancements for Enterprise Suite V2.1
- IMS Enterprise Suite Connect APIs for C
- IMS Enterprise Suite Connect APIs for Java
- IMS Enterprise Suite DLIModel utility plug-in IMS Enterprise Suite V2.1
- IMS Enterprise Suite Explorer for Development
- IMS Enterprise Suite SOAP Gateway 2.1
- IMS Enterprise Suite Java Message Service API

9.1 Enterprise Suite V2.1 contents

The IMS Enterprise Suite components are available to IMS 11 and IMS 12 clients at no additional cost. Some components are available on both z/OS and distributed systems, and some are only available on distributed systems.

The following components are part of the Enterprise Suite V2.1:

- Base Services includes sample jobs to use for installation of z/OS-based components and the IBM 31-bit software development kit (SDK) for z/OS, Java 2 Technology Edition, Version 6 (Java Development Kit (JDK) 6.0).
- IMS Enterprise Suite Connect APIs for C (in IMS 10)

  This component provides simple interfaces for developing custom IMS Connect TCP/IP client applications that are written in C/C++. The application programming interfaces (APIs) can be used to develop custom IMS Connect TCP/IP client applications in Windows environments.
- IMS Enterprise Suite Connect APIs for Java (enhanced in IMS12)

  This component provides simple interfaces for developing custom IMS Connect TCP/IP client applications that are written in Java. It provides a simple way to describe TCP/IP socket connections, interaction protocols, message headers, and data through the concepts of reusable profiles. More granular lower-level calls are provided for more granular controls. The APIs can be used to develop custom IMS Connect TCP/IP client applications in Windows, and z/OS environments.
- IMS Enterprise Suite DLIModel utility plug-in (in IMS 11)

  This component translates IMS source files into reliable, application-independent metadata that can be used for Java application development. The utility can be used to generate XML schemas or graphical Unified Modeling Language (UML) models for IMS databases. You can incorporate additional program communication block (PCB), segment, and field information, and generate IMS database web service artifacts with the utility.
- IMS Enterprise Suite Explorer for Development (new in IMS 12)

  This component simplifies IMS application development tasks by displaying and enabling editing of IMS databases, segments, fields, and more, from an industry-standard integrated development environment (IDE). The IMS Enterprise Suite Explorer for Development is an Eclipse-based graphical tool that enables IMS application developers and database architects and developers to undertake the following activities:

  - Perform common and essential tasks in an end-to-end application development life cycle
  - Simplify the development and visualization of database description (DBD) and program specification block (PSB) resources definitions
  - Import COBOL and PL/I data structures to an IMS Database
  - Share with IBM Rational Developer for System z to generate PSB source, and to import and export DBD and PSB source from or to a z/OS remote system
  - Use the IMS Universal drivers, offering a relational view of IMS data and offering new function, such as graphical assistance to build SQL statements
- IMS Enterprise Suite SOAP Gateway V2.1 (enhanced in IMS 12)

  This component enables IMS applications to interoperate outside of the IMS environment through the SOAP protocol to provide and request services that are independent of platform, environment, application language, or programming model. IMS applications can become web service providers or consumers in a service-oriented business environment.

SOAP Gateway also enables IMS applications to emit business events data to business event processing engines such as IBM WebSphere Business Events and IBM WebSphere Business Monitor.

- IMS Enterprise Suite Java Message Service (JMS) API (in IMS 11)

  This component issues synchronous callout requests to external services from within a Java message processing (JMP) or Java batch processing (JBP).

- MFS Web Enablement

  This component helps you to modernize your existing MFS-based IMS business logic by converting character-based interface-based applications into web-based applications.

9.1.1 Acquiring and installing Enterprise Suite V2.1

As shown in Table 9-2, some components are composed of a z/OS part and a distributed part. The distribution for Enterprise Suite V2.1 is different from Enterprise Suite V1.1.

Downloading and installing on distributed systems

Download the parts for the distributed systems individually from the IMS Enterprise Suite site at:

https://www14.software.ibm.com/webapp/iwm/web/preLogin.do?source=swg-imsentersuite

Depending on the component, some parts require the IBM Rational Application Installation Manager (at a minimum level of 1.4.4) to be installed in a new, or added to an existing, Rational Workbench package.

Downloading and installing on z/OS

For z/OS, install IMS Enterprise Suite components by using the standard SMP/E installation process.

IBM IMS Enterprise Suite for z/OS V2.01.00 consists of the following function modification IDs (FMID):

- HAHF210 (Base Services)
- JAHF201 (SOAP Gateway)
- JAHF202 (JMS API)
- JAHF203 (Connect API Java)

Table 9-1 lists the IMS environments that each IBM IMS Enterprise Suite for z/OS V2.01.00 FMID supports.

Table 9-1 IMS environments

FMID and description	DB Batch	DBCTL	DB/DC	DCCTL
HAHF210 (Base Services)	A[a]	A	A	A
JAHF201 (SOAP Gateway)	N[b]	N	A	A
JAHF202 (JMS API)	N	A	A	A
JAHF203 (Connect API Java)	N	N	A	A

a. The FMID is applicable to this IMS configuration.
b. The FMID is not applicable to this IMS configuration.

9.2 Enhancements for Enterprise Suite V2.1

Table 9-2 lists the differences between Enterprise Suite V1.1 and V2.1 components for the z/OS and distributed environment.

Table 9-2 Differences between Enterprise Suite V1.1 and V2.1

Component name	z/OS	Distributed	Major changes in Enterprise Suite V2.1
Connect API for C		X	► No new feature
Connect API for Java	X	X	► Synchronous callout support ► Support for type-2 commands ► Other minor enhancements
DLIModel utility plug-in		X	► No change from Version 1.1
Enterprise Suite Explorer for Development		X	► New with IMS 12
SOAP Gateway	X	X	► Java separation ► WS-Security enhancements for the web service provider scenario ► SAML 1.1 signed assertions ► SAML 2.0 unsigned assertions ► Rational Developer for System z V8.0.3 enhancements for SOAP Gateway ► Removal of SOAP Gateway deployment utility
JMS API			► No change from Version 1.1

The following sections describe each of the Enterprise Suite V2.1 components. Because Base Services supports the other components, it is not addressed.

- IMS Enterprise Suite Connect APIs for C
- IMS Enterprise Suite Connect APIs for Java
- IMS Enterprise Suite DLIModel utility plug-in IMS Enterprise Suite V2.1
- IMS Enterprise Suite Explorer for Development
- IMS Enterprise Suite SOAP Gateway 2.1
- IMS Enterprise Suite Java Message Service API

For more information, see IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *JMS API* (in “IMS Enterprise Suite Version 1.1”):

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

9.3 IMS Enterprise Suite Connect APIs for C

The IMS Enterprise Suite Component APIs for C were introduced in IMS Enterprise Suite V1.1, which became available for IMS 11 and IMS 10. The IMS Enterprise Suite Connect API for C provides simple interfaces for developing custom IMS Connect TCP/IP client applications that are written in C/C++. This component is only available for the Windows platform, supported for Windows XP.

9.3.1 Overview of API for C

The Connect API for C was developed using Microsoft Visual Studio 2005 Professional Edition and tested using Microsoft Visual Studio 2008 Professional Edition.

The Connect API for C simplifies the process of developing C and C++ applications that interact with IMS through IMS Connect in the following ways:

- It manages the communication between the C application and IMS Connect. The client application provides property values that describe the type of connection to establish with IMS Connect. The IMS Enterprise Suite API for C establishes a connection for the applications and maintains that connection for as long as it is needed,
- It helps you to set the interaction specification, which determines the details of the exchange with IMS. The parameter values in the interaction specification determine the fields that are set by the API in the IMS request message (IRM) header of messages that are sent to IMS Connect.
- It provides functions that encapsulate the creation of an input request message to be sent to IMS Connect and the retrieval of the resulting response from IMS Connect. The creation of the request message is based on properties that are specified in the application or loaded from a reusable properties file. The properties determine the type of interaction to be executed.

By completing these steps on behalf of the application, much of the complexity of the IMS Connect headers and protocols can be shielded.

You can use the IMS Enterprise Suite Connect API for C to drive IMS transactions, Open Transaction Manager Access (OTMA)-supported IMS commands, and IMS Connect-supported commands (such as PING and Resource Access Control Facility (RACF) Password Change).

The IMS Enterprise Suite Connect API for C/C++ supports the HWSSMPL0 and HWSSMPL1 IMS Connect user message exits. The default user exit is HWSSMPL1. In addition to the message segment as expected by the IMS program or the command processor, the input message prepared by the API contains an IMS Connect header of TYPE 2 prefixed. This is also called the *IRM header*.

The IMS Enterprise Suite Connect API for C supports all existing user-supplied IMS Connect client application functions *except* for the following functions:

- Two-phase commit
- Unicode
- Synchronous callout
- Secure Sockets Layer (SSL) support

9.3.2 API for C reference for data types and functions

The C API specification for the Connect API for C includes reference information about the data types and functions of the Connect API for C:

- Data types of the Connect API for C

  APIStatus, ConnectionAttribute, messageSegment, outputData, and TMInteractionAttribute

- Connect API for C

  loadConnection, connectIMS, loadInteraction, is .... examples (isConnected, isReturnMfsModname, isAckNakNeeded..), set ... examples (setHostName,

setPortNumber, setCommitMode ...), get ... examples (getImsConnectReasonCode, getMfsModname, ...), initializeAPI, initializeConnection, initializeInteraction, execute, disconnectIMS, and cleanUp ... examples (cleanUp, cleanUpConnectionMemoryPool ...)

- Tracing with the Connect API for C

  startLogger and stopLogger

- Connect API for C messages

9.3.3 Reference material

For reference information about the IMS Enterprise Suite Connect APIs for C, click the **Connect API** links on the IMS Connect Function and IMS Enterprise Suite Connect APIs page at:

http://www.ibm.com/software/data/ims/connect/

All materials on this site are downloadable and installable. The downloadable material also contains two C and two C++ sample programs. For compiling and linkediting client programs, a C/C++ workbench is required, such as the Microsoft Visual Studio 2008 Professional Edition.

For more information, go to the IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *Connect API for C*:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

9.3.4 Prerequisites for Connect API for C

Before you download and install the Connect API for C, see the supported platforms and software requirements. You can find them in the IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *Installing the Connect API for Java*:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

9.4 IMS Enterprise Suite Connect APIs for Java

This component was introduced in Enterprise Suite V1.1, which became available for IMS 11 and IMS 10, but has been enhanced in IMS Enterprise Suite V2.1. The IMS Enterprise Suite Connect API for Java provides simple interfaces for developing custom IMS Connect TCP/IP client applications that are written in Java. This component is available for both the Windows and the z/OS platform.

9.4.1 Overview of API for Java

The Connect API for Java includes the following key features:

- It opens connections to IMS Connect on behalf of the client application.
- It provides client applications with programmatic control of connections.
- It assembles messages to send to IMS Connect, including the IRM header.
- It manages the IMS Connect message protocol by sending and receiving the appropriate messages for interactions with IMS Connect.

The Connect API for Java manages the communication between the Java application and IMS Connect. The client application provides property values that describe the type of connection to establish with IMS Connect. The Connect API for Java establishes a connection for the application and maintains that connection for as long as it is needed.

You can use the Connect API for Java to drive IMS transactions, OTMA-supported IMS commands, Common Service Layer (CSL) Operations Manager (OM)-supported IMS type-2 commands, and IMS Connect-supported commands (such as PING and RACF Password Change) from your Java client application. The Connect API for Java supports SSL for securing TCP/IP communications between client applications and IMS Connect.

9.4.2 API for Java enhancements in Enterprise Suite V2.1

The IMS Enterprise Suite 2.1 Connect API for Java supports the new items described in the following sections.

Synchronous callout interaction support

The Connect API for Java now supports synchronous callout interactions with IMS Connect. The existing TmInteraction interface is enhanced with new methods and property values that you can use to receive a synchronous callout message from IMS, send an ACK or NAK response to acknowledge receipt of the message, construct a response message or response error message, and then send the response to IMS. The Connect API can issue a `resume Tpipe` and respond to the synchronous callout emitted from dependent region programs in IMS.

Callout interactions are initiated from an IMS application program rather than from the Connect API for Java client application. In a synchronous callout interaction, the IMS application program that sends the callout request remains scheduled in the IMS dependent region while the request is processed by the Connect API for Java client application. Figure 9-1 illustrates how it works.

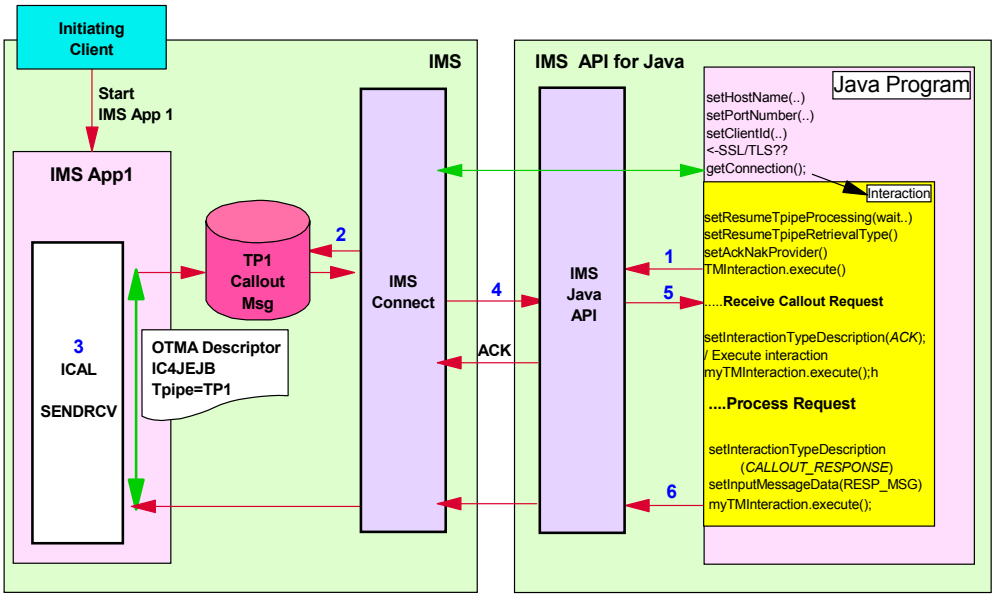

Figure 9-1 Plain Java program accepting and responding to synchronous callout

For a complete sample, see the online documentation in the IBM Information Management Software for z/OS Solutions Information Center at:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

Prerequisites for Connect API for Java

Check the supported platforms and software requirements before you download and install the Connect API for Java. For more information, see the IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *Installing the Connect API for Java*:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

See also OTMA destination descriptors in I*MS Version 12 Communications and Connections*, SC19-3012.

IMS type-2 commands

The Connect API for Java now supports IMS and IMS Connect type-2 command input. The Connect API for Java can return the response data as either a raw XML document or as a parsed response object.

When communicating with IMS 12 and later, client applications can submit IMS type-2 commands to the CSL OM with the Connect API for Java. The Connect API for Java can deliver the response message as either an XML document in a string array or as name and value pairs in a Java Properties array.

The IMS type-2 command interface is provided by the CSL OM component of IMS. Type-2 commands require an active CSL OM in the target IMSPlex and return output in XML format.

The Connect API for Java can send IMS type-2 command input in a standard InputMessage object. The InputMessage is parsed and sent to IMS, and the response message is returned to the Connect API for Java client as an XML instance document that conforms to the imsout.dtd XML definition document. Your client application can retrieve the XML directly, or use a set of method calls provided by the Connect API for Java to retrieve the values of individual fields from the response message.

The `samples.com.myCompany.myProjects.Type2Command.Type2CommandSample.java` program, which is available with the download of the `ImsESConnectApiJavaV2R1Samples.jar` file, shows how to use this facility.

CM0 ACK NOWAIT transaction support

The Connect API for Java includes CM0 ACK NOWAIT transaction support when communicating with an IMS Connect Version 12 host.

Support for CM0 send-and-receive messages that do not receive a response

In IMS 12, a client application that sends a CM0 send-and-receive message with the TMAMHRSP flag in the state data prefix that does not receive a response from the IMS application program is alerted with a `DFS2082` message. This message alerts your Connect API for Java client application when a CM0 send-and-receive request message does not receive a response.

Support for IMS 12 RACF return codes

In IMS 12, the IMS Connect request status message (RSM) contains a 2-byte RACF return code when a RACF security failure occurs during message processing. The RACF return

code indicates what caused the security failure, and it useful for diagnosing security configuration problems. The Connect API for Java provides the `getRacfReturnCode` and `getRacfReturnCodeString` methods to retrieve the error information.

9.4.3 API for Java classes and methods

The runtime implementation of Connect API for Java is provided by the `com.ibm.ims.connect` package in the `imsESConnectApiJavaV2R1.jar` file (Figure 9-2). The `com.ibm.ims.connect` package contains classes and interfaces for the following abstractions:

- Connections to IMS Connect
- Constants for connection and interaction property values
- Error messages
- Interactions with IMS Connect and IMS

Interface Summary

Modifier and Type	Interface and Description
ApiProperties	Constants for setting IMS Connect API connection and interaction properties.
Connection	A TCP/IP socket connection for communicating with IMS Connect.
InputMessage	Contains the data in the input message to be sent to IMS Connect.
OutputMessage	Contains the data in the output message received from IMS Connect.
TmInteraction	Configures interaction properties and executes an interaction with IMS Connect in an IMS transaction.

Class Summary

Modifier and Type	Class and Description
ApiLoggingConfiguration	A helper class to configure tracing for IMS Connect API applications.
ConnectionAttributes	This class represents the configuration of a connection.
ConnectionFactory	Factory class for creating connections to IMS Connect.
TmInteractionAttributes	This class represents the properties that are used to perform an interaction with IMS Connect for running an IMS transaction.

Figure 9-2 The imsESConnectApiJavaV2R1.jar file

9.4.4 Reference material

For reference information about the IMS Enterprise Suite Connect APIs for Java, click the **Connect API** links at the IMS Connect Function and IMS Enterprise Suite Connect APIs page at:

`http://www.ibm.com/software/data/ims/connect/`

To install the Connect API for Java, complete the following tasks:

- Obtain the Connect API for Java component. You can obtain the component by ordering the IMS Enterprise Suite product, or by downloading the component from the IMS Enterprise Suite download website.
- For the z/OS platform, order a Custom-Built Product Delivery Offering (CBPDO) for the IMS Enterprise Suite product through ShopzSeries.
- For other platforms, download the latest service level for the Connect API for Java from the Connect API for Java download site.
- Store the Connect API for Java archive (JAR) file in a directory that is in your class path.

The Connect API for Java is supported on the z/OS and Windows systems. The following software versions are supported:

- z/OS V1.11 or later for IMS 12 and IMS 11
- Microsoft Windows XP (SP2)

The following software is required:

- JDK Version 6.0 (JDK 6.0) or later for the development environment
- Java Runtime Environment (JRE) Version 6.0 or later for the runtime environment

JRE: The JRE must be installed with the extended character set library (installed in the `lib\charsets.jar` file) that includes support for Cp037 and Cp1047 EBCDIC encoding. This library is included with the Support for Additional Languages option in the J2SE installer.

For more information, see IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *Connect API for Java*:

`http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp`

9.5 IMS Enterprise Suite DLIModel utility plug-in IMS Enterprise Suite V2.1

The IMS Enterprise Suite DLIModel utility plug-in translates IMS source files into reliable, application-independent metadata that can be used for Java application development in an Eclipse-based environment, eliminating the need for hand-coded control statements.

The DLIModel utility plug-in can be used on both Windows and Linux systems. For a Java application to access an IMS database, this plug-in needs information about that database. This database information is in IMS source files such as program specification blocks (PSBs) and database descriptions (DBDs).

To access this information, you must first convert it into a form that you can use in the Java application, a subclass of the `com.ibm.ims.db.DLIDatabaseView` class that is called the IMS Java metadata class. The DLIModel utility generates this metadata from IMS source files.

In addition to creating metadata, the DLIModel utility plug-in generates a graphical UML model that illustrates the IMS database structure in an interactive tree model:

- It generates annotated XML schemas of IMS databases, which are used to retrieve XML data from or store XML data in IMS databases.
- It incorporates additional field information from COBOL or PL/I copybooks.
- It incorporates additional PCB, segment, and field information, or overrides existing information through a graphical view of the PCB.
- It generates a DLIModel database report, which assists Java application programmers in developing applications based on existing IMS database structures.
- It generates an optional DLIModel trace log.
- It provides a configuration editor as a launching point for generating IMS database web services artifacts.
- It generates XMI descriptions of the PSB and its databases.

The DLIModel utility plug-in can process:

- All database organizations except MSDB, HSAM, and SHSAM
- All types and implementations of logical relationships
- Secondary indexes, except for shared secondary indexes (*not* for data entry database (DEDB))

DLIModel is a helpful tool for visualizing and documenting all details about DBDs and PSBs sources. DLIModel is also required to produce the `com.ibm.ims.db.DLIDatabaseView` class for accessing IMS databases from Java applications on remote and local locations by using the type 4 and type-2 drivers. Both traditional DLI/SSA and Java Database Connectivity (JDBC) access can be used.

The DLIModel is not changed in this Enterprise Suite V 2.1.

JRE: The JRE must be installed with the extended character set library (installed in the `lib\charsets.jar` file) that includes support for Cp037 and Cp1047 EBCDIC encoding. This library is included with the Support for Additional Languages option in the Java 2 Platform, Standard Edition (J2SE) installer.

For more information, see IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *IMS Enterprise Suite DLIModel utility plug-in*:

`http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp`

9.6 IMS Enterprise Suite Explorer for Development

The IMS Enterprise Suite Explorer (IMS Explorer) is an Eclipse-based graphical tool that simplifies IMS application development tasks such as updating IMS database and program definitions, and using standard SQL to manipulate IMS data. You can use the IMS Explorer graphical editors to import, visualize, and edit IMS database and program definitions. You can also use the IMS Explorer to easily access and manipulate data stored in IMS by using standard SQL.

9.6.1 Building a project with IMS Explorer

After you install the component and its Eclipse environment, you must create a new “IMS Explorer Project”:

1. Select **File** → **New** → **IMS Explorer Project** (Figure 9-3). The Project Explorer tab opens (Figure 9-6 on page 335). Alternatively, select **File** → **New** → **Project**.

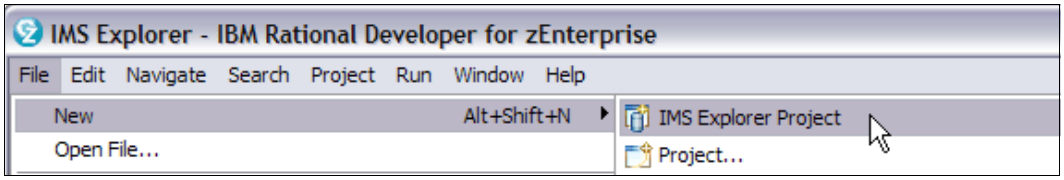

Figure 9-3 New IMS Explorer Project

2. In the New Project window (Figure 9-4), select **IMS** → **IMS Explorer Project**. Then click **Next**.

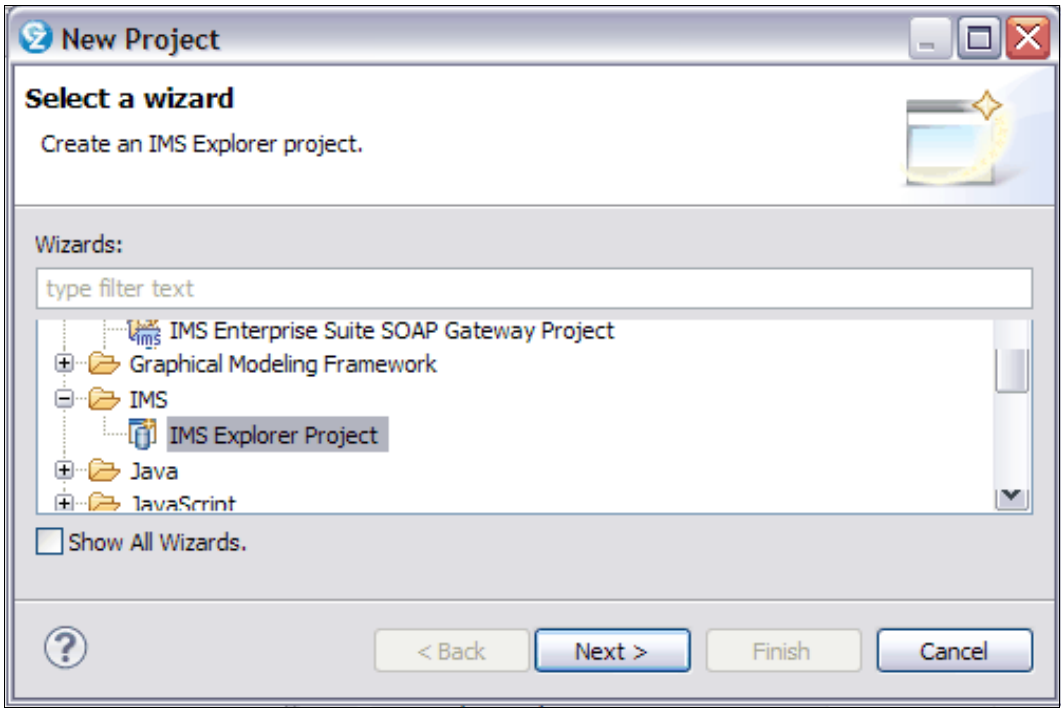

Figure 9-4 New Project Wizard

3. In the New IMS Explorer Project window (Figure 9-5), choose a project name.

   When you click **Next**, you can import PSBs and DBDs from a local or remote file system, which we do later. The reason for postponing this task is that, in an existing project, the import requires the selection of the adequate “input source”. You must make this selection explicitly. In this case, we click **Finish**.

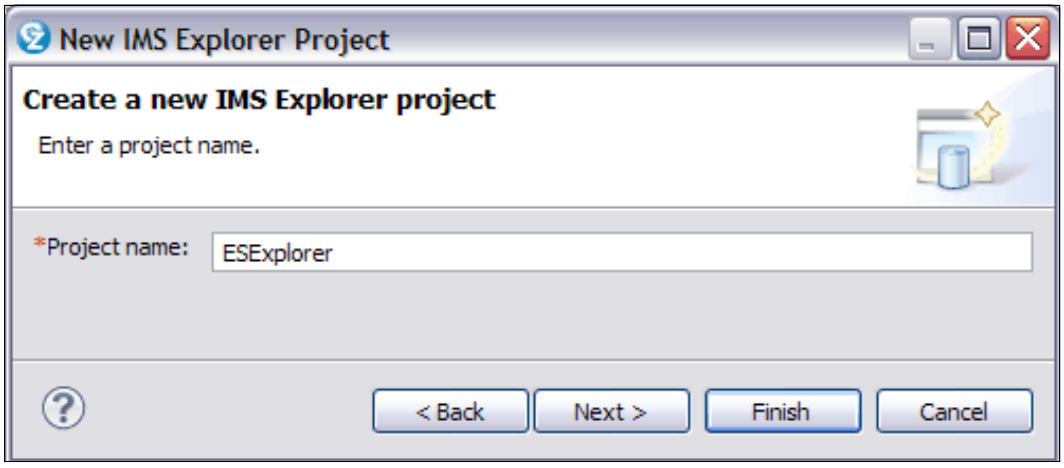

Figure 9-5 Name of the project

The project is built now. Figure 9-6 shows how it looks.

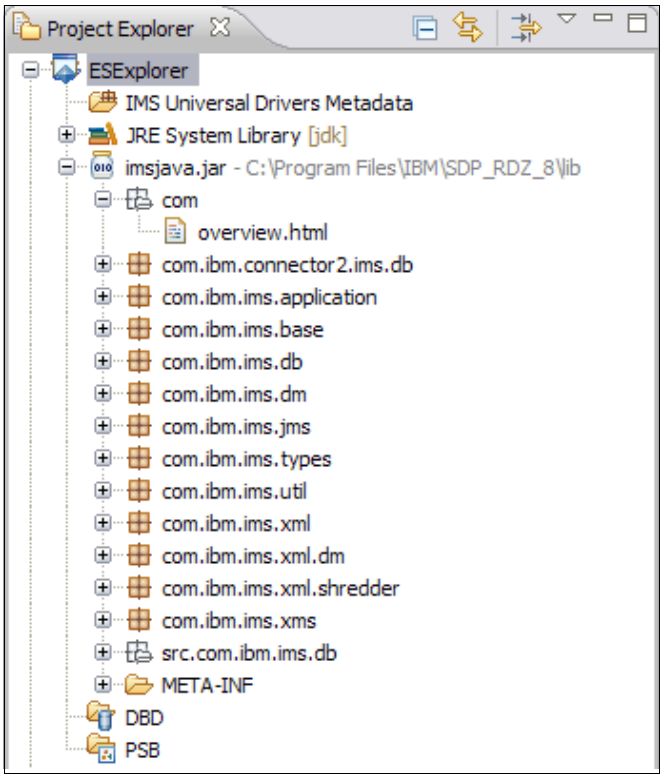

Figure 9-6 ESExplorer project

9.6.2 Importing the resources for DBD and PSB

Many Java classes, all which start with `com.ibm.ims`, have been included in the project. They are packaged in a JAR file, called `imsjava.jar`. The DBD and PSB folders are still empty, because we skipped the resource import.

To import the resources, complete these steps:

1. Right-click **ESExplorer** and select **Import**.
2. In the Import window, select **IMS Resources**, and then click **Next**.
3. In the Import IMS Resources window, enter the project name, and then click **Next**.

Figure 9-7 illustrates the first three steps in this task.

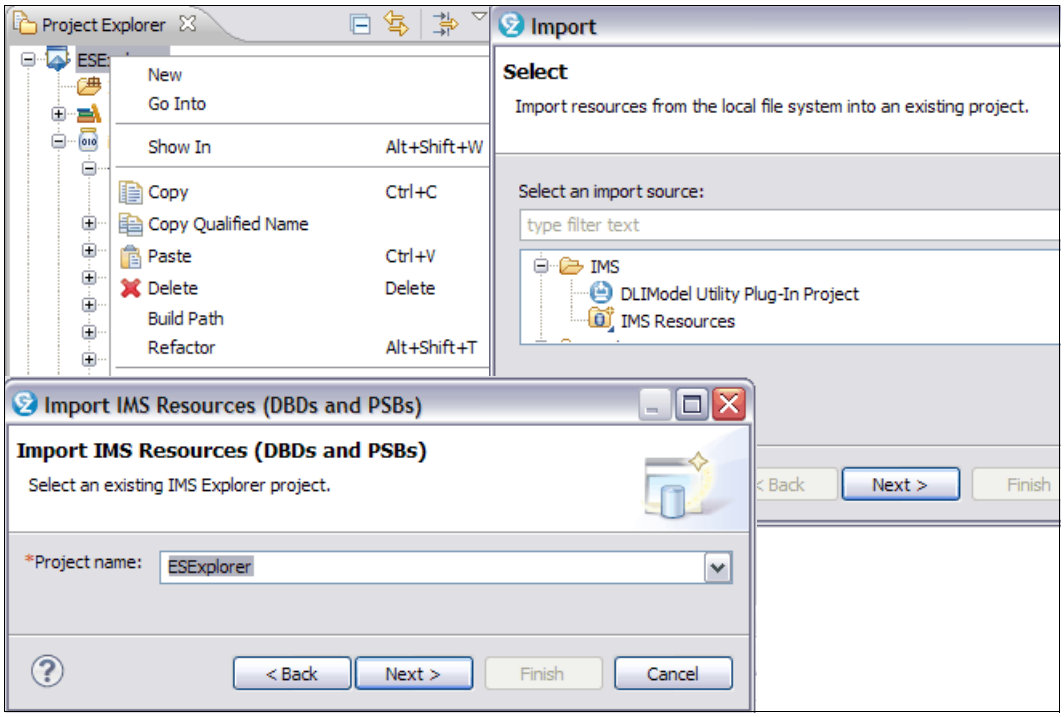

Figure 9-7 Import with Project name selection

4. In the Select an Import Source panel, select **IMS Resources**, and then click **Next**.
5. In the next window (Figure 9-8), select whether to input from a local or remote source. We select Local file system in this example. Then click **Next**.

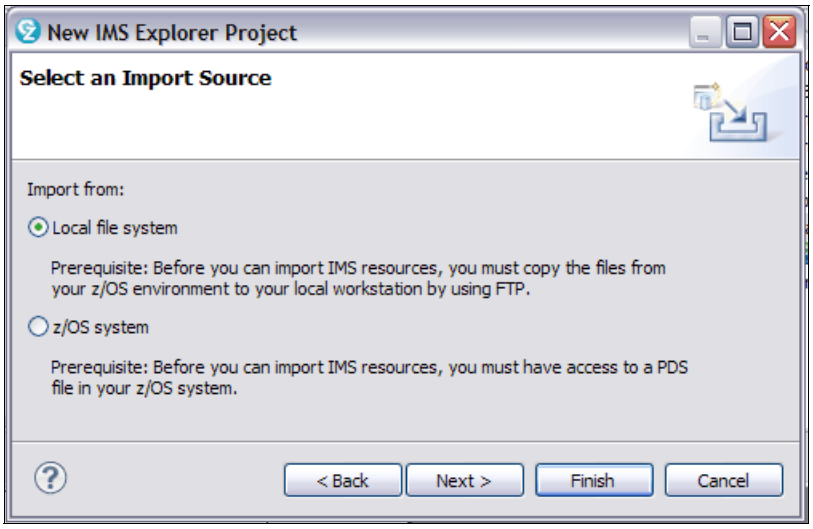

Figure 9-8 Local or remote import source selection

6. Because Local file system was selected in the previous step, select the resources from the file system. In this case, we import from a local folder in which we have PSBs and the DBDs, referenced by the PCBs in this PSB (Figure 9-9). We selected the **AUTO dealer application**, with **PSB AUTPSB11**. All required DBDs are in the same folder and preselected. Click **Finish**.

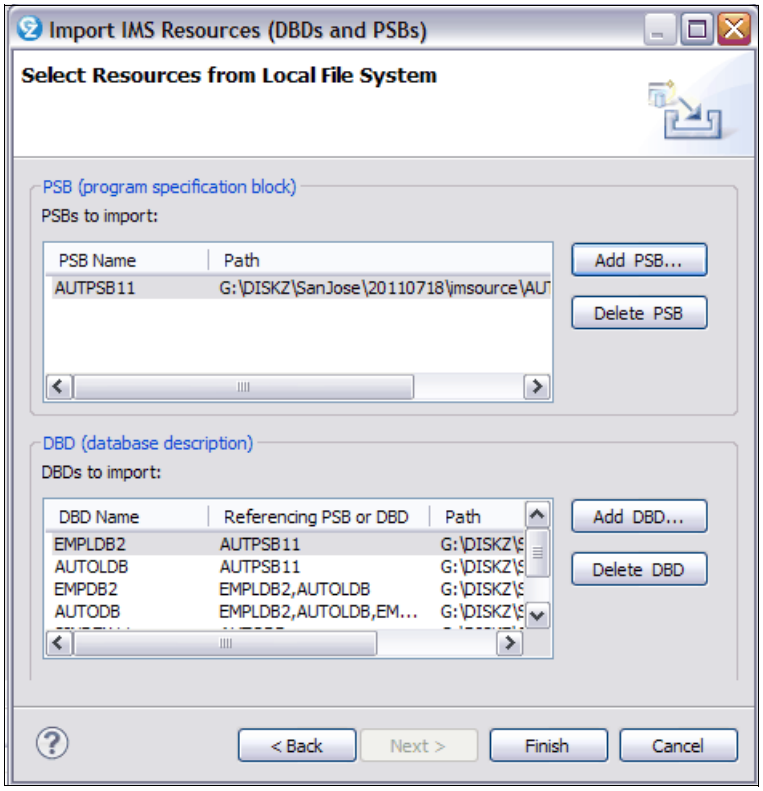

Figure 9-9 PSB selected and DBD found in same folder and preselected

7. If you receive a warning that some fields cannot be used with JDBC/SQL access, which can be solved later (Figure 9-10), click **OK**.

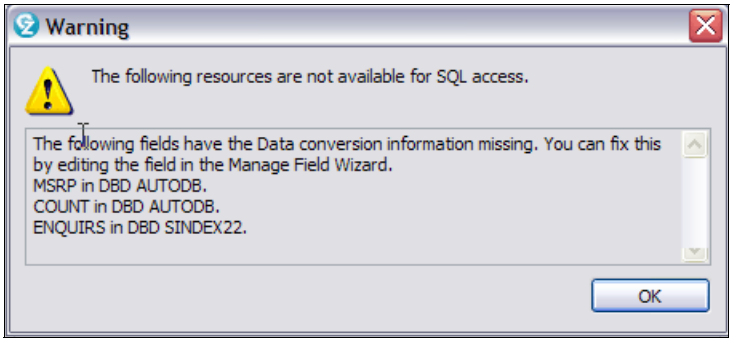

Figure 9-10 Problems to be solved for SQL access

The source code for PSBs and DBDs for the Autodealer program (AUTPSB11) are loaded in the Explorer project. All sources are now available in three copies (Figure 9-11):

- Original imported source code
- Generated or transformed source code
- XML representation of the source (both DBD and PSB)

XML representation of the source is used as meta information. This information can be looked at in two ways. The representation is different for DBDs and PSBs.

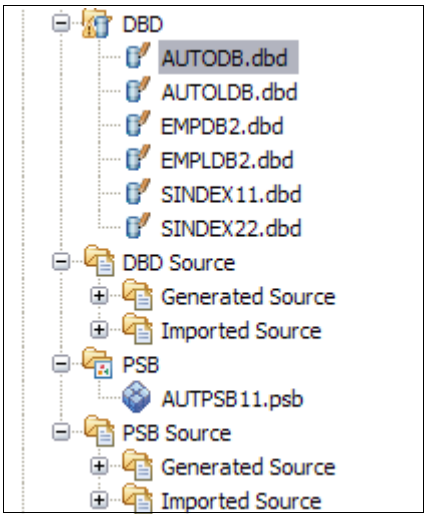

Figure 9-11 Source code

DBDs

The DBD metacode is available in XML format as shown in Example 9-1, which you can view by using a text editor.

Example 9-1 Excerpt of the DBD metacode in XML format for DBD "AUTODB"

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:dbd xmlns:ns2="http://www.ibm.com/ims/DBD" dbdName="AUTODB">
    <access dbType="HDAM">
        <hdam datxexit="N" password="N" osAccess="OSAM">
            <rmName name="DFSHDC40">
                <subOptions bytes="200" maxRBN="5" anchorPoints="1"/>
            </rmName>
            <dataSetContainer>
                <dataSet searchA="0" scan="3" ddname="DFSDLR">
                    <block size="-1"/>
                    <size size="-1"/>
                    <frspc fspf="0" fbff="0"/>
                </dataSet>
            </dataSetContainer>
        </hdam>
    </access>
    <segment imsName="DEALER">
        <field imsDatatype="C" seqType="U" imsName="DLRNO">
            <startPos>1</startPos>
            <bytes>4</bytes>
            <marshaller>
                <typeConverter>CHAR</typeConverter>
```

```
            </marshaller>
            <applicationDatatype datatype="CHAR"/>
        </field>
        <field imsDatatype="C" imsName="DLRNAME">
            <startPos>5</startPos>
            <bytes>30</bytes>
            <marshaller>
                <typeConverter>CHAR</typeConverter>
            </marshaller>
            <applicationDatatype datatype="CHAR"/>
        </field>
.......
```

The original DBD source has been interpreted and enriched by the IMS source reader, and represented in XML. This is the base for editing by the Explorer.

The DBD metacode is also available in graphical format, with the IMS DBD editor (Figure 9-12).

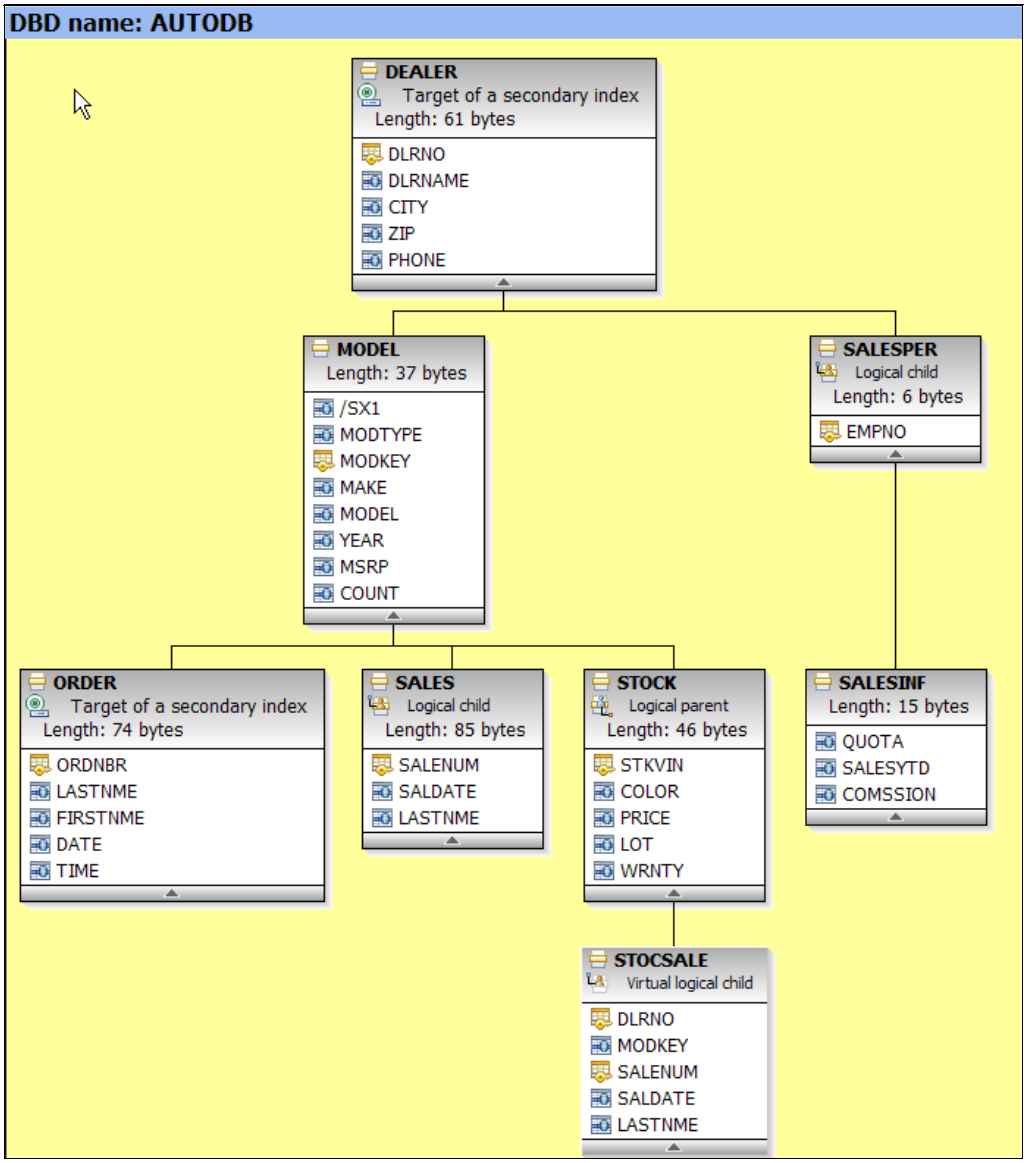

Figure 9-12 AUTODB.dbd file in the IMS DBD editor

Several options are available for using the DBD editor:

- Hovering over a segment field to view the basic characteristics through hover text (Figure 9-13).

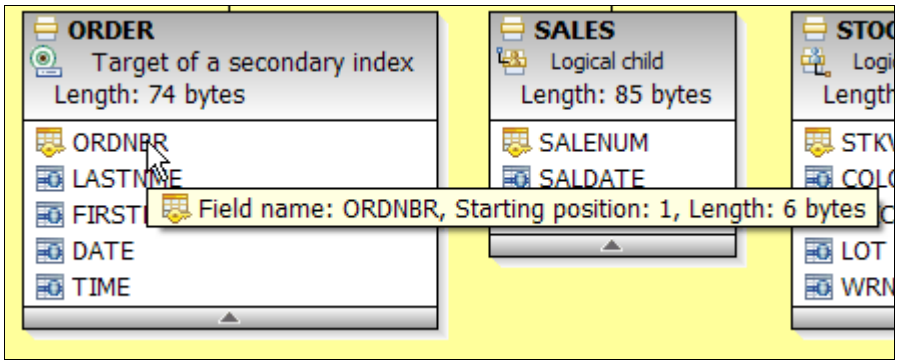

Figure 9-13 Hovering over a field

- Right-clicking a segment, for example ORDER, and selecting an option from the menu (Figure 9-14).

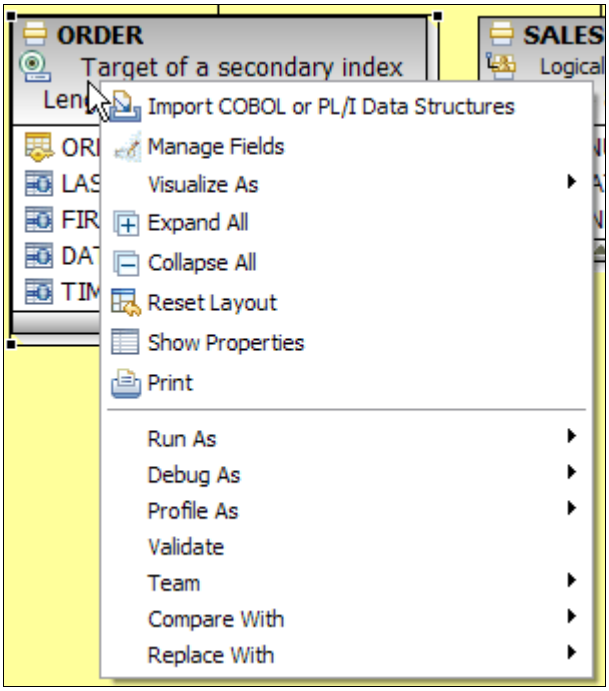

Figure 9-14 Right-clicking a segment

You can enrich the segment information with a COBOL copybook or a PLI include. Managing the fields gives you a list of the fields in the segments (Figure 9-15). In the Manage Fields window, you can add fields, remove fields, or edit fields.

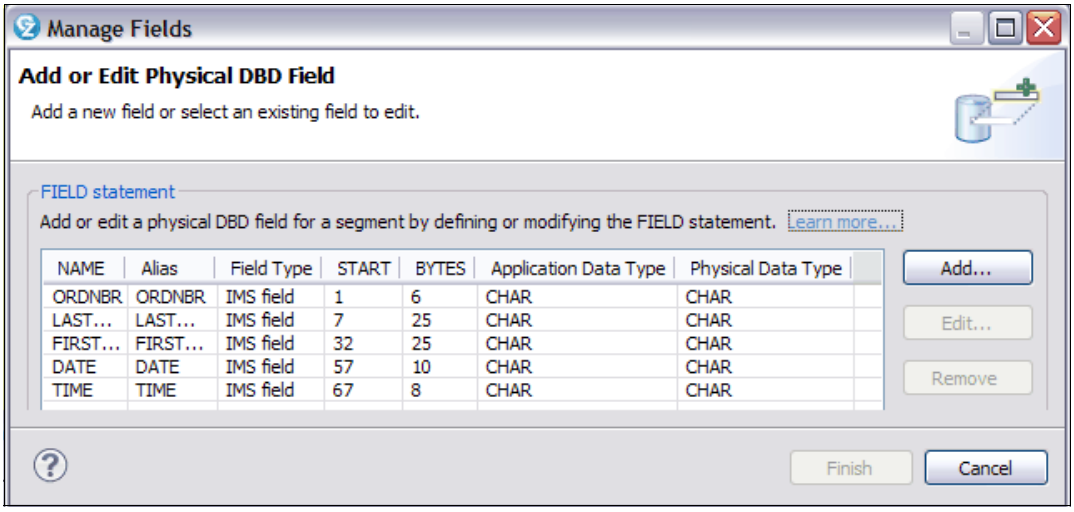

Figure 9-15 Managing fields list

The Edit Field window (Figure 9-16) shows an example of editing the properties for a segment field.

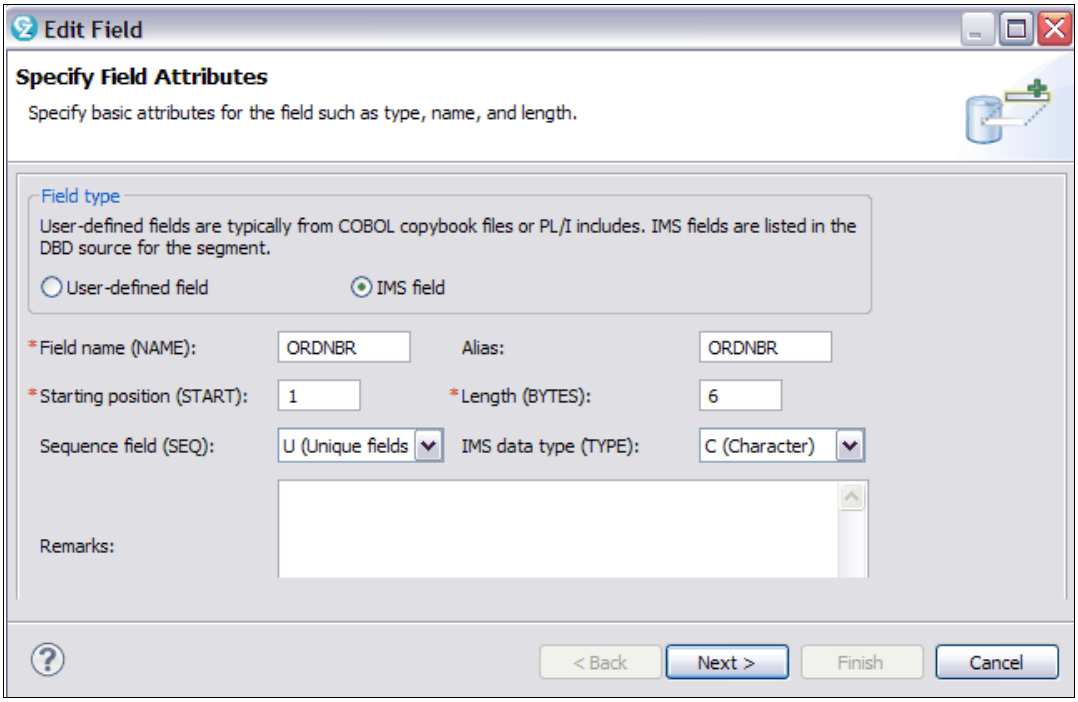

Figure 9-16 Editing of a segment field

PSBs

The PSB metacode is available in XML format as shown in Example 9-2, which you view by using a text editor.

Example 9-2 Excerpt of the DBD metacode in XML format for PSB "AUTPSB11"

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:psb xmlns:ns2="http://www.ibm.com/ims/PSB" compat="N" lang="JAVA"
psbName="AUTPSB11">
    <dbPCB copies="1" procopt="AP" keyLength="100" dbdName="AUTOLDB"
name="AUTOLPCB">
        <label>AUTOLPCB</label>
        <senseg name="DEALER">
            <indices/>
            <senseg name="MODEL">
                <indices/>
                <senseg name="ORDER">
                    <indices/>
                </senseg>
                <senseg name="SALES">
                    <indices/>
                </senseg>
                <senseg name="STOCK">
                    <indices/>
                    <senseg name="STOCSALE">
                        <indices/>
                    </senseg>
                </senseg>
            </senseg>
            <senseg name="SALESPER">
                <indices/>
                <senseg name="SALESINF">
                    <indices/>
                </senseg>
                <senseg name="EMPLINFO">
                    <indices/>
                </senseg>
            </senseg>
        </senseg>
    </dbPCB>
......
```

You can also view the PSB metacode by using the IMS PSB editor. The first part of the PSB editor (Figure 9-17) shows sections related to the IO (alternate) PCB, DB PCBS, and GSAM PCB (not shown).

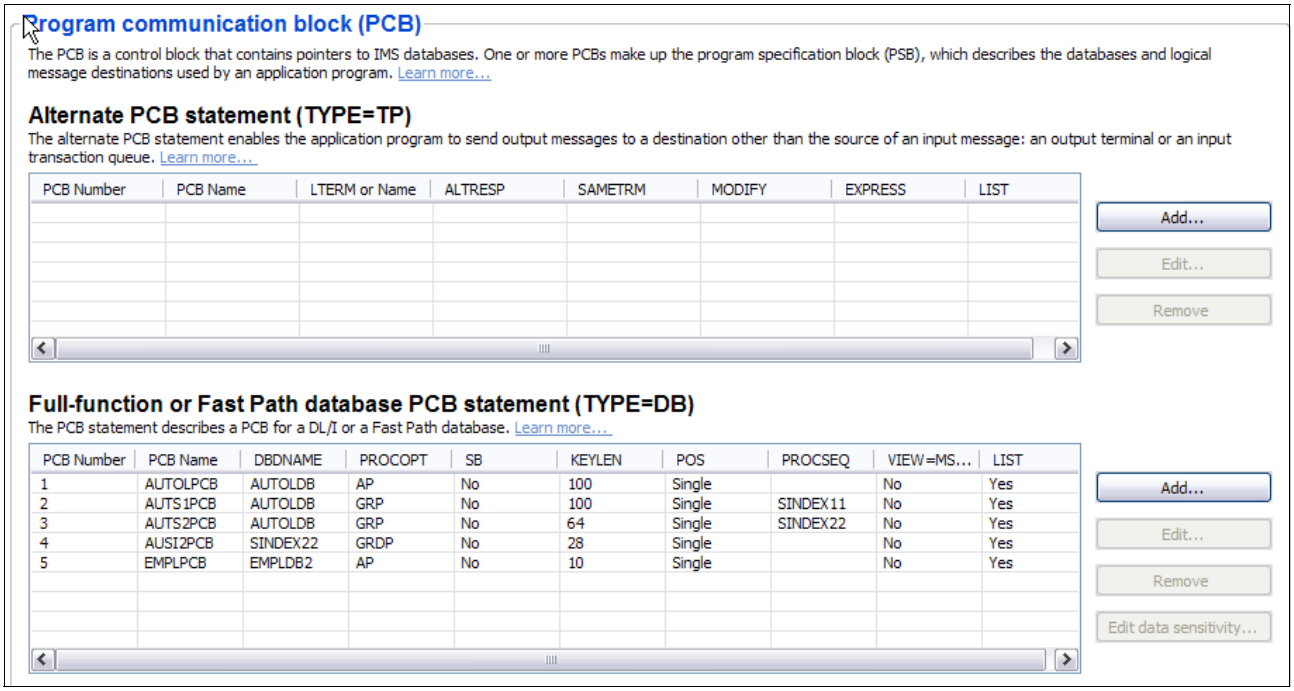

Figure 9-17 Alternate and DB PCB sections

The last part of the editor shows general characteristics of the PSB (Figure 9-18).

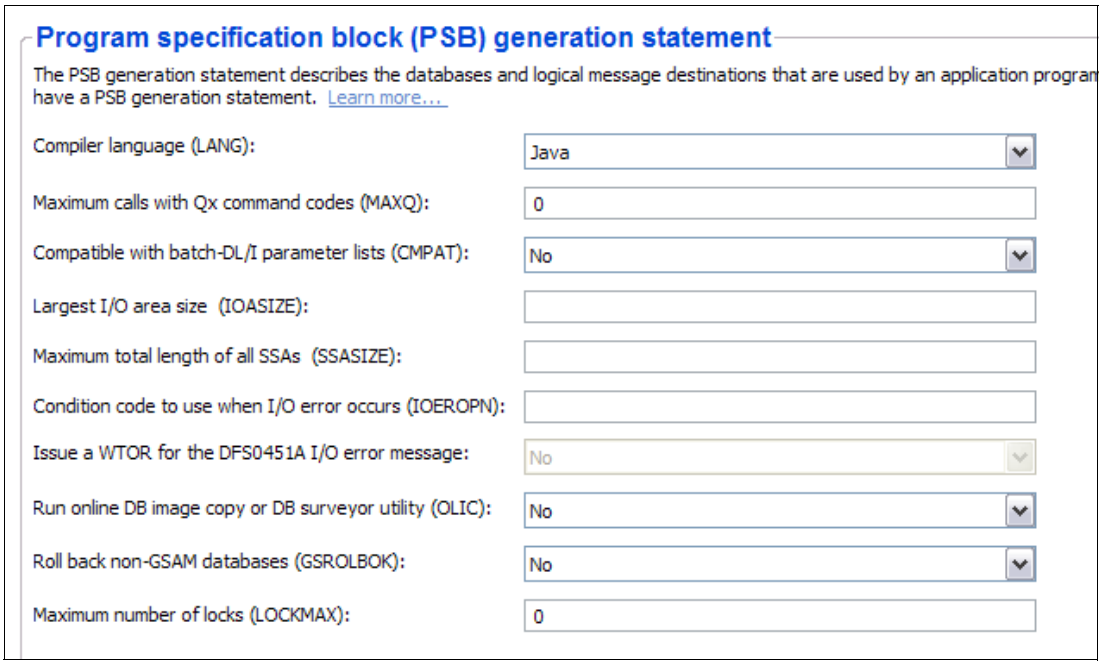

Figure 9-18 General PSB section

You can make several adjustments on the PSB in the editing panel. This panel includes the following IO/DB PCB sections:

- New PCBs can be added.
- Existing PCBs can be removed.
- Details of existing PCBs can be edited.

As an example, we edit one PCB in the Full-function or Fast-Path database section (Figure 9-19).

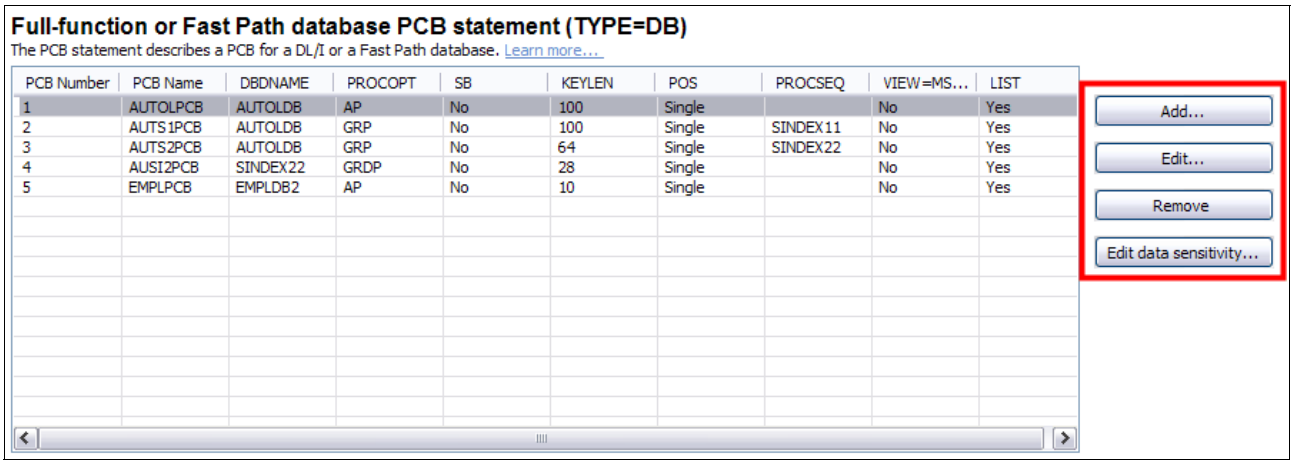

Figure 9-19 Selecting a DBPCB for detailed editing

After selecting the PCB, we have several options, including two edit options (Figure 9-19). We start first with the “Edit” option. Then the Edit PCB Statement window (Figure 9-20) opens. You recognize the options that otherwise are entered with the PCB macro during the PSBGEN. The PCB shown in Figure 9-20 represents access by using a secondary index.

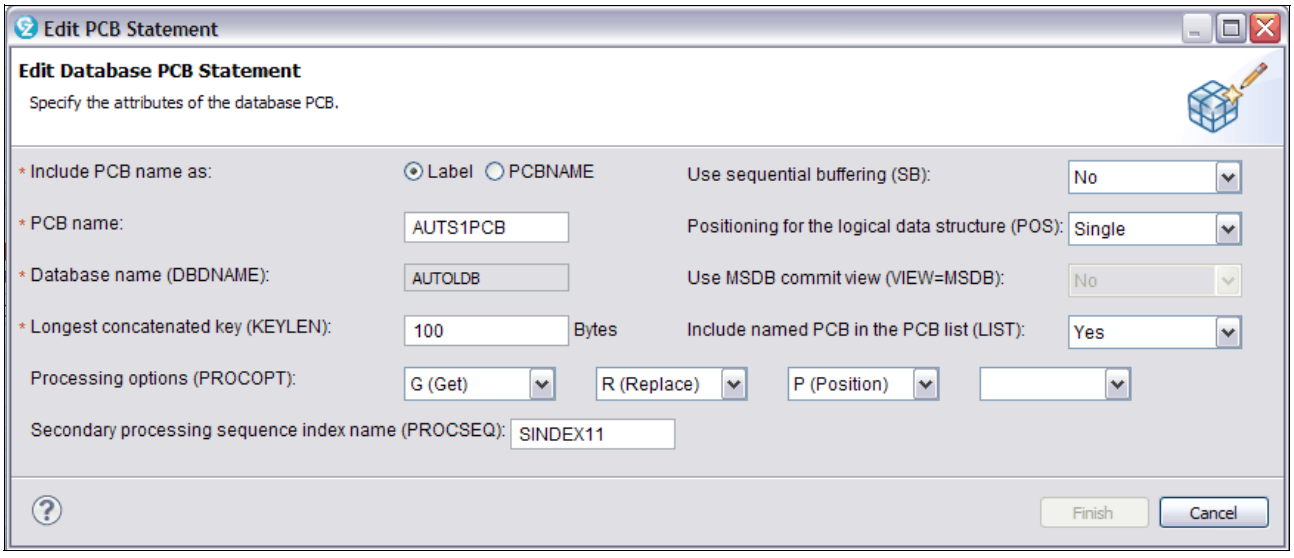

Figure 9-20 Edit PCB Statement window

After returning to the previous panel, we can select **Edit data sensitivity**. Figure 9-21 shows the sensitivity by segment and by field. This sensitivity can be changed. By using the symbols in the upper-right corner, you can switch between editing mode and read-only mode.

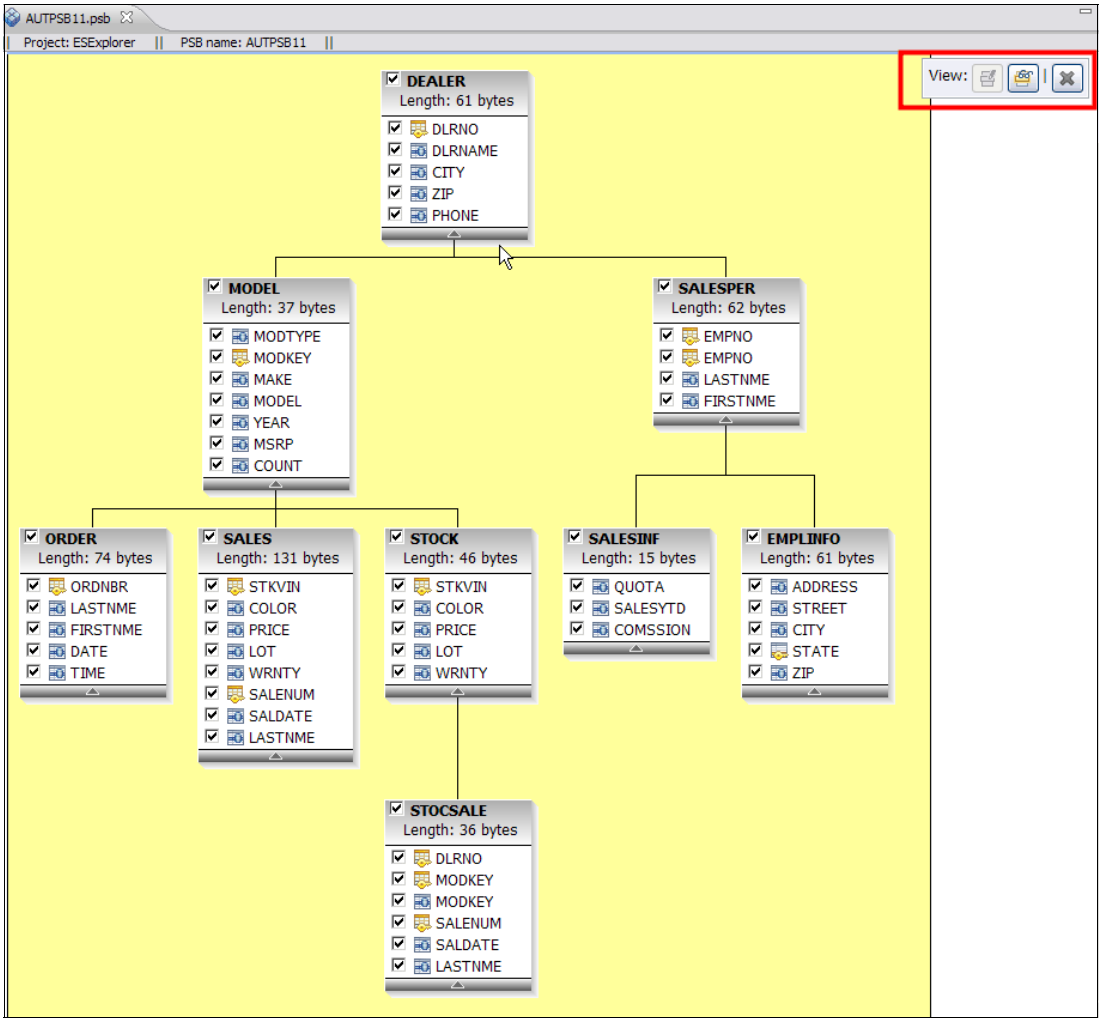

Figure 9-21 Sensitivity panel

By hovering over a segment name or even over a field, hover text is displayed, indicating the details of the sensitivity (Figure 9-22).

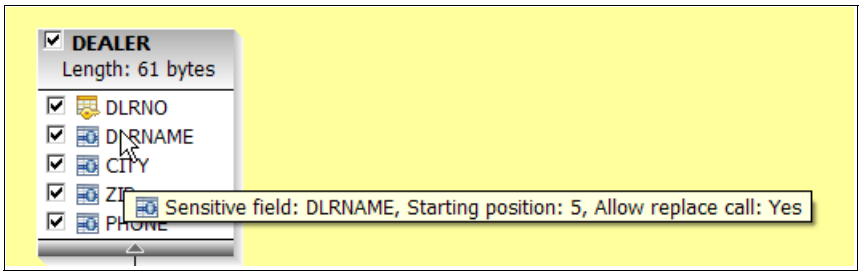

Figure 9-22 Field sensitivity

With the PCB macro from the PSBGEN (Example 9-3), you can verify the graphical representation.

Example 9-3 PCB macro in PSBGEN corresponding to Figure 9-21

```
AUTOLPCB PCB TYPE=DB,DBDNAME=AUTOLDB,PROCOPT=AP,KEYLEN=100          00170000
         SENSEG NAME=DEALER,PARENT=0                                00180000
         SENSEG NAME=MODEL,PARENT=DEALER                            00190000
         SENSEG NAME=ORDER,PARENT=MODEL                             00200000
         SENSEG NAME=SALES,PARENT=MODEL                             00210000
         SENSEG NAME=STOCK,PARENT=MODEL                             00220000
         SENSEG NAME=STOCSALE,PARENT=STOCK                          00230000
         SENSEG NAME=SALESPER,PARENT=DEALER                         00240000
         SENSEG NAME=SALESINF,PARENT=SALESPER                       00250000
         SENSEG NAME=EMPLINFO,PARENT=SALESPER
```

9.6.3 Input for IMS Explorer

Chapter 8, “Installation and migration considerations” on page 279, explains how input for IMS Explorer was taken from local PSB and DBD sources. The explorer can also accept input in the following ways:

- Import of a DLIModel Utility project

  An existing DLIModel utility project can be the input for the explorer, by directly referencing its location (Figure 9-23).

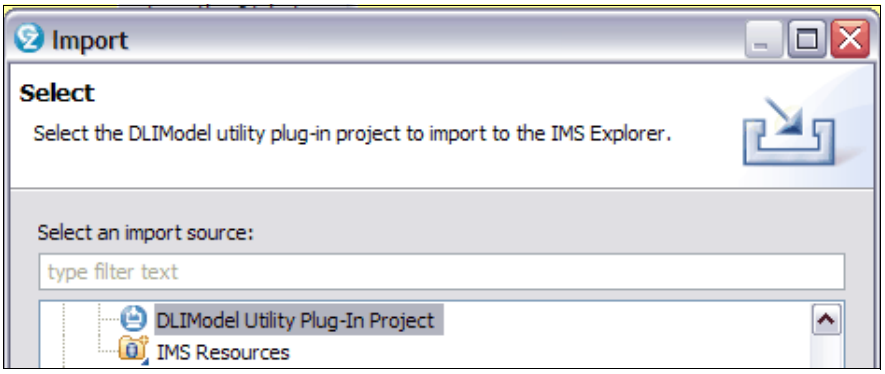

Figure 9-23 Import from DLIModel project

- Remote import

  The sources of PSBs and DBDs can be imported from a remote location by using FTP (Figure 9-24).

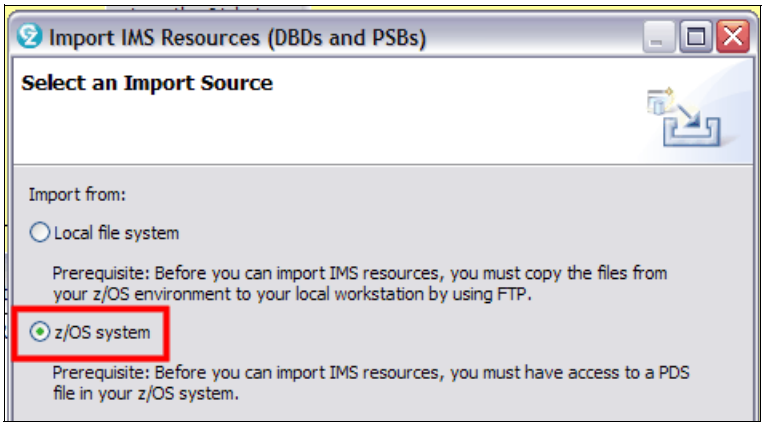

Figure 9-24 Import from z/OS through FTP

9.7 IMS Enterprise Suite SOAP Gateway 2.1

SOAP Gateway enables IMS applications to interoperate outside of the IMS environment through the SOAP to provide and request services that are independent of platform, environment, application language, or programming model. SOAP Gateway helps you transform your IMS applications to either web service providers or consumers (Figure 9-25).

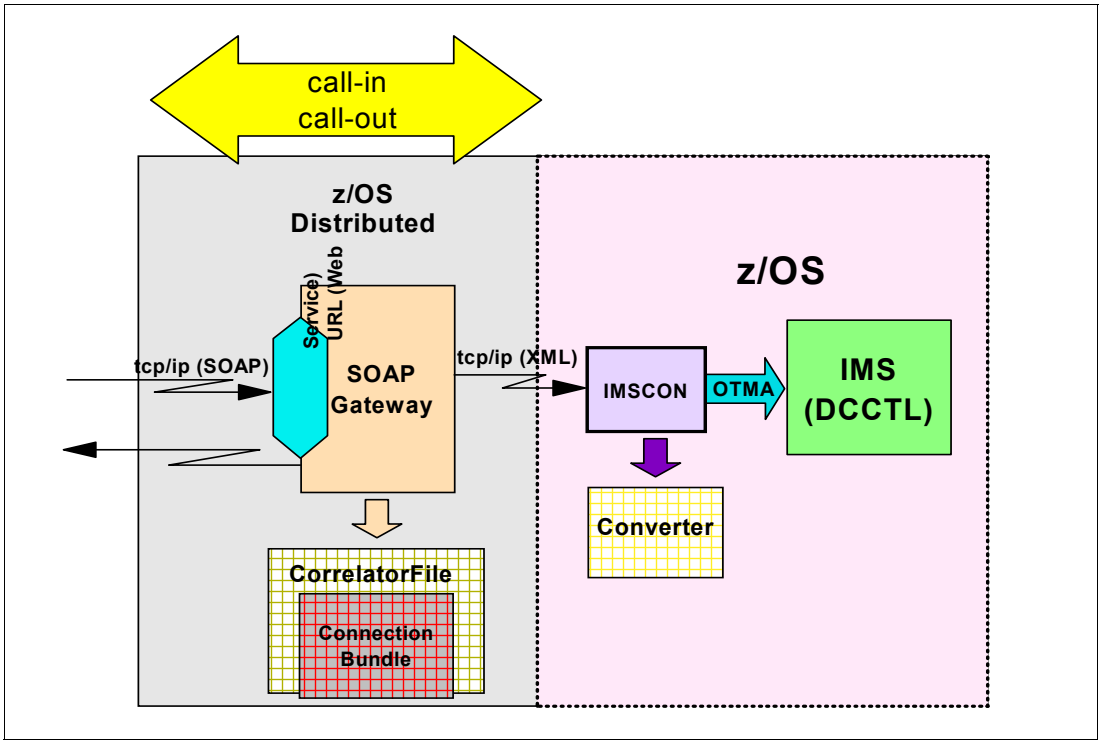

Figure 9-25 Web services call-in and call-out

When IMS applications are enabled as web service providers, different types of client applications such as Microsoft .NET, Java, and third-party applications can submit SOAP requests into IMS to drive the business logic of the COBOL applications.

When IMS applications are enabled as web service consumers, they can call out to any external web services and receive the response in the same or a different transaction.

SOAP Gateway can be used on z/OS, Linux for System z, and Windows systems.

This section addresses the following areas:

- SOAP Gateway components
- Web services security
- SOAP Gateway V2.1 security implementation
- Security setup for Enterprise Suite V2.1
- SOAP Gateway Server
- SOAP Gateway management utility
- Implementing a call-in web service for IMS
- SOAP Gateway Administrative Console

9.7.1 SOAP Gateway components

SOAP Gateway includes several components. First, it includes a server component that processes web service requests between IMS applications and external applications or web services. It also includes a utility for deploying web services and managing server properties and an administrative console for verifying installation and deployed web services.

- SOAP Gateway server

  The SOAP Gateway server acts as the gateway between external web services and IMS applications. It serves as a web service server where IMS applications are enabled as web services. It serves a web service consumer when it forwards IMS application callout requests or business event data to external web services or event processing services.

- SOAP Gateway management utility

  The SOAP Gateway management utility provides a command line or batch interface for configuring server properties, managing the server run time and working with web service artifacts.

- SOAP Gateway administrative console

  The SOAP Gateway administrative console lists the deployed web services when the server is started. Each item in the list is a link to the Web Services Description Language (WSDL) file for the web service. It also replaces the Deploy utility of IMS Enterprise Suite V1.1.

The following items are new in version 2.1:

- When IMS Enterprise Suite Version 2.1 SOAP Gateway is the service provider, it adds support for Security Assertion Markup Language (SAML) 1.1 sender-vouches signed tokens and SAML 2.0 unsigned tokens for the web service provider scenario.
- SOAP Gateway can be run on a previously installed IBM distribution of the JDK.
- The SOAP Gateway management utility provides a command line or batch interface for configuring server properties, managing the server run time, and working with web service artifacts.

9.7.2 Web services security

To help you understand the WS-security implementation in combination with SAML, this section begins with a general overview of security for web services. You can use two types of security: transport-level security and message-level security (Figure 9-26), as explained here.

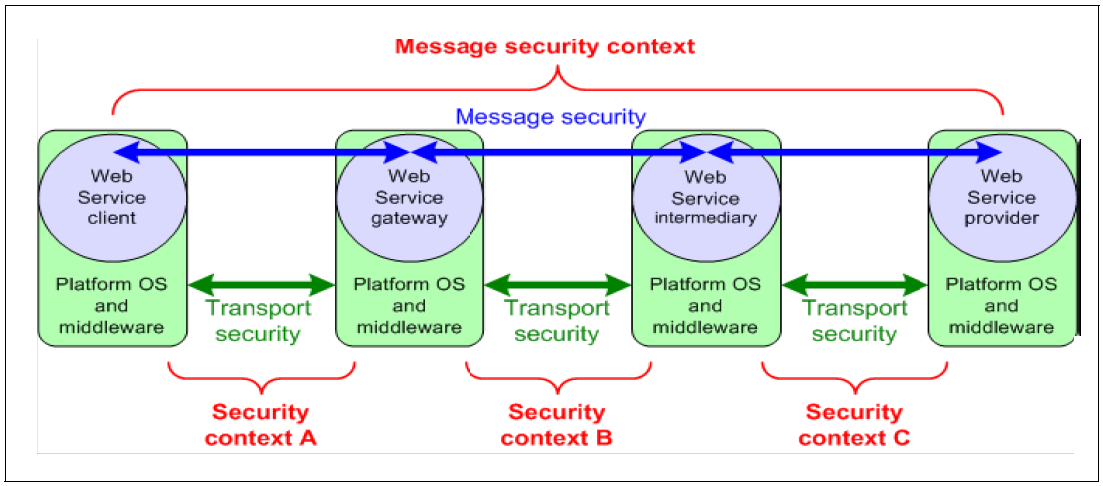

Figure 9-26 Message security and transport security

- Transport-level security (for example, HTTPS)

  This is a point-to-point security model where the channel is protected between two parties. Transport security starts with a SSL/Transport Layer Security (TLS) handshake between two transport endpoints, and creates a transport channel using symmetric encryption.

  Transport security is unaware of the frame protocol used on top of the channel.

  Often the service consumer and service provider are separated by intermediaries (for example, an enterprise service bus). In situations like these, each connection between the endpoints must be secured.

- Message security

  Message security travels with the message and has been formalized by the WS-Security standard. This outlines support for dynamic authentication on a per message basis for accessing IMS applications as web services. It details message-level security. The message level is part of the message, but it does not exclude the transport over a secure transport channel. This is even required if the authentication information, such as a user name and password, are passed in the clear.

WS-Security incorporates security features in the header of a SOAP message, working in the application layer. Thus it ensures end-to-end security. Figure 9-27 shows SOAP frames without and with message security in the header.

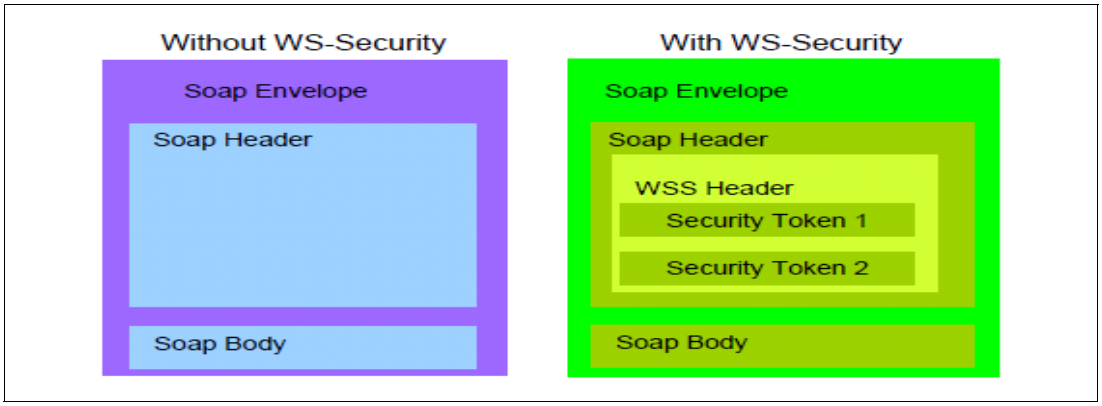

Figure 9-27 Comparing the SOAP frame, without and with message security

The security elements can be packed in different formats in the header. If the header is filled in directly by the requester of the web service, it can be the following types:

- Usertoken (UserID/password)
- Binary Token (509v3 certificate; not in Enterprise Suite Version 2.1)

If the header is asserted by an identity provider (IDp), it can be passed by a requester as a SAML token. This assumes that before the requester works with the web service, the requester first contacts a security server by, for example, a SOAP interaction, to obtain an asserted identification, which will not be contested by the SOAP gateway contact. This identification will be packed in a SAML token and transported with the SOAPheader. The token, which represents the identification, can have the following content:

- SAML with Usertoken (UserId)
  - Format (SAML V1.1 (signed or nonsigned) and SAML V2.0)
- SAML with Binary Token (509v3 certificate, KERBEROS; not in Enterprise Suite Version 2.1 signed, or not signed with attributes)

In 9.7.3, “SOAP Gateway V2.1 security implementation” on page 351, we explain what is implemented in SOAP Gateway Version 2.1. For additional reading about WS-Security, see WS-Security AppNotes at:

http://msdn.microsoft.com/en-us/library/ms951253.aspx

Message- and transport-leve security: Message-level security can provide an end-to-end security solution. It travels with the message. Transport-level security requires that it is implemented between all two-partner nodes in the transport path.

9.7.3 SOAP Gateway V2.1 security implementation

IMS SOAP Gateway can accept web services call-ins and can issue call-outs to a web service server. The security that is available is different.

Figure 9-28 shows what is supported in SOAP Gateway Version 2.1.

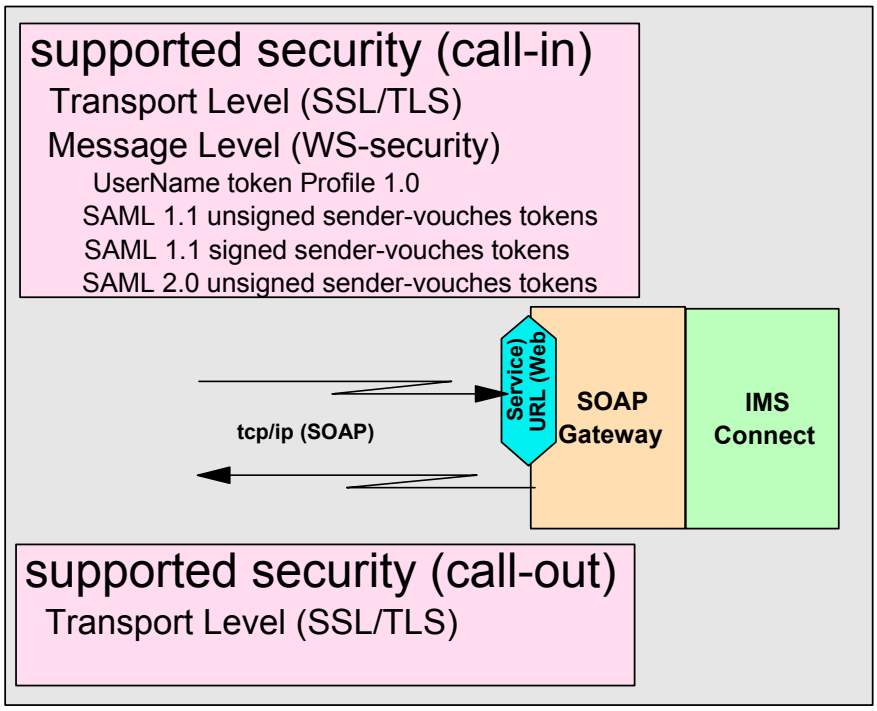

Figure 9-28 Web services SOAP Gateway security

IMS 12 supports two basic scenarios for using web services:

- On the *call-out side*, IMS is the web service client. The only security implemented is based on the transport level. No user ID information is carried in the SOAPheader of the SOAP messages sent to an external web service, but before using the transport a SSL/TLS session can be established (handshaken) between the two partners.

  A user can also use Basic Authorization, which carries user name and password within the HTTP stack.

- On the *call-in side*, the SOAP gateway acts as the server and accepts transport-level security and a subset of the WS-security, eventually in combination with SAML tokens. The security elements which are carried in the SOAPheader are provided from the requester. It is the task of the SOAP gateway server to understand the security information, to extract it from the header, and to pass it to IMS by using the extended header of the IMS Connect IRM.

The following sections provide an overview of WS-security (eventually in combination with SAML) supported in Enterprise Suite SOAP gateway V2.1

Security implementation without SAML

The configuration that is supported without SAML is based on “UserName token profile 1.0”. The UserName token is carried in the SOAPheader. This possibility was already available in Enterprise Suite SOAP Gateway V1.1.

Figure 9-29 shows the flow from requester to IMS. The real SOAP envelope (header, body) is used between the requester and the SOAP gateway.

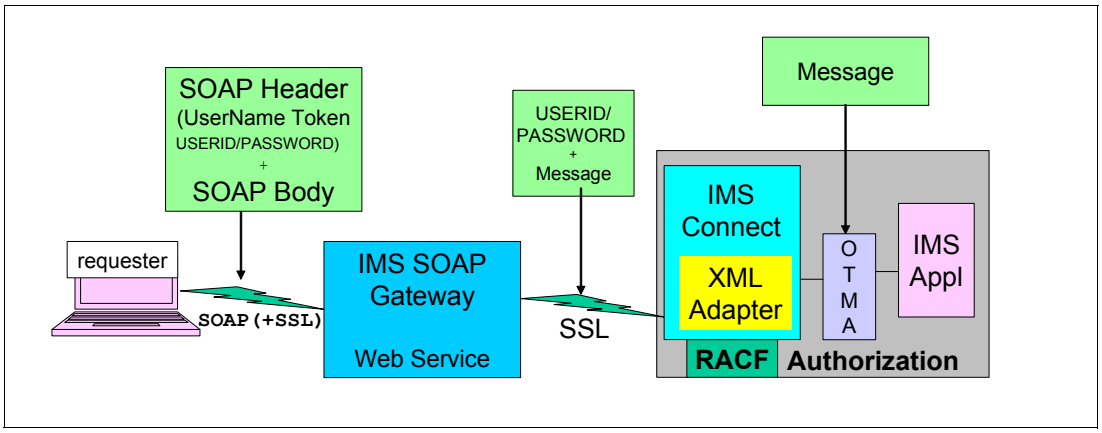

Figure 9-29 Web service flow from requester to IMS with UserNametoken

The UserName and Password are extracted from the UserName token in the SOAP Gateway and passed to IMS Connect in the IRM request to IMS Connect. IMS Connect verifies the user ID and password with RACF.

The excerpt in Example 9-4 shows the format of the SOAP frame, with `Header` and `Body`.

Example 9-4 SOAPheader with UserNametoken

```
<?xml version=\"1.0\" encoding=\"utf-8\"?>
<soapenv:Envelope xmlns:soapenv=\"http://schemas.xmlsoap.org/soap/envelope/\">
   <soapenv:Header xmlns:wsa=\"http://www.w3.org/2005/08/addressing\">
      <wsse:Security xmlns:wsse=\"http://docs.oasis-..;env:mustUnderstand=\"1\">
         <wsse:UsernameToken xmlns:wsu=\"http://docs.oasis-open.org/..... .">
            <wsse:Username>
               USRT001
            </wsse:Username>
            <wsse:Password Type=\"http://docs.oasis-open.....Text\">
               MYPASSWORD
            </wsse:Password>"
         </wsse:UsernameToken>
      </wsse:Security>
      <wsa:.......
         (NOT SHOWN)
      </wsa:.....>
   </soapenv:Header>
   <soapenv:Body>
      .......
   </soapenv:Body>
</soapenv:Envelope><
```

Inside the header, you can recognize the wsse:UsernameToken, with Username and Password. This information in the SOAP frame is in the clear in this case. The only way to protect it is by using transport-level security. Otherwise, the information passes in the clear over TCP/IP.

Security implementation with SAML

In the UserName token case, the identity/authentication username information came directly from the requester.

With SAML, this information must be obtained beforehand from an identity provider (security server). SAML is a specification designed to provide cross-vendor single-sign-on interoperability. SAML was developed by a consortium of vendors (including IBM) under the auspices of OASIS, through the OASIS SSTC (Security Services Technical Council). SAML has two major components:

- SAML assertions are used to transfer information within a single sign-on protocol.
- SAML bindings and profiles are used for a single sign-on protocol.
  - How SAML is employed in any given context is known as a *SAML profile*.
  - How SAML assertions or protocol messages are conveyed in or over another protocol is known as a *SAML binding*.

A SAML assertion is an XML-formatted token that is used to transfer user identity (and attribute) information from a user's identity provider to trusted service providers as part of the completion of a single sign-on request. A SAML assertion provides a vendor-neutral means of transferring information between federation business partners.The identity provider asserts the identity of the requester. In practice it happens by the requester contacting the identity server and obtaining this proof of identity in the format of a SAML token.

This token can be used for several purposes. In the case of web services the SAML token, which asserts the identity of the requester, is passed in the SOAPheader, replacing the UserName token or other identity tokens.

The SAML token is a richer alternative to standard WS-security identity tokens because in addition to its identity/authentication content, it can also carry several additional attributes, such as access control information, that are related to the requester.

As a protocol, SAML has three versions: SAML 1.0, SAML 1.1, and SAML 2.0, as explained here:

- SAML 1.0 and SAML 1.1 (collectively, SAML 1.x) focus on single sign-on functionality.
- SAML 2.0 represents a major functional improvement over SAML 1.x. Approved in March 2005, SAML 2.0 is based on SAML 1.x with significant input from the Liberty Alliance ID-FF and Shibboleth specifications.

For more information about SAML, see the SAML Technical Overview at:

- *Technical Overview of the OASIS Security Assertion Markup Language (SAML) V1.1* (May 2004)

  http://www.oasis-open.org/committees/download.php/6837/sstc-saml-tech-overview-1.1-cd.pdf

- *Security Assertion Markup Language (SAML) V2.0 Technical Overview* (March 2008)

  http://www.oasis-open.org/committees/download.php/27819/sstc-saml-tech-overview-2.0-cd-02.pdf

See also *Federated Identity Management and Web Services Security with IBM Tivoli Security Solutions*, SG24-6394.

SOAP gateway V1.1 already supports SAML V1.1 unsigned. SOAP gateway V2.1 supports two additional versions of SAML.

SAML 1.1 signed sender-vouches tokens

With SAML 1.1 signed sender-vouches tokens, the requester contacts the security server (identity server) to obtain an identity assertion (a proof of identity), which is passed to the SOAP gateway. This model can also be called “push/post” because the assertion obtained from the security server is pushed with the “post” request to the web service.

A signed SAML token further protects message integrity by enabling the recipient of the token to validate the authenticity of the token and assert SAML token identity and attributes based on the trust relationship with the token issuer. Figure 9-30 illustrates the flow.

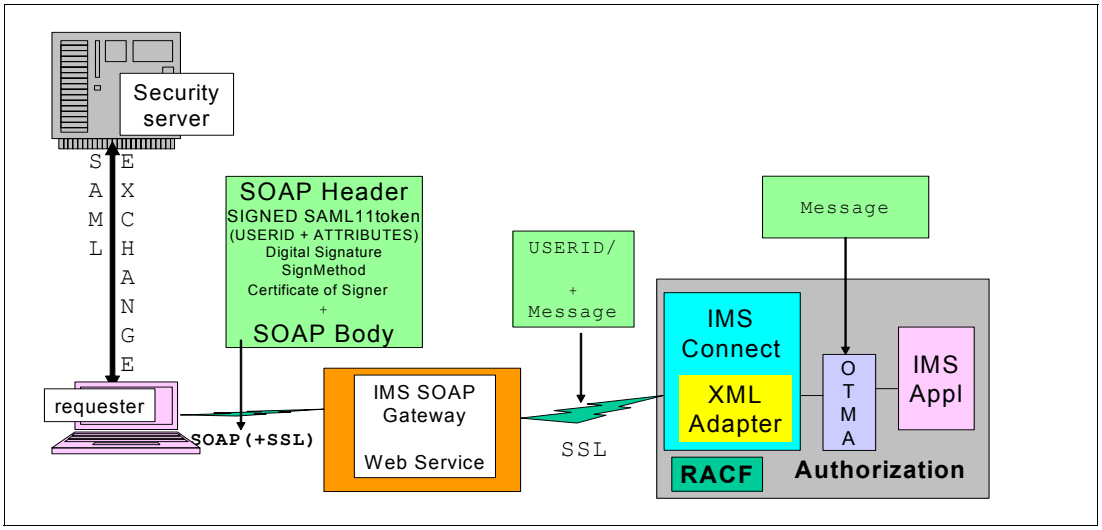

Figure 9-30 Web service flow from requester to IMS with signed SAML 1.1 token

The signed token has two variants:

SAML11SignedTokenTrustOne
: Only one certificate is allowed to verify the digital signature.

SAML11SignedTokenTrustAny
: All valid certificates carried together with the signed token are allowed to verify the digital signature.

Example 9-5 shows an excerpt of a SOAPheader containing a signed SAML 1.1 token that is emitted to the requester by the security domain server.

Example 9-5 SOAPheader with SAML11SignedToken

```
<?xml version="1.0" encoding="utf-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
   <soapenv:Header xmlns:wsa="http://www.w3.org/2005/08/addressing">
      <wsse:Security xmlns:wsse="http://docs..." soapenv:mustUnderstand="1">
         <wsu:Timestamp xmlns:wsu="http://..../01/oasis-200401-w....">
            <wsu:Created>2011-08-03T21:04:44.406Z</wsu:Created>
         </wsu:Timestamp>
         <saml:Assertion xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion".... ">
            <saml:Conditions NotBefore="...” NotOnOrAfter="2011-08-03T22:...Z">
            </saml:Conditions>
            <saml:AttributeStatement>
               <saml:Subject>
                  <saml:NameIdentifier>
                     Alice
```

```
            </saml:NameIdentifier>
            <saml:SubjectConfirmation>
               <saml:ConfirmationMethod>
               ....SAML:1.0::sender-vouches
               </saml:ConfirmationMethod>
            </saml:SubjectConfirmation>
         </saml:Subject>
         <saml:Attribute AttributeName="Address" .......">
            <saml:AttributeValue>
               123 SAML street, Austin
            </saml:AttributeValue>
         </saml:Attribute>
         <saml:Attribute AttributeName="Groups">
            <saml:AttributeValue>
               admin users
            </saml:AttributeValue>
            <saml:AttributeValue>
               Building ABC
            </saml:AttributeValue>
         </saml:Attribute>
      </saml:AttributeStatement>
      <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
         <ds:SignedInfo>
            <ds:CanonicalizationMethod Algorithm="http://...-exc-c14n#">
            </ds:CanonicalizationMethod>
            <ds:SignatureMethod Algorithm="http://...xmldsig#rsa-sha1">
            </ds:SignatureMethod>
            <ds:Reference URI="#_D876F2C5FB687FC5911312405484323">
               <ds:Transforms>
                  <ds:TransformAlgorithm=" http://www.w3.org/2000#env...">
                  </ds:Transform>
                  <ds:TransformAlgorithm=" http://www.w3.org/2001/...4n#">
                  </ds:Transform>
               </ds:Transforms>
               <ds:DigestMethod Algorithm="http://www.w3.org//2000/...1">
               </ds:DigestMethod>
               <ds:DigestValue>
                  14W3D22XvLKj2QrltLE9HzZ2eZo=
               </ds:DigestValue>
            </ds:Reference>
         </ds:SignedInfo>
         <ds:SignatureValue>
            M20/hY4MRqyLIVVTxFyYNeIx41BNeXbp9nv9HOIglfQ
         </ds:SignatureValue>
         <ds:KeyInfo>
            <ds:X509Data>
               <ds:X509Certificate>
                  MIIB1zCCAUCgAwIBAgIERvpxxzANBgkqhk
               </ds:X509Certificate>
            </ds:X509Data>
         </ds:KeyInfo>
      </ds:Signature>
   </saml:Assertion>
</wsse:Security>
<wsa:.......
```

```
        (NOT SHOWN)
      </wsa:.....<
   </soapenv:Header>
   <soapenv:Body>
      ........
   </soapenv:Body>
</soapenv:Envelope>
```

In Example 9-5, you see the SOAPheader with WS-security included. The “wsse:..” section contains a “signed SAML11 token”. Within this <saml:Assertion..> token, you can see the following details:

- `<saml:Subject>..`
  - `<saml:NameIdentifier>.no credentials (?password)` must be present; the user is asserted by the security server.
  - `<saml:Attributes>..`
- `<ds:signature../>`
  - `<ds:SignedInfo...>,`

    `<ds:canonicalizationMmethod>`

    `<ds:SignatureMethod>` transform, digest algorithms
  - `<ds:signatureValue>`
  - `<ds:KeyInfo>..ds:X509Data..ds:X509Certifcate` of the signer (if SAML11SignedTokenTrustAny)

SAML 2.0 unsigned sender-vouches tokens

With SAML 2.0 unsigned sender-vouches tokens, the requester contacts the security server (identity server) to obtain an identity assertion (a proof of identity), which is passed to the SOAP gateway. In this case, the token is not signed. Figure 9-31 illustrates the flow.

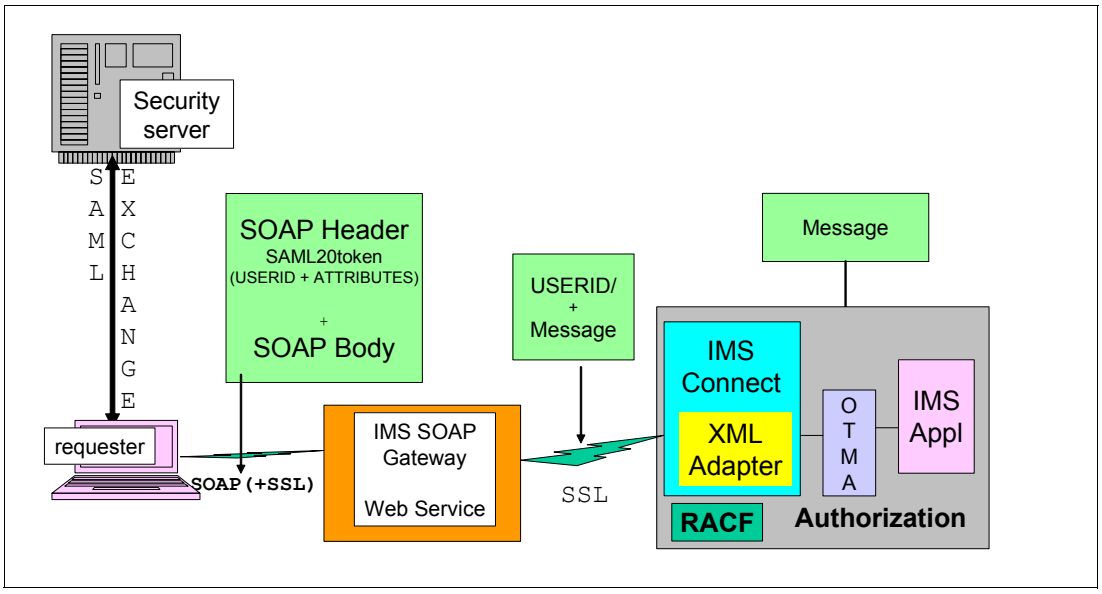

Figure 9-31 Web service flow from requester to IMS with SAML 2.0 token

SAML 2.0 is a newer standard that introduces features such as session management, attribute profiles, encryption, metadata specifications, and pseudonyms. Example 9-6 shows an excerpt of the SOAPheader with WS-security. It contains a SAML 2.0 token that is followed by attributes. The SOAPheader is then emitted to the requester by the security domain server.

Example 9-6 SOAPheader with SAML 2.0 token

```
<?xml version=\"1.0\" encoding=\"utf-8\"?>
<soapenv:Envelope xmlns:soapenv=\"http://schemas.xmlsoap.org/soap/envelope/\">
   <soapenv:Header xmlns:wsa=\"http://www.w3.org/2005/08/addressing\">
      <wsse:Security xmlns:wsse=........" soapenv:mustUnderstand=\"1\">
         <wsu:Timestamp xmlns:wsu=\"http://docs.......-utility-1.0.xsd\">
            <wsu:Created>
               getActualRunDateIso()
            </wsu:Created>
         </wsu:Timestamp>"
         <Assertion..AssertionID=..IssueInstant=..Issuer=..MajorVersion=..MinorV"
            <Conditions NotBefore=....NotOnOrAfter=....>
            </Conditions>
            <AuthenticationStatement AuthenticationInstant/Method=..
               <Subject>"
                  <NameIdentifier Format=... :unspecified\">
                     A202545<
                  /NameIdentifier>
                  <SubjectConfirmation>
                     <ConfirmationMethod>
                        urn:oasis:names:tc:SAML:1.0:cm:sender-vouches
                     </ConfirmationMethod>
                  </SubjectConfirmation>
               </Subject>
            </AuthenticationStatement>
            <AttributeStatement>
               <Subject>
                  <NameIdentifier Format=....:unspecified\">
                     USRT001
                  </NameIdentifier>
                  <SubjectConfirmation>"
                     <ConfirmationMethod>urn:oas...:tc:SAML:1.0:cm:sender-vouches
                     </ConfirmationMethod>"
                  </SubjectConfirmation>"
               </Subject>
               <Attribute xmlns:xsd=....AttributeNamespace=\"urn:bea:..\">
                  <AttributeValue>
                     Issuer_TEST_PROTECTIONDOMAIN
                  </AttributeValue>
                  <AttributeValue>
                     XY_GROUP
                  </AttributeValue>" +
               </Attribute>
            </AttributeStatement>
         </Assertion>
      </wsse:Security>"
      <wsa:......
         ....NOT shown
      </wsa:Action>
```

```
   </soapenv:Header>
   <soapenv:Body>"
   ........
   </soapenv:Body>"
</soapenv:Envelope
```

9.7.4 Security setup for Enterprise Suite V2.1

The previous section explained aspects of WS-security and the use of SAML. The transport-level security between nodes connected by TCP/IP is also important. This requires the setup of SSL/TLS.

Without the use of SAML tokens, two actors are involved in the Web Services traffic: the requester (client) and the server hosting the web service (SOAP gateway). With SAML, there is a third actor: the security service (identity provider). All three must be able to communicate in a secure way, and eventually other security opportunities will be used (encryption, digital signatures).

SSL and TLS protocol technology protects data exchanges between client and server applications. SSL provides security for your interactions by securing the TCP/IP connection between SOAP Gateway and IMS Connect. TLS is the successor to the SSL protocol. TLS V1.0 was the first version, succeeding SSL V3.0. New TLS versions continue to be defined by the Internet Engineering Task Force (IETF), and the TLS protocol maintains compatibility modes for the earlier SSL protocol.

The SAML security server can also be called the “identity server”. This is the server that is contacted by the requester to obtain a SAML token with user ID and attributes included, which are asserted by this server. This SAML token is passed in the SOAP header between the requester and the SOAP gateway.

If you are using SAML, for example by using the SignedSAML11 token, and you also implement “transport security”, you can have an SSL setup as illustrated in Figure 9-32.

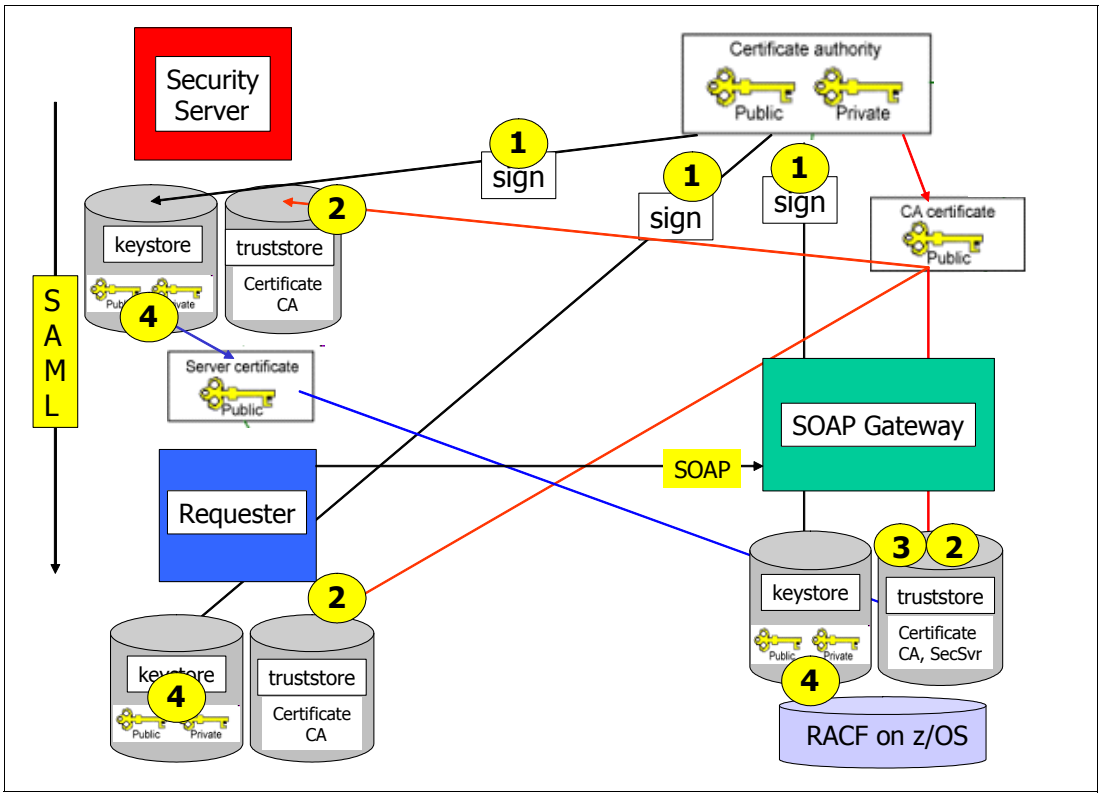

Figure 9-32 Security infrastructure based on public and private key pairs

The figure contains the following details:

- A PUB/PRIV key pair (4) has been generated for each of the three actors, signed by a certificate authority (CA) (1) and deposed in the keystore (or RACF, if z/OS), for each actor.

  Signing by a CA normally requests the respect of a procedure. The signing must be done by officially recognized organizations (such as Verisign and Thawthe). However, for test purposes, you can set up a “self-signed CA”. With most of the tools and RACF on z/OS, you can generate a PUB/PRIV key pair for a self-signed CA, which for test purposes can then be used as a signer for all the other PUB/PRIV key pairs.

- Each truststore has to contain the “certificate” of the signers. The certificate of the CA must be present everywhere so that the SSL/TLS handshake between two participants can be certified. The certificate of the CA is used to validate the certificates of the user ID of the actors when they set up the SSL/TLS connection (2). This can be done by importing the CA certificate in the truststore and in the RACF database.

- If a signed SAML 1.1 implementation with option “SAML11SignedTokenTrustOne” was used, then the SAML token in the SOAPHeader was digitally signed by the security server. As a consequence, the “certificate” of the security server must be available in the truststore of the SOAP gateway server (3).

  If a “SAML11SignedTokenTrustAny” was used, then the certificate of the digital signer is carried with SOAP envelope/header.

Tooling is available on Distributed and z/OS platforms to install the keystores or truststores and their required contents. z/OS can use RACF for this.

All tools must have the following functions and capabilities:

- Generate PUB/PRIV key pairs
- Submit the generated certificate to a CA for signing
- Export the key pair in binary and 64-bit encoding for transport with protection by password
- Import key pairs (if password is known)
- Export the certificate in binary and 64-bit encoding for transport
- Import certificates
- View and list installed items

In a test environment, to avoid the cost of signing by official authorities, it is useful to have “self-signed” certificates for test CAs.

The following sections list and describe several of the many keytools that are available for z/OS and distributed environments.

Security setup on z/OS

With Fix Pack 2 and later, SOAP Gateway supports the use of the application transparent-TLS (AT-TLS) feature in IBM z/OS Communications Server for SSL protocol handling. Therefore, any SSL or TLS version that the AT-TLS feature supports, including TLS V1.0, TLS V1.1 and SSL V3.0, are supported.

AT-TLS is governed by a policy file, installed on a TCP/IP stack in z/OS. The policies in this file determine whether SSL/TLS will be used or not, depending in the most simple case on the IP/port combinations which will go in session. For example, all sessions connecting to SOAP gateway server port 8443 will have SSL/TLS.

To configure the IBM z/OS Communications Server AT-TLS feature for SOAP Gateway, use the IBM Configuration Assistant for z/OS Communications Server.

The high-level steps to configure the AT-TLS feature for SOAP Gateway are listed here:

1. In the Configuration Assistant, configure your z/OS image.
2. Enable the AT-TLS technology.
3. In the AT-TLS perspective:
   a. Configure the port, IP address, cipher, trace level, and keyring information for server authentication.
   b. Configure other settings such as:
      - Client authentication
      - Certificate selection
      - Certificate revocation list (CRL)
      - Connection settings such as cipher reset timer and SSL session timeouts
      - Additional authentication between SOAP Gateway and IMS Connect
4. Install the master AT-TLS policy configuration file.

After you activate AT-TLS, you must set up RACF as the store.

For information about SSL/TLS and AT/TLS, see *IBM z/OS V1R12 Communications Server TCP/IP Implementation: Volume 4 Security and Policy-Based Networking*, SG24-7899.

Next, we describe the preparation of SSL/TLS on z/OS. Basically you have to set up keydatabases and build the pub(certificates)/priv key pairs.

Using RACF

The information in RACF can be used directly by the AT-TLS implementation. RACF is in itself the key and truststore.

If the SOAP Gateway requires the keystores or truststores in a hierarchical file system (HFS/zFS), the preparation work and all generations can still be performed from RACF.

Exports of keys and certificates from RACF and imports in Local and Remote (after FTP) keystores or truststores can do the ultimate setup.

RACF does not make a distinction between keystore or truststore. Everything is in one store. The keys are maintained in a key ring. Before you can do anything, the user ID must be known to RACF security and must have a key ring added. In practice, the name of the key ring is qualified (`username.keyringname`). Example 9-7 shows what is required for the user SOAPSVR1. SOAPSVR1 is signed with a “so-called” self-signed CA, which is generated first.

Example 9-7 RACF definition sample

```
* we assume that the user SOAPSVR1 does exist on z/OS
* if he has not a keyring yet, first create a keyring
* Creating SSL keyrings for SOAPSVR1
RACDCERT ADDRING(KeyringSV) ID( SOAPSVR1 )
* Generate a SELF SIGNED CA
RACDCERT CERTAUTH GENCERT SUBJECTSDN +
 (CN('SGW CertAuth Security Domain') OU('SoapGateway Test setup in RACF'))+
 WITHLABEL('SoapGatewayCA.SVL') TRUST NOTAFTER(DATE(2011/12/31))
* Connect the SoapGatewayCA with the keyring of the user SOAPSVR1
RACDCERT ID(SOAPSVR1) CONNECT +
 (RING(KeyringSV) CERTAUTH LABEL('SoapGatewayCA.SVL') USAGE(CERTAUTH))
* Generate a PUB/PRIV keypair and sign directly with SoapGatewayCA
RACDCERT ID (SOAPSVR1) GENCERT +
    SUBJECTSDN(CN('SOAPSERVER') O('IBM') OU('SVL')) +
    WITHLABEL('DefaultCert.SOAPSVR1') +
    SIGNWITH(CERTAUTH LABEL('SoapGatewayCA.SVL')) +
    NOTAFTER(DATE(2011/12/31))
* Connect the SOAPSVR1 pub/priv with the keyring of user SOAPSVR1
RACDCERT ID(SOAPSVR1) CONNECT +
     ( RING(KeyringSV) LABEL('DefaultCert.SOAPSVR1') DEFAULT)
* Export the Certificate of the CA to a z/OS dataset, bin option
* also possible with 64bit encoding
RACDCERT CERTAUTH +
    EXPORT(LABEL('SoapGatewayCA.SVL')) DSN('SOAPGW.CACERT.DER') +
    FORMAT(CERTDER)
* Export PRIV/PUB keys of user SOAPSVR1 to a z/OS dataset, bin option
* also possible with 64bit encoding
RACDCERT ID(SOAPSVR1) EXPORT (LABEL('DefaultCert.SOAPSVR1')) +
    DSN('SOAPSVR1.USERCERT.P12DER') FORMAT(PKCS12DER) +
    PASSWORD( 'MYSOAPGW')
* Transform the datasets to HFS files that can be
* -transported (FTP in this case BIN, mode)
* -imported in the keystores or truststores
OPUT 'SOAPGW.CACERT.DER'   '/u/SOAPSVR1/SECURITY/CAGWCERT.der' BIN
OPUT 'SOAPSVR1.TMCERT.P12DER'   '/u/SOAPSVR1/SECURITY/USERCERT.p12' BIN
```

We also show the exports of the certificate of the CA and the public or private information for the user SOAPSVR1. Everything is done with one RACF command, **RACDCERT**.

In the **OPUT** command, the **BIN** option must be specified, because the exports were done in binary.

For test purposes, the task must be repeated for the other users' requesters and security server. The benefits of this solution are that you have a central place where all security elements are preserved, and that the **RACDCERT** command is easy to use and can be executed by a batch job. When you have the file systems with certificate and P12 (public or private keys), you can easily distribute them and import in the users' keystores and truststores.

Using the gskkyman command

The **gskkyman** UNIX command (Figure 9-33) is used to create and maintain digital certificate key databases in a z/OS UNIX file system. This is an alternative to storing digital certificates in the RACF database.

Be aware, though, that if you are using SSL/TLS client authentication to map a digital certificate to a RACF user ID, you must use the RACF **RACDCERT** command to store the client certificate, and not the **gskkyman** command.

```
VANAERS @ SC63:/u/vanaers>gskkyman

       Database Menu

   1 - Create new database
   2 - Open database
   3 - Change database password
   4 - Change database record length
   5 - Delete database
   6 - Create key parameter file
   7 - Display certificate file (Binary or Base64 ASN.1 DER)

  11 - Create new token
  12 - Delete token
  13 - Manage token
  14 - Manage token from list of tokens

   0 - Exit program

Enter option number:
```

Figure 9-33 Options for the gskkyman command

In RACF, a key database is always present. In a gskkyman environment, the key databases, keystores, trust databases, or truststores must be explicitly created as public/private key, certificate repositories. In turn, those stores can be shared by any user IDs that have access using the HFS.

For more information, see *IBM z/OS V1R12 Communications Server TCP/IP Implementation: Volume 4 Security and Policy-Based Networking*, SG24-7899.

Security setup on Windows

Many tools are available to build stores and to build and import keys. This section highlights two of them. Keys generated under Windows can also be exported and even imported in z/OS RACF.

Using iKeyman

The **iKeyman** utility is a GUI-based tool that you can use to manage your digital certificates. With **iKeyman**, you can create a new key database or test a digital certificate, add CA roots to your database, copy certificates form one database to another, request and receive a digital certificate from a CA, set default keys, and change passwords.

The **iKeyman** utility is a part of the IBM Java Security Socket Extension package. It is shipped with the WebSphere Application Server and with many other Java-related packages.

Using keytool

The command line tool for Windows, **keytool**, is available in almost all `jdk/bin` and `jre/bin` directories. Figure 9-34 shows the options for **keytool**.

```
C:\Program Files\IBM\SDP_RDZ_8\jdk\bin>keytool
keytool usage:

-certreq     [-v] [-protected]
.....
-changealias [-v] [-protected] -alias <alias> -destalias <destalias>
.....
-delete      [-v] [-protected] -alias <alias>
.....
-export      [-v] [-rfc] [-protected]
.....
-exportseckey      [-v]
.....
-genkeypair  [-v] [-protected]
.....
-genseckey   [-v] [-protected]
.....
-help
-identitydb  [-v] [-protected]
.....
-import      [-v] [-noprompt] [-trustcacerts] [-protected]
.....
-importkeystore [-v]
.....
-importseckey       [-v]
.....
-keyclone    [-v] [-protected]
.....
-keypasswd   [-v] [-all | -alias <alias>]
.....
-list        [-v | -rfc] [-protected]
.....
-printcert   [-v] [-file <cert_file>]
-selfcert    [-v] [-protected]
.....
-storepasswd [-v] [-all] [-new <new_storepass>]
.....
```

Figure 9-34 Keytool options

9.7.5 SOAP Gateway Server

The SOAP Gateway server acts as the gateway between external web services and IMS applications. It serves as a web service server where IMS applications are enabled as web services. It serves a web service consumer when it forwards IMS application callout requests or business event data to external web services or event processing services.

In all scenarios, the SOAP Gateway server acts as a client to IMS Connect. The IMS Enterprise Suite V2.1 SOAP gateway server can run on both z/OS and Windows (Figure 9-35).

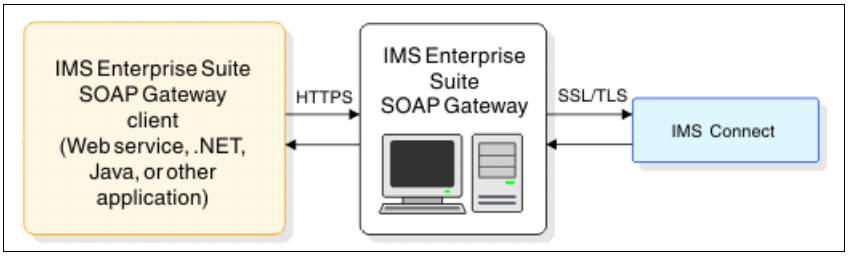

Figure 9-35 SOAP Gateway as the web service server and the SSL/TLS client

SOAP Gateway provides support for both server authentication and client authentication and Web-services security (WS-Security) for the web service provider scenario regardless of the platform that SOAP Gateway runs on.

SOAP Gateway clients can secure data exchanges with SOAP Gateway through HTTPS requests by using the SSL/TLS security protocol. Similarly, SSL/TLS connections are supported between SOAP Gateway and IMS Connect.

Enabling the SSL on the SOAP gateway server

If you want to use the possibilities of the WS-security, with or without SAML, the implementation of SSL/TLS in the transport between the SOAP gateway and IMS Connect is a solution. You can have HTTPS between the client and SOAP (provider) or SOAP and Service (callout). SSL between SOAP and ICON is optional. Between the client and the SOAP gateway, use HTTPS.

Tip: To configure the server to know where the Java is located, issue the following SOAP command either from UNIX System Services or with sample job AEWIOGBP:

```
iogmgmt -prop -u -java -h /path/to/java
```

Enablement on z/OS with AT-TLS

For the z/OS platform, you can use the IBM z/OS Communications Server AT-TLS feature using System Authorization Facility (SAF; RACF) to secure the connection. You can also benefit from the additional security features in AT-TLS or Quality of Service (QoS), such as security connection refresh settings, maximum connection settings, and revocation of certificates.

The traditional setup with keystores or truststores is available as well for z/OS, but the preferred selection of AT-TLS for the SOAP Gateway does not require the usage of the stores (Figure 9-36).

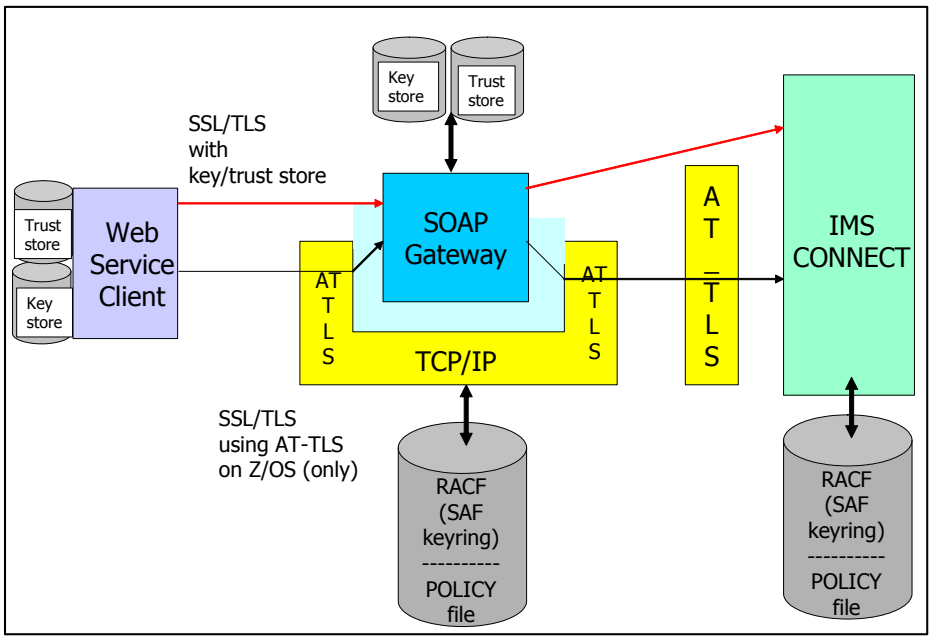

Figure 9-36 SOAP Gateway SSL implementations

In addition to the inbound message connection rule for connections from the web service client (service requester) to SOAP Gateway, you can configure an additional set of rules for the connections between SOAP Gateway and IMS Connect.

Figure 9-36 shows the rules that are created to protect traffic in the following ways:

- Inbound traffic in the SOAP Gateway from the requester (assuming not in z/OS)

  Use the QoS feature in IBM z/OS Communications Server to specify traffic thresholds and traffic priority to help manage traffic to the SOAP Gateway server. QoS refers to the overall service that a user or application receives from a network, in terms of throughput and delay. To configure the maximum connections, create a traffic descriptor, a traffic shaping level, and a requirement map in the QoS perspective.
- Outbound traffic from the SOAP Gateway to IMS Connect
- Inbound traffic in IMS Connect from the SOAP Gateway

  The “policy rules” in the TCP/IP stacks that are passed in z/OS can all be different. Moreover, for each authentication (client/server), individual SAF key rings in RACF can be used and as a consequence a different set of certificates.

For information about setting up AT-TLS, see the IBM Information Management Software for z/OS Solutions Information Center at:

`http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp`

In this information center, search for the following topics:

- *Configuring AT-TLS for SOAP Gateway for server authentication*
- *Configuring maximum connections for SOAP Gateway*
- *Configuring additional connectivity rules for SOAP Gateway-to-IMS Connect communication*

Enablement on z/OS with keystores or truststores

The tools that are available to build the stores and their contents are described in 9.7.4, “Security setup for Enterprise Suite V2.1” on page 358.

You make the SSL/TLS setup active by pointing to the stores and then activating SSL in the SOAP Gateway configuration for inbound and in the Connection bundles for outbound to IMS Connect.

Perform the following tasks:

- Modify the `server.xml` file to point to the keystore and truststore with the appropriate passwords (Example 9-8). The configuration for the SOAP gateway server is in the `/..../IBM/IMS Enterprise Suite V2.1\SOAP Gateway\server\conf\server.xml` file.
  - Set clientAuth to true.
  - Set sslProtocol to SSL.
  - Specify the file location for keystore and truststore.
  - Specify the password for keystore and truststore
- Connection bundle

  SSL keystore name
  This specifies the fully qualified path name of the keystore in which trusted certificates and private keys are stored.

  SSL keystore password
  This specifies the password for the keystore. The password length must be in the range of 6–20 alphanumeric characters.

  SSL truststore name
  This specifies the fully qualified path name of the truststore in which trusted certificates are stored.

  SSL truststore password
  This specifies the password of the truststore in which trusted certificates are stored. The password length must be in the range 6–20 alphanumeric characters.

  SSL encryption level
  This specifies the encryption type. A value of Strong indicates that a strong cipher suite needs to be used. A value of Weak indicates that a weak cipher suite needs to be used. A value of None indicates that no encryption is used. The None encryption level is used only for authentication.

Attention: Leave these properties blank if you are using IBM z/OS Communications Server AT-TLS feature to secure the connection between the SOAP Gateway and IMS Connect.

Enablement on Windows

For Windows, you can only use keystores or truststores. The build of the stores and their contents and the available tools are described in 9.7.4, “Security setup for Enterprise Suite V2.1” on page 358.

You make the SSL/TLS setup active by pointing to the stores and activating SSL in the SOAP Gateway configuration for inbound, and in the Connection bundles for outbound to IMS Connect.

Perform the following tasks:

- Modify the file server.xml to point to the keystore and truststore with the appropriate passwords. See Example 9-8.

  The configuration for the SOAP gateway server is in the `C:\Program Files\IBM\IMS Enterprise Suite V2.1\SOAP Gateway\server\conf\server.xml` file.

  - Set clientAuth to true.
  - Set sslProtocol to SSL.
  - Specify the file location for keystore and truststore.
  - Specify the password for keystore and truststore

Example 9-8 Changes to the server.xml file for enabling SSL port 8443

```
<!-- Define a SSL HTTP/1.1 Connector on your port -->
<Connector port="8443"
maxThreads="150" minSpareThreads="25" maxSpareThreads="75"
enableLookups="false" disableUploadTimeout="true"
acceptCount="100" debug="0" scheme="https" secure="true"
clientAuth="true" sslProtocol="SSL"
keystoreFile="C:\Program Files\IBM\IMS Enterprise Suite V2.1\SOAP
Gateway\server\conf\SGWkeystore.ks"
keystorePass="password"
truststoreFile="C:\Program Files\IBM\IMS Enterprise Suite V2.1\SOAP
Gateway\server\conf\SGWtruststore.ks"
truststorePass="password"
algorithm="IbmX509"/>
```

You can also make the changes shown in Example 9-8 by using the “SOAP Gateway management utility” command:

`iogmgmt -prop...”` command option

- Connection bundle

  This is the same as for z/OS.

  - SSL keystore name:
  - SSL keystore password:
  - SSL truststore name:
  - SSL truststore password:
  - SSL encryption level:

Starting the SOAP Gateway

This section explains how to start the SOAP Gateway on z/OS and on Windows, depending on your environment.

Starting the SOAP Gateway on z/OS

Example 9-9 shows how to start the gateway.

Example 9-9 Starting the SOAP Gateway

```
/S es21sgb1
```

ES21SGB1 is simply a customized name for the start procedure distributed by IBM under the name AEWIOGPR.

Example 9-10 shows the results as displayed on the console after a short time.

Example 9-10 Messages on the console for start of SOAP gateway

```
   IEF695I START ES21SGB1 WITH JOBNAME ES21SGB1 IS ASSIGNED TO USER IMSSOAP ,
GROUP SYS1
   $HASP373 ES21SGB1 STARTED
   IOG30001I: The SOAP Gateway server is now up and running. Elapsed  233
   time is 14,738,455,125 nano seconds.
   //ES21SGB1 JOB MSGLEVEL=1
   //STARTING EXEC ES21SGB1
```

The JOB is associated with user IMSSOAP. This is a result of the RACF association with the started task name.

This JOB is executed as a JZOS job; the required Open MVS environment is read from member JDKSEPB1. The procedure is shown in Example 9-11.

JZOS Batch Toolkit for z/OS SDKs: The IBM JZOS Batch Toolkit for z/OS SDKs is a set of tools that improves many of the functional and environmental characteristics of the current Java batch capabilities on z/OS. It includes a native launcher for running Java applications directly as batch jobs or started tasks, and a set of Java methods that make access to traditional z/OS data and key system services directly available from Java applications.

Example 9-11 START procedure for SOAP Gateway on z/OS

```
//*************************************************************/
//* Licensed Material - Property of IBM                       */
//* 5635 - A02                                                */
//* COPYRIGHT IBM CORP. 2009,2010 ALL RIGHTS RESERVED         */
//* US GOVERMENT USERS RESTRICTED RIGHTS - USE, DUPLICATION OR */
//* DISCLOSURE RESTRICTED BY GSA ADP SCHEDULE CONTRACT WITH   */
//* IBM CORP                                                  */
//*************************************************************/
//*                                                           */
//* PROC NAME: AEWIOGPR                                       */
//*                                                           */
//* DESCRIPTION: THIS PROC STARTS the IMS Enterprise Suite    */
//*              SOAP Gateway                                 */
//*                                                           */
//* NOTES:                                                    */
//* 1) REVIEW THE CONTROL STATEMENTS BEFORE SAVING THIS PROC  */
//*                                                           */
//* 2) SAVE IN THE PROCLIB OF YOUR CHOICE                     */
//*                                                           */
//* 3) CHANGE ppppp to THE PROCNAME TO MEET YOUR SYSTEM'S     */
//*    REQUIREMENTS.                                          */
//*    EG                                                     */
//*    //IMSESOAP                                             */
//*                                                           */
//* 4) CHANGE llllll TO THE LOAD LIBRARY containing the       */
//*    JAVA LOAD MODULE - MUST BE A PDSE                      */
//*    This library is created by job AEWPARMF                */
//*    E.G.                                                   */
//*    //LIBRARY='IMSPERF.ESSOAP.LOADLIB',                    */
```

```
//*                                                              */
//* 5) CHANGE eeeee TO THE the CONFIGURATION MEMBER PDS and      */
//*    MEMBER NAME                                               */
//*    E.G.                                                      */
//*    DSN=SYS1.PROCLIB(IMESOAPZ)                                */
//*                                                              */
//* TIP: Enable trace level in the proc to help diagnose the     */
//* configuration during your initial setup by modifying         */
//* LOGLVL:                                                      */
//* Change: LOGLVL=''                                            */
//* To:   LOGLVL='+T'                                            */
//*                                                              */
//*************************************************************/
//*
//ES21SGB1 PROC REGSIZE='0M',
//   JAVACLS='org.apache.catalina.startup.Bootstrap',
//   ARGS='start',
//   LIBRARY='IMSESA.JZOS16.SR7.LOADLIB',
//   VERSION='60',         < VERSION OF JZOSVM MODULE
//   LOGLVL='',            < DEBUG LVL: +I(INFO) +T(TRC)
//   PARMS='',
//   LEPARM=''
//IEFPROC  EXEC PGM=JVMLDM&VERSION,REGION=&REGSIZE,
//   PARM='&LEPARM/&LOGLVL &JAVACLS &ARGS &PARMS'
//STEPLIB  DD DSN=&LIBRARY,DISP=SHR
//SYSPRINT DD SYSOUT=*          < SYSTEM STDOUT
//SYSOUT   DD SYSOUT=*          < SYSTEM STDERR
//STDOUT   DD SYSOUT=*          < JAVA SYSTEM.OUT
//STDERR   DD SYSOUT=*          < JAVA SYSTEM.ERR
//CEEDUMP  DD SYSOUT=*
//ABNLIGNR DD DUMMY
//*
//*
//STDENV  DD DISP=SHR,DSN=SYS1.PROCLIB(JDKSEPB1)
// PEND
```

Starting the SOAP Gateway on Windows

The SOAP Gateway server can be started (and stopped) from the installation menu (Figure 9-37).

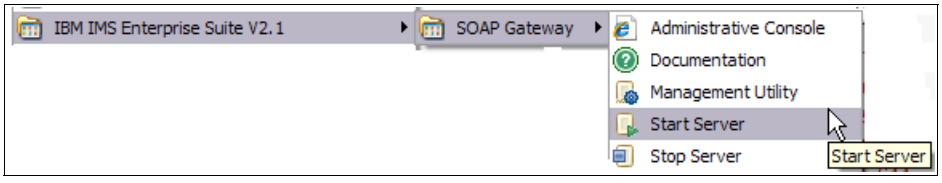

Figure 9-37 Start and stop options from the installation menu

Example 9-12 shows the upcoming messages in the Windows console.

Example 9-12 Start of SOAP gateway server on Windows

```
IOG30006I: Checking on server status.
Aug 5, 2011 10:17:33 PM org.apache.catalina.startup.Embedded initDirs
Aug 5, 2011 10:17:35 PM org.apache.coyote.http11.Http11Protocol init
```

```
INFO: Initializing Coyote HTTP/1.1 on http-8080
Aug 5, 2011 10:17:35 PM org.apache.catalina.startup.Catalina load
INFO: Initialization processed in 2026 ns
[2011-08-05 22:17:35,468] main ParserStartupRoutines
 ERROR: IOGS0104E: An I/O exception occurred with the (C:\Program Files\IBM\IMS
Enterprise Suite V2.1\SOAP Gateway\server\webapps\imssoap\WS-SECURITY\SAML2OSign
edTokenTrustAny\server\policy.xml) file. Either the file could not be read or fo
und, or the file encoding is not UTF-8.
Message= SOAP Gateway was unable to load file into memory, defaulting to I/O int
ensive routine..
Aug 5, 2011 10:17:37 PM org.apache.catalina.core.StandardService start
INFO: Starting service Catalina
Aug 5, 2011 10:17:37 PM org.apache.catalina.core.StandardEngine start
INFO: Starting Servlet Engine: Apache Tomcat/6.0.18
Aug 5, 2011 10:17:53 PM org.apache.coyote.http11.Http11Protocol start
INFO: Starting Coyote HTTP/1.1 on http-8080
[2011-08-05 22:17:53,796] main Catalina
 INFO : IOG30001I: The SOAP Gateway server is now up and running. Elapsed time i
s 18,792,597,662 nano seconds.
```

Stopping the SOAP Gateway

You can stop the SOAP Gateway on z/OS in the following ways:

- The **p(stop)** command (Example 9-13), which is the preferred method.
- The **c(cancel)** command; issue this command when purge does not work.

Example 9-13 Purge command

```
/P es21sgb1
```

A **p(stop)** generates the messages shown in Example 9-14.

Example 9-14 Messages on the console for purge

```
P ES21SGB1
   JZOS - MVS STOP command received
   IOG30004I: The SOAP Gateway server is stopped. 208
```

On Windows, you can stop the SOAP Gateway server from the installation menu (Figure 9-37 on page 369).

9.7.6 SOAP Gateway management utility

The SOAP Gateway management utility, **iogmgmt**, provides a command line or batch interface for configuring server properties, managing the server run time, and working with web service artifacts. The command-line interface (CLI) facilitates task automation and management flexibility.

With the SOAP Gateway management utility, you can perform the following tasks:

- Start and stop the SOAP Gateway server on Windows systems:
  - For z/OS, use the START and STOP console commands.
  - For Linux on System z, run the **iogstart.sh** and **iogstop.sh** scripts.
- Configure SOAP Gateway server properties.

- Enable your IMS application as a web service provider or a web service consumer (callout), or to emit business event data.

The SOAP Gateway management utility also contains the deployment function, which previously was performed by the deployment utility.

An **iogmgmt** command consists of the **iogmgmt** statement followed by arguments to specify the command and associated options. The management utility can be used in z/OS and distributed environments.

The universal **iogmgmt** command has many options, which are explained with the specific task. For details about commands, see the IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *SOAP Gateway management utility reference*:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

You can invoke the **iogmgmt** command in the following way; Example 9-15 lists the available options.

Example 9-15 Options for the iogmgmt utility

```
-callout -startall/-startone: Start threads
-callout -startpool: Start the thread pool
-callout -stopall/-stopone: Stop threads
-callout -stoppool: Stop the thread pool
-callout -updateprop: Update SOAP Gateway callout properties
-conn: Create, update, or delete a connection bundle
-corr: Create or update a correlator entry
-deploy: Deploy a web service or callout application
-diagnose: Diagnose SOAP Gateway problems
-migrate: Migrate and upgrade SOAP Gateway
-prop: Set/Modify SOAP Gateway server properties
-start: Start the SOAP Gateway server
-stop: Stop the SOAP Gateway server
-undeploy: Undeploy a web service or callout application
-view -connectionbundle/-connectionbundleentry view connection bundle entries.
-view -correlatorfile: View correlator information
-view -calloutproperties: View callout properties
-view -callouthreads: View the status of callout threads
-view -soapgatewayproperties: View SOAP Gateway server properties
-view -workerthreads: View status of the callout worker thread pool
```

The utility on z/OS

The SOAP Gateway management utility, **iogmgmt**, is only available from within a UNIX System Services session. UNIX System Services is a required component of z/OS. For SOAP Gateway servers running on z/OS, the SOAP Gateway management utility must run on the same LPAR as the target server.

You can invoke the commands in the following ways:

- Invoke a UNIX System Services session as an OMVS command.

  Switch to the SOAP Gateway management utility directory with the following command:

  ```
  cd SOAP_Gateway_home_directory/deploy
  ```

Invoke the SOAP Gateway management utility by entering the following command:

```
./iogmgmt ...arguments
```

- Use a UNIX System Services Batch submit (Example 9-16).

Example 9-16 BPXbatch job control language (JCL)

```
//AEWIOGBP  JOB 'SOAP BATCH',CLASS=A,REGION=0M,MSGLEVEL=(1,1),
//            MSGCLASS=H,USER=UUUUUUUU
//*
//*****************************************************************/
//* LICENSED MATERIALS - PROPERTY OF IBM                          */
//* 5655-T62 (C) COPYRIGHT IBM CORP 2011                          */
//* ALL RIGHTS RESERVED.                                          */
//* US GOVERNMENT USERS RESTRICTED RIGHTS -                       */
//* USE, DUPLICATION OR DISCLOSURE RESTRICTED                     */
//* BY GSA ADP SCHEDULE CONTRACT WITH IBM CORP.                   */
//*****************************************************************/
//*                                                               */
//* BPXBATCH SAMPLE NAME:        AEWIOGBP                         */
//* AEWIOGBP VERSION:            2.1.0                            */
//*                                                               */
//* DESCRIPTION: THIS WILL EXECUTE IOGMGMT COMMANDS FROM BPXBATCH.*/
//* SEVERAL SAMPLE COMMANDS ARE DEMONSTRATED. MODIFY THIS         */
//* ACCORDINGLY.                                                  */
//*                                                               */
//* NOTES:                                                        */
//* 1) SET VARIABLE IOGPP TO YOUR -PathPrefix- SPECIFIED IN JOB   */
//*    AEWJSMKD. IF YOU DID NOT CONFIGURE THE -PathPrefix- THEN   */
//*    DO NOT CHANGE IOGPP.                                       */
//*    E.G. With a -Pathprefix of "/s/esuite21/"                  */
//*      IOGPP=/s/esuite21                                        */
//*    E.G. Without a path -Pathprefix-                           */
//*      IOGPP=                                                   */
//*                                                               */
//* 2) BELOW IS AN EXAMPLE OF SEVERAL IOGMGMT COMMANDS CONTAINED IN */
//*    AN ARRAY CMD. WHEN ADDING MORE REPEAT THE SYNTAX AS NEEDED.*/
//*    SYNTAX:                                                    */
//*      CMD[3]="iogmgmt [-OPTION] [ARG] "; +                     */
//*      SEE IOGMGMT COMMANDS FOR OPTIONS AND ARGS                */
//*                                                               */
//* 3) IF YOU WANT TO SPECIFY A TCP/IP STACK NAME ADD THE EXPORTED */
//*    VARIABLEBELOW VARIABLE IOGPP.                              */
//*    E.G.                                                       */
//*    export _BPXK_SETIBMOPT_TRANSPORT=stack_name; +             */
//*                                                               */
//* 4) MODIFY THE PATH AND FILE NAMES FOR THE OUT LOG AND ERROR   */
//*    LOG CURRENTLY SET TO /tmp/iogmgmt.out.txt AND              */
//*    /tmp/iogmgmt.err.txt IF YOU WANT TO HAVE THEM WRITTEN      */
//*    ELSEWHERE. IF YOU MODIFY THE LOG PATH YOU MUST ALSO MODIFY */
//*    THE JAVAOUT AND JAVAERR PATH TO MATCH.                     */
//*****************************************************************/
//*
//STEP1  EXEC PGM=IKJEFT01,DYNAMNBR=250,REGION=0M
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
```

```
//STDOUT   DD SYSOUT=*
//STDERR   DD SYSOUT=*
//SYSTSIN DD   *
BPXBATCH sh +
IOGPP=; +
OUT=/tmp/iogmgmt.out.txt; +
ERR=/tmp/iogmgmt.err.txt; +
O>$ERR;O>$OUT; +
SOAP=$IOGPP/usr/lpp/ims/imses/V2R1/soap_gw; +
DIAG=$SOAP/tools/diagnostics; +
MGM=$SOAP/deploy; +
IOGJH=$IOGPP/usr/lpp/ims/imses/V2R1/java160/SR9/FP1/J6.0; +
CMD[0]="iogmgmt -prop -u -java -h $IOGJH";+
CMD[1]="iogmgmt -view -java -h";+
CMD[2]="iogmgmt -view -sgp";+
for _CMD in "${CMD[@]}"; +
do $MGM/$_CMD >>$OUT 2>>ERR;+
done;
//*
//*******************************************************************/
//* Copies script output back to joblog                             */
//*******************************************************************/
//PRINTJ   EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=*
//JAVAOUT  DD PATH='/tmp/iogmgmt.out.txt'
//JAVAERR  DD PATH='/tmp/iogmgmt.err.txt'
//STDERRL  DD SYSOUT=*,DCB=(RECFM=VB,LRECL=600,BLKSIZE=604)
//STDOUTL  DD SYSOUT=*,DCB=(RECFM=VB,LRECL=133,BLKSIZE=137)
//SYSPRINT DD SYSOUT=*
//SYSTSIN  DD *
OCOPY INDD(JAVAOUT) OUTDD(STDOUTL)
OCOPY INDD(JAVAERR) OUTDD(STDERRL)
/*
```

The utility on Windows

To execute the utility, go to the `deploy` directory of the SOAP gateway installation as indicated in Example 9-17. From here on, you can run the `.bat` file with the required parameters.

SOAP Gateway management utility commands are case-sensitive and must be entered in all lowercase. Alternatively, you can enter them as shown in the IBM Information Management Software for z/OS Solutions Information Center at the following address (search for *command reference*):

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

Example 9-17 Starting the managed tool without parameters on Windows

```
C:\Program Files\IBM\IMS Enterprise Suite V2.1\SOAP Gateway\deploy>iogmgmt
IOGDO201E: The iogmgmt command failed because a valid command
parameter was not specified.
  A SOAP Gateway management utility command requires a valid
command parameter.
  See the SOAP Gateway management utility command reference
 information for a list of valid command parameters.
```

9.7.7 Implementing a call-in web service for IMS

The *call-in web service* has several changes. However, the *call-out web service* did not change in IMS 12. The implementation of a web service for existing IMS transactions requires several steps. Some steps are required for all new web services, but other steps are shared later.

Building the web service

The implementation of a new web service requires some activity in an Eclipse Workbench environment. You can use the Enterprise Service Tools option in IBM Rational Developer for System z with Java to help you. You must complete the work in an IMS Enterprise Suite SOAP Gateway Project.

This opportunity already existed in IMS 10 and IMS11. Documentation and examples are available in the following documents:

- IMS 11
- IMS Phonebook sample

Insist on the following setup during the definition process:

- If using WS-security (UserName token or SAML token), in the Generation Options (WSDL and XSD) window, the service location must indicate secure HTTP (HTTPS) and reference the corresponding SSL-enabled port on the SOAP gateway.
- In the IMS Enterprise Suite SOAP Gateway Web Service Provider window, WS-Security must be enabled.

After successful completion of this preparation, Figure 9-38 shows the data sets that are available.

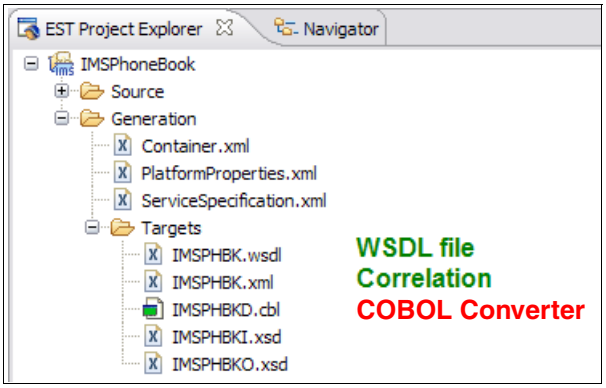

Figure 9-38 Enterprise Suite Project in Rational Developer for System z Version 8

The following data sets are available:

IMSPHBKD.cbl The COBOL converter and driver file, to be installed on the host for IMS Connect.

IMSPHBK.xml The correlator file, to be installed in the SOAP gateway (distributed or z/OS). This file contains a reference to the “connection bundle”, which describes the connection.

IMSPHBK.wsdl Web Service Description File, which can be used to build a client embryo.

IMSPHBKI.xsd The inbound schema file (not used by the SOAP Gateway).

IMSPHBKO.xsd The outbound schema file (not used by the SOAP Gateway).

For usage of the SAML token, the correlator can require a manual update to indicate what token is present in the SOAP header. This information must be set in extendedProperty1. Example 9-18 shows the SAML11SignedTokenTrustAny correlator file.

Example 9-18 Updated correlator file for extendedProperty.

```
<?xml version="1.0" encoding="UTF-8"?>
<correlator:correlator xmlns:correlator="http://www.ibm.com/IMS/Correlator"
version="1.0">
  <wsdlFile name="IMSPHBK.wsdl"
targetNamespace="file://target.files1312407250521"/>
  <serviceTraceLevel>Error</serviceTraceLevel>
  <correlatorEntry operationName="IMSPHBKOperation" portName="IMSPHBKPort"
serviceName="IMSPHBKService">
    <adapterType>IBM XML Adapter</adapterType>
    <converterName>IMSPHBKD</converterName>
    <connectionBundleName>IMSPHBK</connectionBundleName>
    <socketTimeout>0</socketTimeout>
    <executionTimeout>0</executionTimeout>
    <ltermName></ltermName>
    <inboundTPIPEName></inboundTPIPEName>
    <inboundCCSID>1208</inboundCCSID>
    <hostCCSID>1140</hostCCSID>
    <outboundCCSID>1208</outboundCCSID>
    <trancode>IVTNO</trancode>
    <calloutConnBundleName></calloutConnBundleName>
    <calloutWSTimeout>7500</calloutWSTimeout>
    <enabledWSS>true</enabledWSS>
    <calloutURI></calloutURI>
    <extendedProperty1>SAML11SignedTokenTrustAny</extendedProperty1>
    <extendedProperty2></extendedProperty2>
  </correlatorEntry>
</correlator:correlator>
```

Connection bundle

The connection bundle describes the characteristics of the SOAP Gateway connection to the IMS Connect server. For TCP/IP, the SOAP Gateway is always a client. The name of the connection bundle has been nominated during the build of the web service, and we have to create it by using the command shown in Example 9-19.

Example 9-19 Creation of the connection bundle

```
iogmgmt -conn -c -n IMSPHBK -d I12A -h wtsc63.itso.ibm.com -p 5100
IOGD0113I: The create connection bundle entry (IMSPHBK) command successfully
changed the SOAP Gateway master configuration. The parameters submitted
with the command were:
                -conn
                -c
                -n  IMSPHBK
                -d  I12A
                -h  wtsc63.itso.ibm.com
                -p  5100.
```

```
 The SOAP Gateway server file system was updated. The changes will be reflected
in the runtime
configuration of the server after the next time that the SOAP Gateway
starts.
 No action is required.
```

Many other parameters are available for the connection bundle. In addition to the options shown in the example, the options listed here are also available. The command is used to create, update, and delete the bundle.

Example 9-20 shows the following information:

- The options **-c** for create, **-d** for delete, and **-u** for update.
- The host_name and port_number referencing the IP address of IMS Connect
- The data_store_name from which we are accepting messages
- The callout tpipe name, used with the **-callout** parameter

Example 9-20 Create, delete, update options for the connection bundle

```
iogmgmt
>  -conn    -c -n--bundle_name
             -d -n--bundle_name
             -u -n--bundle_name

             -h    host_name
             -p    port_number (default 9999)

             -d--datastore_name -i callout_tpipe_name
```

Most of the other parameters deal with the security references of the SOAP Gateway as a client as shown in Example 9-21, where:

- `saf_user_ID`, `saf_password`, and `saf_group_name` are the default values passed in the extended IRM type-2 header, if no user information is received from `ws_security`
- `-r new_bundle_name` to rename the connection bundle
- `-i callout_tpipe_name`
- `- ....callout_targets...` to call out with a client or server and basic authentication

Example 9-21 Additional options available on create connection bundle

```
   -f saf_user_ID -s saf_password
   -g saf_group_name
   -r new_bundle_name
   -i callout_tpipe_name
   -l callout_target_keystore_name -y callout_target_keystore_password
   -v callout_target_truststore_name -q callout_target_truststore_password
   -m callout_target_basic_auth_id -b callout_target_basic_auth_password
```

The options in Example 9-22 describe SSL characteristics for the connection to IMS Connect, when AT-TLS is not used.

Example 9-22 Parameters not used in combination with AT-TLS in TCP/IP

```
   -k keystore_name -w keystore_password
   -t truststore_name -o truststore_password
   -e encryption_type
```

Attention: Leave these properties blank if you are using IBM z/OS Communications Server AT-TLS feature to secure the connection between SOAP Gateway and IMS Connect. Specifying JKS SSL properties in AT-TLS environment will cause SSL handshake to fail.

Deploying the web service

The web service prepared by the Eclipse tool must be deployed in the SOAP gateway, which is done with SOAP Gateway management utility. During deployment of the web service, in some cases you need to indicate the kind of identity (authentication) information that is carried in the SOAP header.

Deploying the web service to SOAP Gateway enables the application and allows it to begin processing client requests. Before you deploy the web service, you must have the WSDL file name, correlator XML file name, and connection bundle entry name for the web service.

To deploy the web service, complete the following steps:

1. Issue the following command with the name of the WSDL file and correlator XML file:

   ```
   iogmgmt -deploy -w wsdl_file -r correlator_file
   ```

   The SOAP Gateway management utility parses the correlator XML file to determine the name of the linked connection bundle. If the connection bundle is not already active in the runtime cache, it is loaded when the service is deployed.

2. Optional: Specify a security token type (for example, `-t SAML11Token`) to enable WS-Security for the service.

   See Figure 9-39.

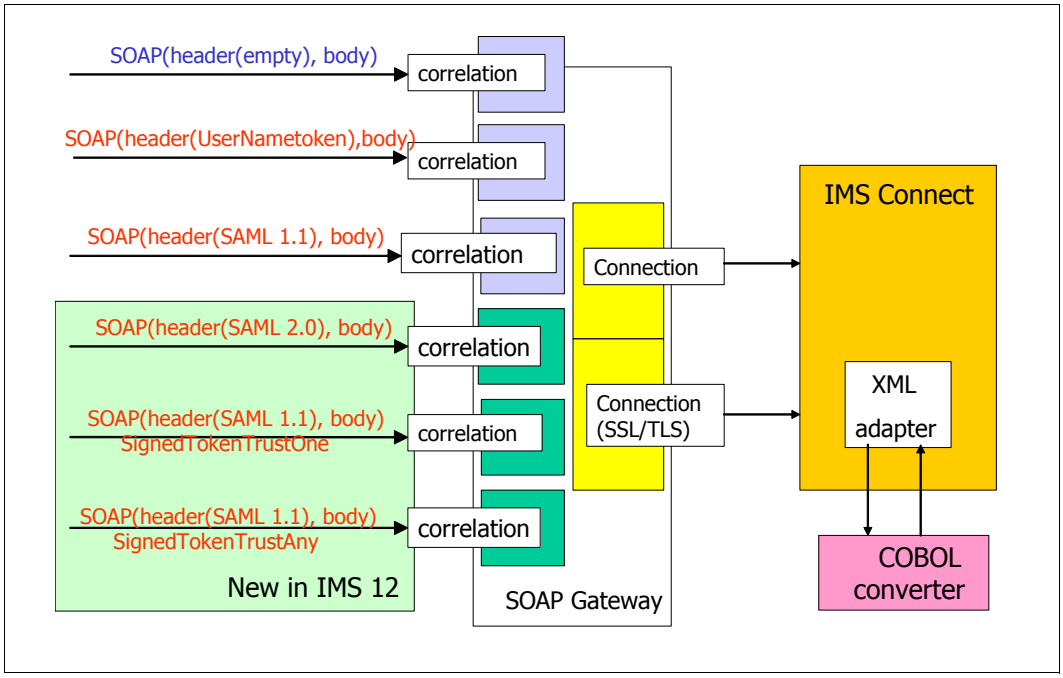

Figure 9-39 Identity (authentication) options with SOAP

3. Specify whether the service requires SSL transport. As shown previously for z/OS, you can choose between AT-TLS setup and a setup with keystores or truststores. Windows supports only keystores or truststores. SSL setup will be required in case of an incoming

web service request over SSL and if the SAML11token was signed, we need certificates in the truststore to verify the digital signature.

The deployment must be done with the **iogmgmt** utility. Example 9-23 shows the SAML11SignedTokenTrustAny security token.

Example 9-23 Deployment of the web service with a SAML11SignedTokenTrustAny token

```
iogmgmt -deploy
 -w C:\temp\IMSPHBK.wsdl -r c:\temp\IMSPHBK.xml -t SAML11SignedTokenTrustAny

IOGD0104I: The deploy command successfully deployed the
 IMSPHBKService web service to the runtime and master configurations:
  Web service definition and associated schema XML files:
        C:\temp\IMSPHBK.wsdl
  Correlator XML file:
        c:\temp\IMSPHBK.xml.
```

The **-t** parameter has the following options:

- UserNameToken
- SAML11Token (unSigned)
- SAML11SignedTokenTrustOne

  The SAML11 token in the SOAPheader carries the identity signed by the security server. This signature can only be verified by one element, the certificate of the security server, which must be available in the truststore of the SOAP Gateway server.

  The following additional parameters are mandatory for the truststore:

  - **-y** JCEKS/JKS/PKCS12 the truststore type
  - **-p** truststore password
  - **-h** truststore path
- SAML11SignedTokenTrustAny

  The SAML11 token in the SOAPheader carries a signed identity. This signature can be verified by the certificate that travels with the SOAP request.
- SAML20Token (unsigned)

4. Optional: Verify that the service is active with the following command:

   ```
   iogmgmt -view -correlatorfile ALL
   ```

   The correlator file for the newly-deployed service appears in the list of active correlator files in the runtime configuration. If the server is stopped, the correlator file name appears in the list of correlator files in the master configuration instead.

Message security

SSL deals with the transport-level security. This section explains what happens to the message security, which is security carried in the SOAP header of the envelope (Figure 9-40 on page 379). The transport-level security should eventually protect the message level security so that it cannot be read or altered.

It is the function of the SOAP Gateway to pass the message security from the SOAP header into the header extensions of the IMS Connect request message (IRM TYPE 2) as RACF recognizable information. By the type parameter, specified during the deployment, the SOAP Gateway server is aware of the type of security in the SOAP header.

If the security is not available from the SOAP header, defaults are taken for USERID/GROUP and PASSWORD specifications in the connection bundle.

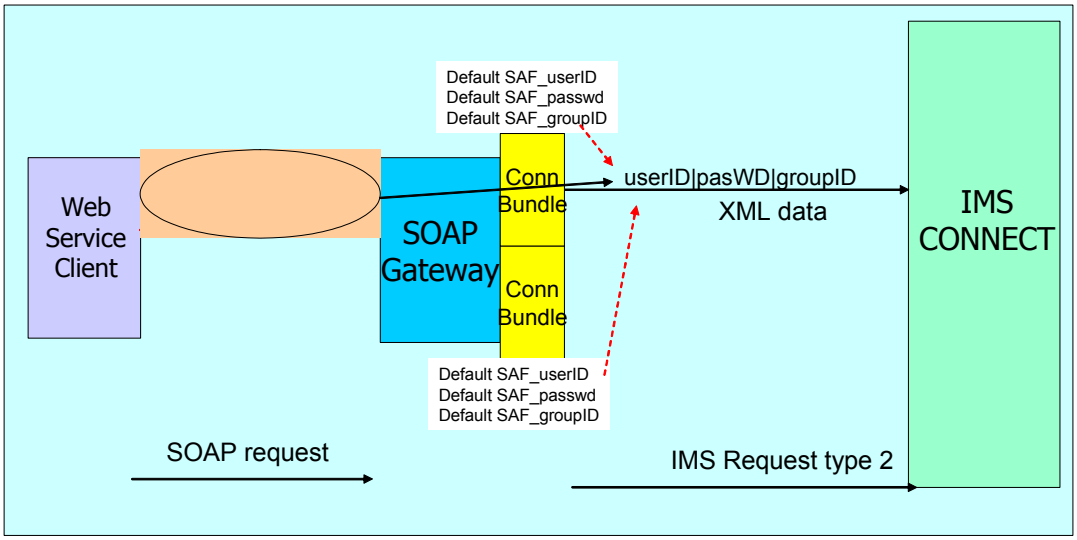

Figure 9-40 Passing WS_security into the IRM request to IMS Connect

COBOL converter

The COBOL converter function did not change from previous releases. To handle the XML data from the client, you can either modify the IMS application to accept the XML input message and to return an XML output message, or use the IBM Rational Developer for System z XML converter drivers to transform the XML data in IMS Connect. These converter drivers are generated in the COBOL or PL/I language.

The IMS Connect XML adapter function allows the XML adapter to run the converter driver inside IMS Connect to perform the XML transformation in the IMS Connect address space. To handle IMS transaction input and output messages in XML format from the SOAP client, the XML adapter converts the XML-tagged data to the appropriate IMS application format that the IMS application accepts and vice versa for outgoing messages.

If the IMS application is a multi-segment message processing program (MPP), you must use IBM Rational Developer for System z to generate the XML converter SOAP Gateway server administration.

The COBOL XML converter driver that was generated by Rational Developer for System z as part of the WSDL generation must be uploaded to your host IMS machine and compiled and link-edited so it can be accessed by IMS Connect.

To configure IMS Connect to convert XML data from the client into COBOL or PL/I IMS application program data, complete the following basic steps:

1. Specify the HWSSOAP1 user message exit in the EXIT= parameter of the TCP/IP configuration statement (see **1** in Example 9-24).
2. Include the ADAPTER configuration statement, ADAPTER=(XML=Y), in the IMS Connect configuration member HWSCFGxx (see **2** in Example 9-24).

Example 9-24 Changes in IMS Connect configuration for SOAP gateway

```
HWS=(ID=HWSI12A2,PSWDMC=N,RACF=N,RRS=Y,UIDCACHE=Y,XIBAREA=50)
TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=5100),          1
  PORT(ID=5101),PORT(ID=5102))
DATASTORE=(GROUP=I12XOTMA,ID=I12A,MEMBER=HWBI12A2,TMEMBER=I12AOTMA)
ADAPTER=(XML=Y)                                                        2
```

```
IMSPLEX=(MEMBER=HWSI12A2,TMEMBER=IM12X)
ODACCESS=(DRDAPORT=(ID=4100,KEEPAV=0,PORTTMOT=18000),
  DRDAPORT=(ID=4101,KEEPAV=0,PORTTMOT=18000),
  ODBMAUTOCONN=Y)
```

3. Define the XML adapter as a BPE exit routine for IMS Connect by coding a BPE exit list in a IMS PROCLIB data set member (Example 9-25).

Example 9-25 XML adapter as a BPE exit routine in member HWSEXIT0

```
EXITDEF(TYPE=XMLADAP,EXITS=(HWSXMLA0),ABLIM=8,COMP=HWS)
```

4. Reference it from the BPE IMS PROCLIB member (Figure 9-26).

Example 9-26 Excerpt of IMS Connect BPE member

```
# point to previous member from BPE config member
EXITMBR=(HWSEXIT0,HWS)
# DEFINITIONS FOR SOAP GATEWAY
```

5. For COBOL application programs, the XML converter is based on the COBOL copybook of the IMS COBOL application program that processes the message. For PL/I application programs, the XML converter is based on the source of the PL/I application program. Each IMS application that processes messages converted from XML must have its own unique XML converter.

   The XML converters run in an IBM Language Environment for z/OS enclave in the IMS Connect region and use approximately 33 MB of storage. The IMS Connect region size must be increased to accommodate this storage requirement. Compile and link the XML converter into an APF-authorized data set that is concatenated to the STEPLIB in the IMS Connect startup JCL. When linking the XML converter, specify an additional program entry name for an internal service as an ALIAS in the link job.

Refreshing an existing converter: If you are updating an existing converter, refresh it by issuing one of the following commands:

- The z/OS Modify command **`UPDATE CONVERTER`**
- The WTOR command **`REFRESH CONVERTER`**
- The type-2 command **`UPDATE IMSCON TYPE(CONVERTER)`**

You can find details about this installation in the IBM Information Management Software for z/OS Solutions Information Center at the following address. Search for *configuring XML conversion support for IMS Connect clients* for IMS 12:

`http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp`

Deploying the web service to SOAP Gateway enables the application and allows it to begin processing client requests. Before you deploy the web service, you must have the WSDL file name, correlator XML file name, and connection bundle entry name for the web service.

- Configure and remove the configuration for a web service or business event server.
- Set up the connection and correlation properties for a web service.
- Configure callout properties, and manage the callout threads and thread pool.

9.7.8 SOAP Gateway Administrative Console

The SOAP Gateway Administrative Console lists the deployed web services when the server is started. Each item in the list is a link to the WSDL file for the web service. The SOAP Gateway server must be started before proceeding. If the SOAP Gateway is stopped, issue the command shown in Example 9-27.

Example 9-27 Command to retrieve information from the file system configuration of a stopped server

```
iogmgmt -view -correlatorfile ALL
```

The web-based Administrative Console is not available if the server is stopped. However, this command retrieves information from the master (file system) configuration of a stopped server instead of the runtime configuration.

To start the SOAP Gateway Administrative Console, choose one of the following options depending on your environment:

- For Windows, from the Start menu, select **Start** → **Programs** → **IBM IMS Enterprise Suite Vx.x** → **SOAP Gateway** → **Administrative Console**.
- For Linux on System z and z/OS, from a web browser, enter the address shown in Example 9-28, where *hostname* is the host name and *port* is the port number where SOAP Gateway is running. The default port number is 8080.

  Example 9-28 Start the SOAP Gateway Administrative Console from browser

  ```
  http://hostname:port/imssoap
  ```

The Administrative Console opens in a web browser. Click **View Deployed web services**. The list of the currently deployed web services is displayed. Each item in the list is a link to the web service's WSDL file.

For more information, see the IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *IMS Enterprise Suite SOAP Gateway* for IMS 12:

http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp

9.8 IMS Enterprise Suite Java Message Service API

The IBM Enterprise Suite JMS API component is not changed from IMS Enterprise Suite V1.1. We include it in this chapter for completeness.

JMS is a Java technology to access queue or topic resources. Each vendor offering with the Java language the possibility “to write to/read from queues (point-to-point (PTP) domain)” or “to publish to/subscribe on topics (PUB/SUB domain)” has to implement the core abstract JMS classes. An *abstract class* contains only the signatures of the methods, but has no logic included.

Implementation classes provide the actual interface to the resources. IBM has its implementation classes for WebSphere MQ.

The dlicall “ICAL” for IMS dependent regions allows a program to perform synchronous callouts when using DLI calls, from traditional languages such as PL/I, COBOL, C, and Java.

With the JMS extension, Java IMS dependent regions (JBP, JMP) can issue the “ICAL” equivalent in a JMS way. The extension is delivered for IMS as a package with classes extending the standard WebSphere MQ JMS implementation package (Example 9-29).

Example 9-29 WebSphere MQ and IMS extension classes for JMS

```
com.ibm.mq.jms.jar (IBM implementation for MQseries)
com.ibm.ims.jms.jar (extension for IMS/ICAL)
```

The IMS implementation of JMS is limited to supporting the PTP messaging domain only. In addition, support is provided only for non-transacted QueueSession objects with `Session.AUTO_ACKNOWLEDGE` mode. If the JMP or JBP application attempts to call any JMS method not supported by IMS or pass any unsupported argument to JMS method calls, a JMSException exception is thrown.

The `com.ibm.ims.jms` package provides IMS-specific extensions for performing synchronous call-out from JMP or JBP regions. It contains the `IMSQueueConnectionFactory` class, which is the Factory class used to create IMS point-to-point messaging domain `QueueConnection` objects.

JMS calls can be issued to three target types:

- JMS/ICAL to StateLess Session Bean (SLSB), located in WebSphere Application Server
- JMS/ICAL to Message Driven Bean (MDB), available in WebSphere Application Server
- JMS/ICAL to web services by using the SOAP Gateway

Figure 9-41 on page 382 illustrates the following flow:

1. JMS ICAL is issued.
2. It nominates an OTMA descriptor, which dictates the target.
3. It passes through IMS Connect, and Web Services call messages are prepared for XML.
4. If the destination is SLSB or MDB, it passes through the IMS/TM adapter for WebSphere Application Server.
5. Destination is Stateless Session Bean.
6. Destination is Message Driven Bean.
7. If the destination is Web Services, it passes through the IMS SOAP Gateway.
8. Destination is Web Services.

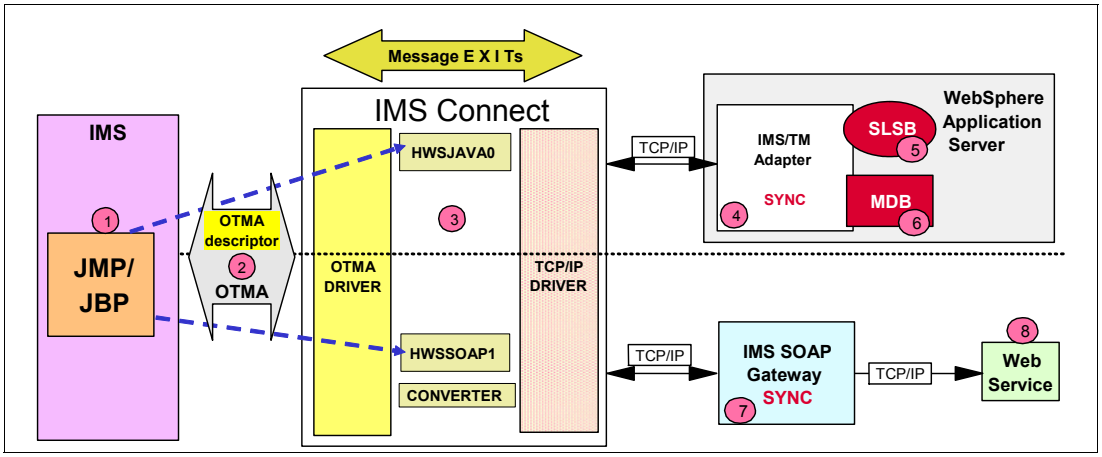

Figure 9-41 JMS ICAL destinations

Example 9-30 shows an excerpt of the JMS code.

Example 9-30 JMS Code excerpt

```
import javax.jms.JMSException;
import javax.jms.Queue;
import javax.jms.QueueConnection;
import javax.jms.QueueRequestor;
import javax.jms.QueueSession;
import javax.jms.Session ;
import javax.jms.TextMessage;
import com.ibm.ims.jms.IMSQueueConnectionFactory;
public class IMS_Sample {
public static void main(String argv[]) {
   IMSQueueConnectionFactory jmsConnectionFactory = new
               IMSQueueConnectionFactory();
   QueueConnection jmsConnection = null;
   QueueSession jmsQueueSession = null;
   Queue jmsQueue = null;
   QueueRequestor jmsQueueRequestor = null;
   try {
      jmsConnectionFactory.setTimeout(1000);
      //Set 10 second timeout
      jmsConnectionFactory.setResponseAreaLength(128000);
      //Allocate 128K response area
      jmsConnection = jmsConnectionFactory.createQueueConnection();
      jmsQueueSession = jmsConnection.createQueueSession(false,
               Session.AUTO_ACKNOWLEDGE);
      jmsQueue = jmsQueueSession.createQueue("OTMDEST1");
      jmsQueueRequestor = new QueueRequestor(jmsQueueSession, jmsQueue);
      TextMessage sendMsg = jmsQueueSession.createTextMessage();
      String msg = "My Message";
      sendMsg.setText(msg);
      TextMessage replyMsg = (TextMessage)jmsQueueRequestor.request(sendMsg);
      System.out.println("Received message: "+replyMsg.getText());
   } catch (Exception e)
   {
      e.printStackTrace();
   }
}
```

To send a message using the JMP and JBP support for synchronous callout and synchronously receive a response:

1. Create a `com.ibm.ims.jms.IMSQueueConnectionFactory` object.
2. Create a JMS QueueConnection instance by calling the `createQueueConnection` method on the `IMSQueueConnectionFactory` object.
3. Create a JMS QueueSession instance by calling the `createQueueSession` method on the QueueConnection instance. In the method call, you must set the input parameter values to false and `Session.AUTO_ACKNOWLEDGE` to specify that the generated QueueSession instance is non-transacted and runs in AUTO_ACKNOWLEDGE mode.
4. Create a queue identity by calling the `createQueue` method on the QueueSession instance. In the method call, you must set the input parameter value to the OTMA descriptor name for the synchronous callout operation.

5. Create a JMS QueueRequestor instance and pass in the QueueSession instance from step 3 and the Queue instance from step 4 as input parameters to the `QueueRequestor` constructor method.
6. Create a TextMessage instance by calling the `createTextMessage` method on the QueueSession instance from step 3. Set the string containing the message data.
7. To send the message and retrieve a response, call the request method on the `QueueRequestor` object from step 5. In the method call, pass in the TextMessage instance from step 6. You need to cast the return value from the request method call to a TextMessage instance. If the call is successful, the return value is the response to the synchronous callout request.

For more information, see the IBM Information Management Software for z/OS Solutions Information Center at the following address, and search for *JMS API*:

`http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp`

10

Tools for IMS 12

This chapter provides an overview of the IBM Information Management System (IMS) Tools portfolio and of the major updates to the tools to support IMS 12. It introduces the new IBM Tools strategy with solution packs, including descriptions and useful information about the documentation, maintenance, end of support (EOS), and compatibility with various IMS versions.

The chapter includes the following sections:

- IMS Tools general information
- Examples of specific product updates for IMS 12 support

10.1 IMS Tools general information

IBM continues to increase its investment in tools to deliver comprehensive solutions that respond to customer requirements faster than ever before. The focus of the investment is on common interfaces, cross-tool integration, and usage testing.

To meet the objectives about common interface and cross-tool integration, in 2010, IBM announced the following Solution Packs:

- IBM Tools Base for z/OS (product number 5655-V93) also called IMS Tools Base for z/OS for version 1.1
- IMS Fast Path Solution Pack for z/OS (5655-W14)
- IMS Database Solution Pack for z/OS (5655-S77)
- IMS Recovery Solution Pack for z/OS (5655-V86)
- IMS Performance Solution Pack for z/OS (5655-S42)

You can still order some of the products included in these packs individually, but most of them are now only available through those packs. Other products, which are not included in packs, can be ordered as before.

This section provides an overview of those tools and the major updates made to some of them to support IMS 12.

10.1.1 Useful links

The information that is available on the Internet is constantly being updated. Check the referenced websites in the following sections periodically to ensure that you have latest version of the information.

Documentation

For complete IMS Tools documentation see the IMS Tools Product Page, which is available for DB2 and IMS Tools at:

https://www.ibm.com/support/docview.wss?uid=swg27020942

Select the product name at the top of the page to go directly to the information.

Product life cycle

For product life cycle information, see the Product Lifecycle for DB2 and IMS Tools page at:

https://www.ibm.com/support/docview.wss?rs=434&uid=swg27008621

This page includes a table with the following information and more:

- The product number
- The General Availability (GA) date with a link to the announcement letter if you click the GA date
- The End of Marketing (EOM) date with a link to the withdrawal letter
- The End of Support (EOS) date with a link on the service discontinuance announcement
- The replacement product name and version if it is no longer supported

This table is constantly being updated.

Important: No letter of discontinuance of service is sent for One Time Charge products. You have to check this information on this site when it is available.

Figure 10-1 shows an example of the information you can find:

```
IMS Tools Base V1.1 has no End of Marketing yet, nor End of Support date
IMS Tools Knowledge Base is End of support on 30 Sept 2011, and is replaced by IMS
Tools Base V1.1.
```

IMS Tools Base						
Ver/Rel	OS/Platform	PID	GA	EOM	EOS	Replacement Product
1.1.0	z/OS	5655-V93	19-Feb-10	TBD	TBD	Not Established
IMS Tools Knowledge Base						
Ver/Rel	OS/Platform	PID	GA	EOM	EOS	Replacement Product
1.1.0	z/OS	5655-R34	05-June-07	05-July-10	30-Sep-11	IMS Tools Base v1.1

Figure 10-1 Product life cycle information

Maintenance

For a list of available fixes (program temporary fixes (PTFs) and a description of the problems they solve (APARs), see the IBM DB2 and IMS Tools PTF Listing page at:

https://www-304.ibm.com/support/docview.wss?rs=434&uid=swg27008646&context=SSZJXP

You can also save this information as a comma-separated value (CSV) file to import the list of APARs into a spreadsheet or database for sorting or downloading. Keep a current level of maintenance on the tools, and check this web page as soon as you experience a problem. You might notice that one APAR solves more than one problem, which makes the time to apply them worth it, especially before starting to use new functions or a new version of IMS.

Compatibility matrix

For information about the minimum maintenance level required for IMS Tools to support all the current IMS versions, which are Versions 10, 11, and 12, see the IMS Information Management Tools and IMS for z/OS V11.1 Compatibility page at.

https://www-304.ibm.com/support/docview.wss?rs=434&uid=swg21296180

Check this page before you start a new IMS migration to access the latest tools.

10.1.2 IMS Tools portfolio

Figure 10-2 on page 388 shows a complete overview of the products and the application area they belong to. A brief description of the solution packs and some of the products is provided in the sections that follow.

For more information about tools, see the official documentation at websites referenced in the 10.1.1, “Useful links” on page 386.

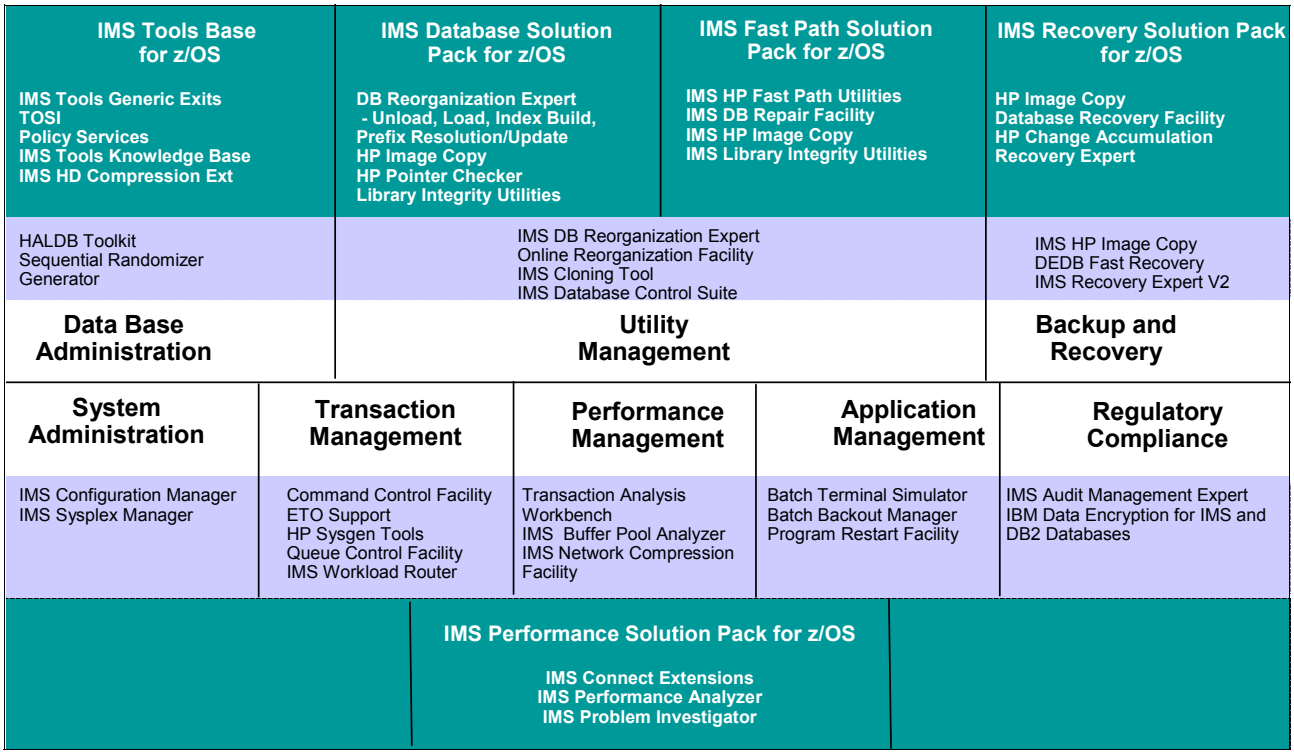

Figure 10-2 IMS tools portfolio overview

The following sections describe the tools belonging to the Solutions Packs:

- IBM Tools Base Pack for z/OS Version 1 (5655-V93)
- IMS Fast Path Solution Pack for z/OS (5655-W14)
- IMS Database Solution Pack for z/OS (5655-S77)
- IMS Recovery Solution Pack for z/OS (5655-V86)
- IMS Performance Solution Pack 110 (5655-S42)

They also include a short description of the following tools:

- IMS Recovery Expert for z/OS 210 (5655-S98)
- IMS Sysplex Manager 130 (5655-P01)
- IBM Transaction Analysis Workbench 110 (5697-P37)

10.1.3 IBM Tools Base Pack for z/OS Version 1 (5655-V93)

Version 1.1 of this pack has been available until now. Version 1.2 was announced on 9 August 2011 and has been available since 9 September 2011. This new release adds a common interface to some DB2 tools.

Important: This pack is the foundation of the other packs, and must be installed as a prerequisite to all the IMS solution packs and most of the IMS tools products.

The tools base pack is a *no charge* product, but is not included in other packs. Therefore, you must order it.

IMS Tools Base for z/OS, V1.1 (5655-V93), now called IBM Tools Base for z/OS Version 1.1, combines several IMS products and the entire collection of IMS Tools common infrastructure components into a single, consolidated installation package.

Attention: To support IMS 12, the IMS Tools Base Pack, FMID HAHN110, needs PM21167/UK62373.

The IMS Tools Base package provides the following features, functions, and common services:

- IMS Tools Knowledge Base
- IMS Tools Common services
- IMS Tools Distributed Access Infrastructure
- IMS Hardware Compression Extended

This pack replaces:

- IMS Tools Knowledge Base (5655-34; end of support on 30 September 2011)
- IMS Tools Online Interface (5697-N50)

IMS Tools Knowledge Base

IMS Tools Knowledge Base (ITKB) provides a common information management service that allows the sharing of data generated by multiple tool products within a sysplex from a single, centralized interface.

This information can be:

- Reports from IMS Tools or third parties
- Sensor data: information captured by an IMS Tools product (such as IMS Reorganization Expert 410) at an instance in time that represents the condition, or state, of one or more databases
- Policies: sets of rules that define threshold limits for specific types of database conditions. These threshold limits are then evaluated against your sensor data.

This data is centralized in a common report repository and can be managed with its viewing interface through a complex sysplex environment. Historical report data can be found through a powerful search, and preserved for future decision making. ITKB is the single interface within a sysplex environment for multiple IMS tools products to share report output.

IMS Tools Common services

IMS Tools Common services includes the IMS Tools Generic Exits and the IMS Tools Online System Interface (TOSI) functions. IMS Tools Generic Exits is a set of specialized utilities used by IMS Tools product code to manage various interfaces including the managing of IMS exits. TOSI is a general purpose command interface that allows IMS Tools to interface with all supported IMS versions.

IMS Tools Distributed Access Infrastructure

IMS Tools Distributed Access Infrastructure serves as the IMS Administrative Gateway Emphasis on flexibility of communication. It acts as a dispatcher for IMS Tools and can construct an execution environment that typically runs under Time Sharing Option (TSO) commands or batch.

IMS Hardware Compression Extended

IMS Hardware Compression Extended is a productivity aid for implementing Hardware Assisted Data Compression. It offers the following benefits:

- It extends IMS basic Hardware Data Compression (HDC) support with utilities that ease compression implementation and provide additional flexibility and function. For more information about standard HDC support, see *IMS Version 12 Exit Routines,* SC19-3016.
- It works on Image Copies, High Performance Unload files, and IMS Unload files.
- It includes sample Compression Dictionaries.
- It enables the effectiveness of existing dictionaries to be assessed.
- It allows monitoring of dictionary effectiveness over time.
- Builds database description (DBD) and Reload job control language (JCL).

Important: IMS Tools Knowledge Base, IMS Tools Common services, IMS Tools Distributed Access Infrastructure, and IMS Hardware Compression Extended cannot be ordered separately and are only available from IMS Tools base pack or IBM Tools base pack.

IBM Tools Base for z/OS Version 1.2

IBM Tools Base for z/OS, V1.2 (5655-V93) consists of the features, functions, and common services listed previously in V1.1. Additionally, it offers IBM Tools Customizer for z/OS, which is used by various IM tools (IMS and DB2) and which assists in customization by providing an enhanced, streamlined customization process. For more information about this topic, see announcement letter 2011_ENU5211-283.

Attention: IBM Tools Base for z/OS Version 1.2 supports IMS 12 without additional maintenance

10.1.4 IMS Fast Path Solution Pack for z/OS (5655-W14)

Application: IMS Fast Path Solution Pack for z/OS applies to data entry databases (DEDBs). IMS Database Solution Pack for z/OS applies to Full Function Databases.

This pack includes:

- IMS High Performance Fast Path Utilities
  - IMS Fast Path Advanced Tools
  - IMS Fast Path Basic Tools
  - IMS Fast Path Online Tools
- IMS High Performance Image Copy
- IMS Library Integrity Utilities
- IMS Database Repair Facility

Important: IMS HP Fast Path Utilities (5655-W14) and IMS Database Repair Facility (5655-E03) are only available from the IMS Fast Path Solution Pack and cannot be ordered separately. The old versions of those products are *not* compatible with IMS 12 and are withdrawn from support on 30 September 2011.

The pack also replaces the old version of Fast Path Utilities product, Fast Path Basic Tools (5655-E30), and Fast Path Online Tools (5655-F78), which are at end of support (EOS) since 2006.

For APAR and PTF numbers, see Table 10-1. Other APARs are available. Be current with the maintenance level by checking the maintenance website. When you order this pack, you receive all the products included in it.

Table 10-1 Fast Path Solution Pack maintenance to support IMS 12

Product name	Product number	FMID	APAR/PTF	Abstract
IMS Fast Path Solution Pack 110	5655-W14	HAHQ110	PM21939/UK62565 PM31908/UK65466 PM36509/UK69078 PM37894/UK69302	► Preconditioning APAR for IMS 12 DEDB secondary index enhancement Compatibility with LIU for IMS12 ► Compatibility with Recovery solution Pack DRF function for IMS 12
IMS High Performance Image Copy 420	5655-N45	H1J0420	PM21942/UK62577 PM34347/UK66329	► Preconditioning APAR for IMS 12 ► EAV OSAM IMS 12 support for HPIO
IMS Library Integrity Utilities 210	5655-U08	H27P210	PM21961/UK62602 PM46494/UK71799	► Preconditioning APAR for IMS 12 ► New function to support indexed DEDB and Fast Path secondary index with IMS 12.

IMS High Performance Fast Path Utilities

It is a challenge to increase system online availability when maintaining databases, while reducing total maintenance time. IMS High Performance Fast Path Utilities (IMS HP FP Utilities) provides you with extensive functions to manage your DEDBs in both online and offline environments. It consists of three tools and supplementary utilities as listed in Figure 10-3, and works with IMS 10, 11, and 12, and z/OS 1.9 or later.

- Fast Path Advanced Tool (FPA)
- Fast Path Basic Tools (FPB)
- Fast Path Online Tools (FPO)
- Supplementary utilities

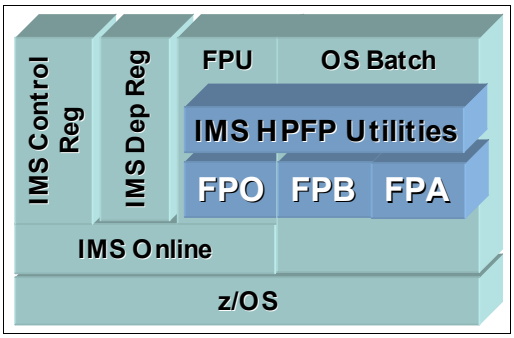

Figure 10-3 IMS High Performance Fast Path Utilities components

IMS HP FP Utilities provides a complete set of high performance utilities such as unload, reload, reorganize, backup, and verify. It reports on DEDB areas and tunes up the libraries. It also reduces CPU and elapsed time, processes in parallel multiple DEDB areas in a single step, and eliminates I/Os for intermediate data sets by enabling unload, reload, analyze and backup tasks to run in a single step.

IMS HP FP Utilities reduces the unavailability time of taking database image copies using advanced technologies. It provides online reorganize, extract, extend, backup, verify and report functions on “online” DEDB areas, and then improves system availability.

Additionally, IMS HP FP Utilities has been enhanced to support the IMS 12 Fast Path Secondary Index (FPSI) new feature. For information about this support, see 10.2.1, “High Performance Fast Path Utilities updated for IMS 12” on page 410.

High Performance Image Copy

IBM High Performance Image Copy (HPIC) 420 is included in the pack. It can be ordered separately with product number 5655-N45, but it comes with the pack if the pack is ordered.

This product is a replacement for IMS Image Copy standard solutions for both full function (including high availability large databases (HALDB)) and fast path DEDB databases, whether you are dealing with a batch or concurrent image copy, either standard or DFSMS COPY image copy.

HPIC works with enhanced capabilities such as:

- Allow Parallel IC processing (copy multiple DBDS at the same time)
- Enable hash pointer checking during image copy (not available with concurrent image copy)
- Support compressed image copy output
- Copy image copies with compression or without compression
- Allow stacking of multiple output data sets on tape
- Dynamic allocation of input and output data sets
- Integration with the IMS Tools Base Pack (stop and start database around creation of batch image copy)

HPIC advanced copy services have the following characteristics:

- They are implemented using DFSMSdss API to invoke **DUMP** and **COPY** commands.
- They are based on the concept of logical copy and physical copy.
  - Logical copy takes a short time and the database is available afterward.
  - Physical copy (IC) is created from the logical copy.
- They use a combination of software and hardware:
  - Concurrent Copy support for cached subsystems.
  - SnapShot support for RAMAC Virtual Array (RVA) devices.
  - IBM FlashCopy® support for IBM TotalStorage® Enterprise Storage Server® (ESS) and IBM TotalStorage DS8000 devices (there is similar support for OEM devices).
- They are available for both clean and fuzzy image copy processing.

HPIC includes a High Performance I/O engine for read and write processing, and can automatically restart for failed image copies. It also detects automatically improved data recording capability (IDRC) for output tape.

To summarize, High Performance Image Copy offers the following benefits:

- It reduces copy and recovery time.
- It provides a powerful engine and parallelism capabilities to reduce CPU and elapsed time.
- It allows higher database availability by passing commands to IMS itself.
- It tightly integrates with other tools to give better performance and simplify the copy process.

Library Integrity Utility

Library Integrity Utility (LIU) 210 is included in the pack. It can be ordered separately with product number 5655-U08, but it comes with the pack if the pack is ordered.

LIU helps to efficiently maintain the numerous IMS data sets that contain definitions, such as DBDLIB, PSBLIB, ACBLIB, formats MFS. For example, it ensures that a correct definition is in use to prevent database corruption.

To do this, LIU provides the following utilities:

- Integrity checker

  This utility prevents DB corruption caused by using a wrong DBD. A wrong DBD is a DBD that is different from the one used to load the database. This situation can arise if you use an old DBD after a DBD change is applied.

- Consistency checker

  This batch utility ensures that the necessary definition in IMS has been created for your database, such as ACB in an ACB library, a Database Definition entry in the MODBLKS module (DFSDDIRx), a DFSMDA dynamic allocation member for database data sets in a MDA library, and DB and DSG registration in recovery control (RECON).

- DBD/PSB/ACB Compare

  This batch utility reports the difference between DBD, program specification block (PSB), and application control block (ACB) members that have the same name but reside in separate object libraries, whatever their type is (same or different).

- DBD/PSB/ACB Mapper

  This batch utility produces a printed map (picture of segment hierarchy) from DBDs, PSBs, and ACBs.

- DBD/PSB/ACB Reversal

  This batch utility converts a DBD, PSB, or ACB member back into IMS **DBDGEN** or **PSBGEN** utility control statements.

- Advanced ACB generator

  This batch utility provides a high-speed generation process for processing large volumes of IMS ACBs. It replaces the IMS **ACBGEN** utility.

- MFS reversal

  This batch utility can compare two MFS load module libraries, and convert the format in MSF source format.

LIU has been enhanced to support the IMS 12 Fast Path Secondary Index new feature. For more information about this topic, see 10.2.2, “Library Integrity Utilities updated for IMS 12” on page 423.

Database Repair Facility

The Database Repair Facility product cannot be ordered separately, and it comes with the Fast Path Solution Pack or with the High Performance Pointer Checker 310. The purpose of this function is to repair IMS databases, Full Function or DEDB, that contain pointer or data errors in interactive mode or in batch mode.

10.1.5 IMS Database Solution Pack for z/OS (5655-S77)

IMS Database Solution Pack provides a complete set of high performance utilities to analyze, maintain, and tune IMS Full Function databases including HALDB.

This pack includes:

- IMS High Performance Image Copy 420
- IMS Library Integrity Utilities 210
- IMS High Performance Pointer Checker 310
- IMS Database Reorganization Expert 410
- IMS High Performance Unload 120
- IMS High Performance Load 210
- IMS Index Builder 310
- IMS High Performance Prefix Resolution 310

The maintenance to support IMS 12 must be applied to individual products for the Database Solution Pack (see Table 10-2). Other APARs are available. Be current with their maintenance levels and check the maintenance website.

When you order this pack, you receive all the products included in it. However, in this case, all the products can be ordered on a unitary basis.

Table 10-2 Database Solution Pack maintenance to support IMS12

Product name	Product number	FMID	APAR/PTF	Abstract
IMS High Performance Image copy 420	5655-N45	H1J0420	PM21942/UK62577 PM34347/UK66329	► Preconditioning APAR for IMS 12 ► EAV OSAM IMS 12 support for HPIO
IMS Library Integrity Utilities 210	5655-U08	H27P210	PM21961/UK62602 PM46494/UK71799	► Preconditioning APAR for IMS 12 ► New function to support indexed DEDB and Fast Path secondary index with IMS 12.
IMS High Performance Pointer Checker 310	5655-U09	HPC2310 H22K310	PM21945/UK62559 PM25552/UK62558	► Preconditioning APAR for IMS 12 for the HPPC part ► or the Data Repair Facility part
IMS Database Reorganization Expert 410	5655-S35	H25N410	PM22116/UK62553	► Preconditioning APAR for IMS 12
IMS High Performance Unload 120	5655-E06	H1IN120	PM22119/UK62576	► Preconditioning APAR for IMS 12
IMS High Performance Load 210	5655-M26	H1IM210	PM22118/UK62579	► Preconditioning APAR for IMS 12
IMS Index Builder 310	5655-R01	H220310	PM22120/UK62546	► Preconditioning APAR for IMS 12
IMS High Performance Prefix Resolution 310	5655-M27	H1IP310	PM22121/UK62343	► Preconditioning APAR for IMS 12

High Performance Image Copy

HPIC 420 is included in the Database Solution Pack, or it can be ordered separately with product number 5655-N45. For an overview of this product, see “High Performance Image Copy” on page 392.

Library Integrity Utility

LIU 210 is included in the Database Solution Pack, or can be ordered separately with product number 5655-U08. For an overview of this product, see “Library Integrity Utility” on page 393.

IMS High Performance Pointer Checker

High Performance Pointer Checker (HPPC) 310 is included in the Database Solution Pack, or it can be ordered separately with product number 5655-U09.

HPPC can perform a validation of the database pointers, as explained here:

- It can perform standard checking, known as full checking, by checking the pointers one by one and detecting the place of pointer corruption,
- Or it can perform hash checking, which is a quick check used to determine whether a database is valid or has pointer errors. Hash checking cannot detect the location of pointer corruption, but is fast and consumes less CPU time.

IMS databases: HPPC applies to the following IMS databases:

- HDAM
- PHDAM
- HIDAM and primary index databases
- PHIDAM and primary index databases
- HISAM databases
- HDAM/HIDAM/HISAM secondary index databases
- PHDAM/PHIDAM secondary index databases (PSINDEX)

It does not support IMS Partition DB (5697-A06, 5697-D85) or any other products with an equivalent function.

IMS High Performance Pointer Checker provides the following utilities:

HD Pointer Checker (HDPC)
: This is the main component. It scans databases and validates them by checking the relation of pointers and segment starting address. It can perform hash checking or standard checking.

DB Repair Facility
: You can change database data directly by using the DB Repair Facility TSO ISPF panel or batch job.

Space Monitor (SPMN):
: This utility reports space information of the database data set and monitors the threshold for space information.

HD Tuning Aid (HDTA)
: This utility evaluates the distribution of root segments. If the root segments are distributed uniformly, good randomizing parameters are given. If not, it is better to consider different parameters. HDTA can simulate the distribution of root segments as though the parameters or database organization were changed.

DB Historical Data Analyzer (DBHDA)
: If you do not want to use the IMS Tools Knowledge Base repository to keep the data history, the statistics data can be stored in a history data set by DBHDA. It can print reports and show a data set usage trend graph on TSO.

DB Segment Restructure (DBSR)

This utility allows segment data to be changed with control statements. There is no need to code a complicated application program.

IMS Database Reorg Expert

IMS Database Reorg Expert 410 is included in the Database Solution Pack. It can also be ordered separately with product number 5655-S35.

IMS Database Reorg Expert 410 is a complete infrastructure to operate IMS Reorganization-related tools in parallel or independently, thereby allowing a significant reduction in reorganization time.

Online Reorganization Facility tool: IMS Database Reorg Expert shortens the reorganization process by executing the various steps in parallel, being fully integrated with other tools. However, the databases are unavailable during this short process. It is not an online reorganization. Its power is the conditional reorganization with the sensor data.

Online Reorganization (OLR) Facility is an IMS function available from IMS 9 giving a truly online reorganization, only available for HALDB. The Online Reorganization Facility tool, product number 5655-H97, provides an almost online reorganization for full function databases including HALDB. At the end of the reorganization, it needs to make the database unavailable for a short time to finish applying the updates, renaming the data sets, and updating the RECON data set.

IMS Database Reorg Expert provides the following utilities:

- Smart Reorg Utility, which includes two features:
  - Conditional Reorganization Support Service (CRSS)
  - Parallel Reorganization Service
- IMS Parallel Reorg Unload utility
- IMS Parallel Reorg Load utility
- IMS Parallel Reorg Database Scan utility

The Smart Reorg utility (with CRSS) evaluates the full function databases and collects sensor data. It is then able to tell whether the database needs to be reorganized, according to policies and statistics stored in the IMS Tools Knowledge Base repository. After this evaluation it can start the reorganization automatically and evaluate the reorganized database to check the benefit of the reorganization. Finally, it provides a report on the database status and the changes operated on it.

Figure 10-4 summarizes the Smart Reorg driver operations.

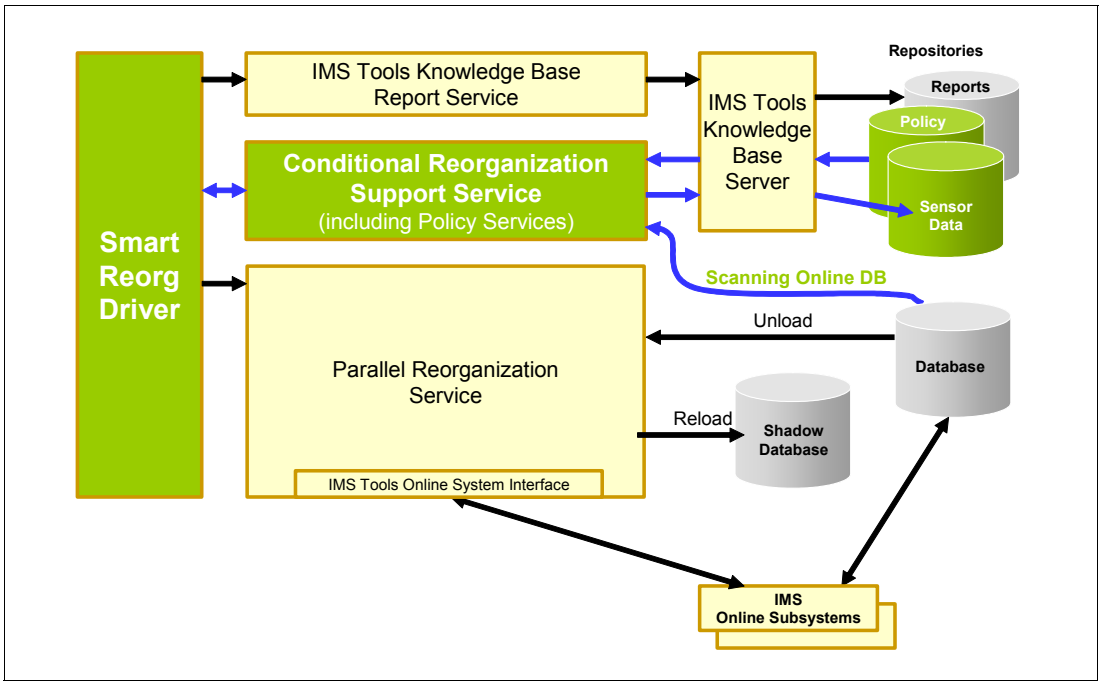

Figure 10-4 Smart Reorg Driver services

The IMS Parallel Reorganization utilities provide a high performance engine, running unload and load in parallel in only one step and performing pertinent functions like index building, image copy and hash pointer checking, and prefix resolution and update.

The JCL becomes easy to write and you do not need to have deep skills in IMS to write a reorganization batch with this tool.

IMS High Performance Unload

HP Unload is included the pack, or it can be ordered separately with product number 5655-E06. It replaces the standard HD Reorganization Unload utility (DFSURGU0). It is serviced by a high performance database retrieval engine called High Speed Sequential Retrieval (HSSR) Engine, and it reduces CPU and elapsed time.

The heart of HP Unload, the HSSR Engine, can be used by two utility programs, FABHURG1 and FABHFSU. These engine provide the following functions among others:

- Unloading of compressed segments without decompression
- User exit for additional selection, editing of unloaded segments, or both
- Production of statistical reports
- Ability to continue after segment sequence errors
- Ability to read corrupted data bases
- Bypass corrupted pointers
- Force access of HIDAM or PHIDAM roots by using an index
- Diagnostic report about pointer errors

HP Unload has an API compatible with HSSR, which enables DL/I application programs to use HSSR to read a database using GN calls. There is no need to change the application to use the engine; the eligibility is done on the PCB.

Similar to other product tools, HP Unload provides a simple JCL, parallelism, and integration with other tools.

IMS High Performance Load

HP Load 210 is included in the pack, or it can be ordered separately with product number 5655-M26. It is a high speed alternative of the IMS HD Reorganization Load utility (DFSURGL0).

IMS HP Load provides a set of high performance reorganization reload procedures for the following database organizations:

- HDAM
- HIDAM
- HISAM
- SHISAM
- PHDAM
- PHIDAM

HP Load includes a Physical Sequence Sort for Reload (PSSR) engine that is used before reload to sort the unload data set, or which can be used before migrating to HALDB to sort into partition sequence. It can use disk or data space to load data during its process.

HP Load provides features such as:

- Accepts (compressed) input in *HD or *CS formats or in a user format
- Initialization of empty HDAM and HIDAM DBs
- Loads HALDB Partitions without them first being Initialized
- Provides a set of statistical reports
- Support of logical relationship or secondary indexes
- Creates data sets DFSURWF1 and optionally HPSRSIDX (if you want split work files) that can be used by:
  - IMS Index Builder tool
  - IMS High Performance Prefix Resolution tool
  - IMS Prefix Resolution utility (DFSURG10)

IMS Index Builder

IMS Index Builder 310 is included in the pack, or it can be ordered separately with product number 5655-R01. It applies to full function databases including HALDB.

With IMS Index Builder, you can build (or rebuild) the following:

- IMS secondary indexes
- Hierarchical Indexed Direct Access Method (HIDAM) primary indexes
- Indirect List Data Sets (ILDS)
- Supports full-function and partitioned HALDB

IMS Index Builder makes it faster to rebuild indexes instead of creating image copy and recover. It streamlines the process by creating multiple indexes in a single job step, and uses both parallel sort and parallel load whenever more than one index is being built, thus reducing the time needed to build multiple indexes of a single physical database.

Index build can be integrated with the DRF recovery process and reorganization process, which is available in the IMS Recovery Solution Pack. See 10.1.6, “IMS Recovery Solution Pack for z/OS (5655-V86)” on page 399.

IMS High Performance Prefix Resolution

HPPR 310 comes with the pack, or it can be ordered separately with product number 5655-M27. With HPPR 310, you can resolve and update prefixes of IMS databases involved in logical relationships in a single job step.

10.1.6 IMS Recovery Solution Pack for z/OS (5655-V86)

With the IMS Recovery Solution Pack for z/OS, clients can easily implement good practices in backup and recovery scenarios and support all recoverable IMS databases types, full function or DEDB.

This pack includes the following products:

- IMS Database Recovery Facility for z/OS
- IMS Database Recovery Facility Extended Functions for z/OS
- IMS High Performance Change Accumulation Utility for z/OS
- IMS High Performance Image Copy for z/OS 420
- IMS Index Builder for z/OS 310

Important: IMS Database Recovery Facility for z/OS 310, IMS Database Recovery Facility Extended Functions for z/OS 110, and IMS High Performance Change Accumulation Utility for z/OS 140 are only available from this pack.

The old versions of these products are not compatible with IMS 12 and are withdrawn from support on 30 September 2011.

The five products come with the IMS Recovery Solution Pack when ordered.

IMS Recovery Expert for z/OS 110 has been renamed to IMS Data Recovery Facility Extended Functions for z/OS 110. It has been merged with the IMS Database Recovery Facility for z/OS 310 into a single library, and they provide a single interface.

IMS Recovery Expert for z/OS Version 2 is another product available outside this pack. For an overview of this product, see “IMS Recovery Expert for z/OS 210” on page 407.

Table 10-3 lists the for APAR and PTF numbers. Other APARs are available. Be sure to stay current with the maintenance levels by checking the maintenance website. When you order this pack, you receive all the products included in it.

Table 10-3 Recovery Solution Pack maintenance to support IMS12

Product name	PID	FMID	APAR/PTF	Abstract
IMS Recovery Solution Pack 110	5655-V86	HAHM110	PM23052/UK64046 PM31377/UK64652 PM40317/UK68936 PM40723/UK68989 PM36306/UK69609	► Preconditioning APAR for IMS 12 ► DRF functions compatibility with FP Solution Pack
IMS High Performance Image copy 420	5655-N45	H1J0420	PM21942/UK62577 PM34347/UK66329	► Preconditioning APAR for IMS 12 ► EAV OSAM IMS 12 support for HPIO
IMS Index Builder 310	5655-R01	H220310	PM22120/UK62546	Preconditioning APAR for IMS 12

Rebuilding Fast Path Secondary indexes: To rebuild Fast Path Secondary indexes, DRF calls the INDEXBLD function that is available in Fast Path Solution Pack if PM36306 is applied. The Fast Path Solution Pack must also have PM37894.

If Fast Path Solution Path is not available, or one or both APARs is not applied, the standard IMS utility is used.

IMS Database Recovery Facility and DRF Extended functions

IMS Recovery Solution Pack for z/OS provides a high performance IMS database recovery solution with parallel I/O, parallel processing and sorting, a single archived log and change accum data set pass, and a single pass DB write. It can recover multiple DBDS or areas in one step, and it can run in parallel with transaction processing, online or batch mode recovery to *any* time stamp, not restricted to allocation boundary.

Figure 10-5 on page 401 provides a general overview of its functions:

- It can be invoked through an IMS **/RECOVER** command (an online region is needed) or through a batch (no online region needed).
- It uses dynamic allocation of data sets for database, log, change accumulation, and image copy.
- It does *not* use IMS resources for recovery.
- It gets all information about recovery data sets from recovery controls (RECONs).
- It performs pre-recovery actions such as the following examples:
  - The **/DBR** command to take DBDS offline.
  - Deleting and redefining the DBDS when necessary. (It can use the **REUSE** option for Virtual Storage Access Method (VSAM) and can always restore-in-place with overflow sequential access method (OSAM).)
  - Defining the Recovery Scope by building the “Recovery List”.
- It performs recovery actions such as the following examples:
  - Using IMS Tools Base to issue commands to IMS and perform automatic delete/define database.
  - Reading log data sets in parallel.
  - Reading Change Accumulation data sets concurrently with log data sets, complete or incomplete (with spill records).
  - Change Accum is not required, even in a data sharing environment.
  - Sorting log records.
  - Updating Image Copy data with log and change accumulation data in a single pass.

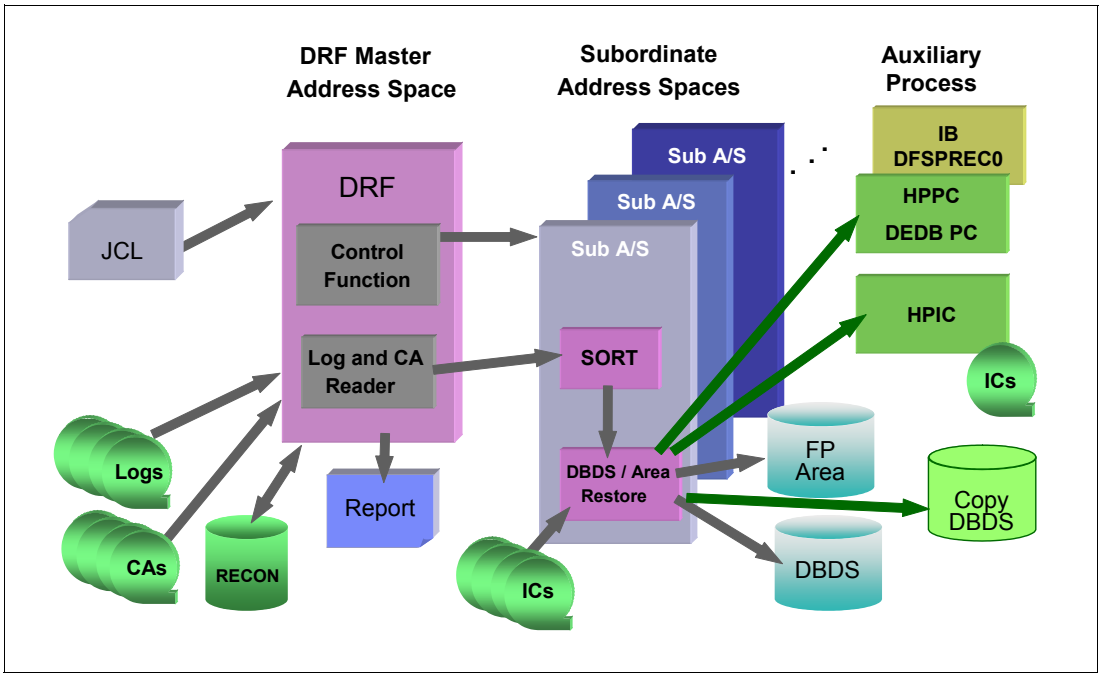

Figure 10-5 Data Recovery Facility at a glance

It can perform auxiliary processing as described here:

- During the recovery phase, such as performing image copies or doing validation pointer checking
- During the post-recovery phase, such as index building and running an IMS Index/ILDS Rebuild utility for HALDB

It runs calling internally High Performance Change Accum to read and sort the change accum records.

IMS High Performance Image Copy

HPIC 420 comes with the Recovery Solution Pack, or it can be ordered separately with product number 5655-N45. For an overview of this product, see “High Performance Image Copy” on page 392.

IMS Index Builder

IMS Index Builder 310 comes with the Recovery Solution Pack, or it can be ordered separately with product number 5655-R01. For an overview of this product, see “IMS Index Builder” on page 398.

10.1.7 IMS Performance Solution Pack for z/OS (5655-S42)

The IMS Performance Solution Pack for z/OS offers an end-to-end performance management and problem determination solution set in an IMS and TCP/IP environment.

This pack includes:

- IMS Problem Investigator (5655-R02)
- IMS Performance Analyzer (5655-R03)
- IMS Connect Extension (5655-S56)

The maintenance to support IMS 12 must be applied to individual products for the Performance Solution Pack. Table 10-4 lists the APAR and PTF numbers.

Table 10-4 Performance Solution Pack maintenance to support IMS12

Product name	PID	FMID	APAR/PTF	Abstract
IMS Problem Investigator	5655-R02	H28T220	PM24662/UK65183 PM34000/UK65462 PM36967/UK68755 PM42203/OPEN	► Preconditioning APAR for IMS 12 ► Compatibility with CEX ► Support for new CEX journal records with IMS 12 ► Compatibility with CEX
IMS Performance Analyzer	5655-R03	H23K420	PM24585/UK64657	► Preconditioning APAR for IMS 12
IMS Connect Extension	5655-S56	H28S220	PM32394/UK65339 PM24860/UK22288	► Preconditioning APAR for IMS 12

IMS Problem Investigator

IMS Problem Investigator (PI) 220 comes with the pack, or it can be ordered separately with product number 5655-R02.

IMS PI is an easy tool to use, with minimum setup required. It provides an enhanced level of problem determination services for IMS Transaction Manager (IMS TM), IMS DB, Common Queue Server (CQS), IMS Connect (with IMS Connect Extension (CEX) tool) and others. It can include log record information coming from IBM IMS, CEX, DB2, CQS, System Management Facilities (SMF), and IBM OMEGAMON®.

IMS PI can select dynamically the right log data sets from the RECON information or from information from IMS Connect Extension and format them quickly so that you can easily navigate them.

Figure 10-6 shows an example of the instantaneous view you can have of the logs records.

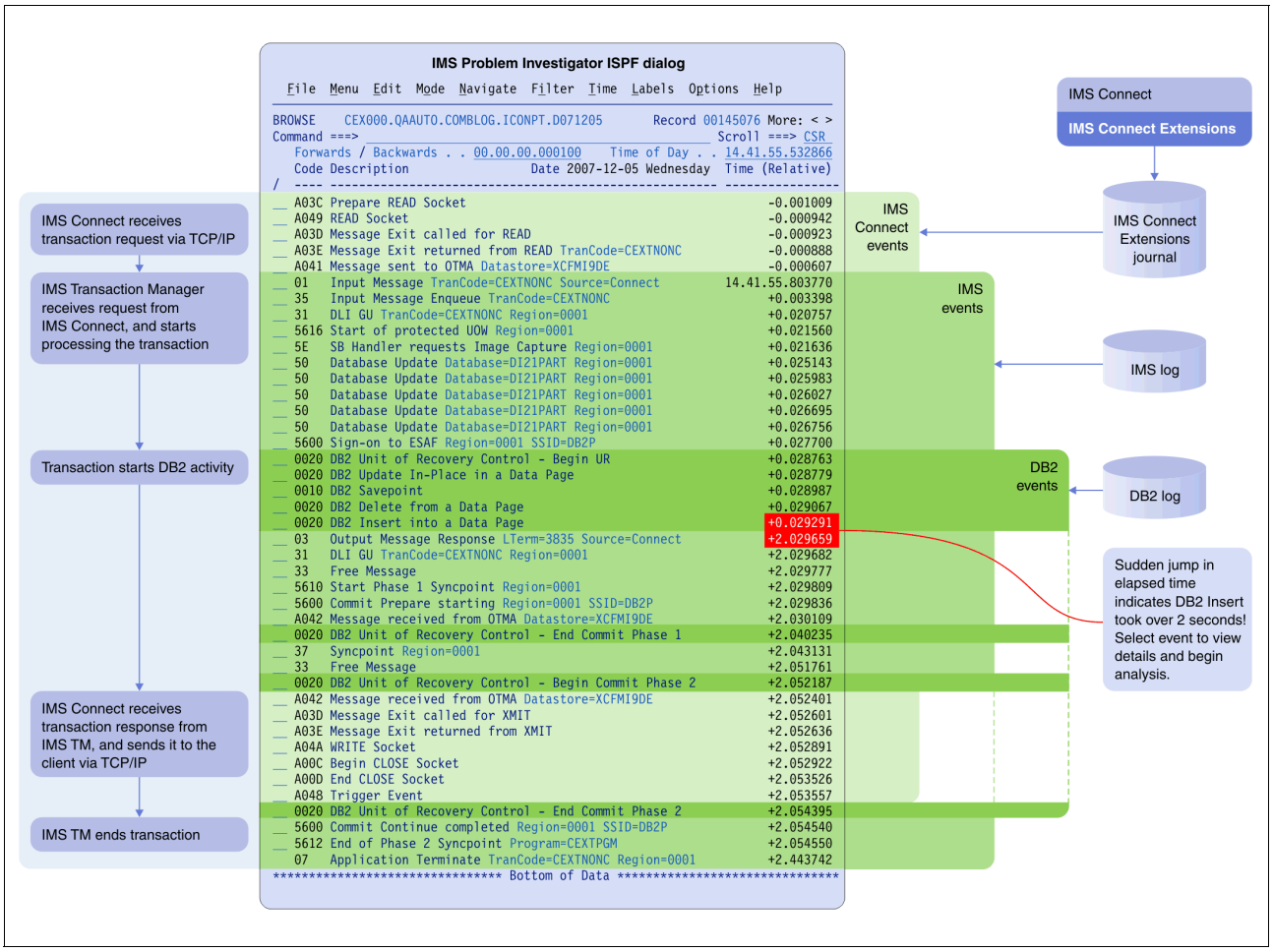

Figure 10-6 Instantaneous view of the log records with IMS PI

Then, you can select records to drill down right to the values of individual flag bits as shown in Figure 10-7.

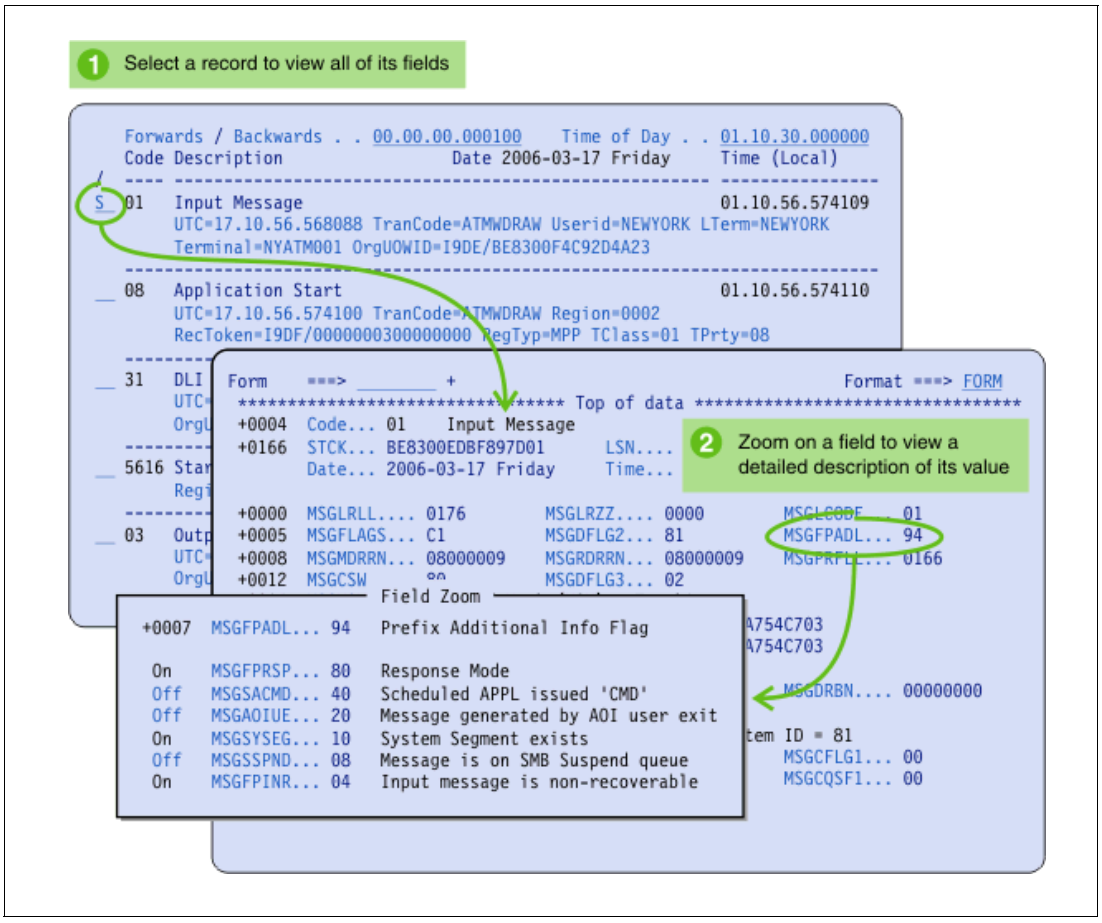

Figure 10-7 Drilling down in a log record with IMS PI

IMS Problem Investigator is integrated with IMS Performance Analyzer and IMS Connect Extension. It provides the most benefits to IMS Transaction Manager.

With IMS PI, you can perform the following actions:

- Isolate problems in complex interrelated components in hours instead of weeks. This translates to reduced down-time and lowered staffing costs.
- Dissect your resource utilization, allowing you to optimize your hardware usage and identify unnecessary overhead.
- Enable less experienced staff to perform advanced analysis.
- Map the life-cycle of individual transactions, providing you a better understanding of your environment and the ability to preemptively eliminate problems.

Another product, called *IBM Transaction Analysis Workbench*, extends the capabilities of IMS PI to CICS and offers more z/OS logging information formatting. For an overview of this product, see “IBM Transaction Analysis Workbench” on page 408.

IMS Performance Analyzer

IMS Performance Analyzer (PA) 420 comes with the pack or it can be ordered separately with product number 5655-R03. IMS PA provides performance reports, through an online interface

able to create the JCL and to select automatically the logs data sets from the RECON or IMS Connect Extension repository.

Figure 10-8 shows an overview of IMS PA functions at a glance.

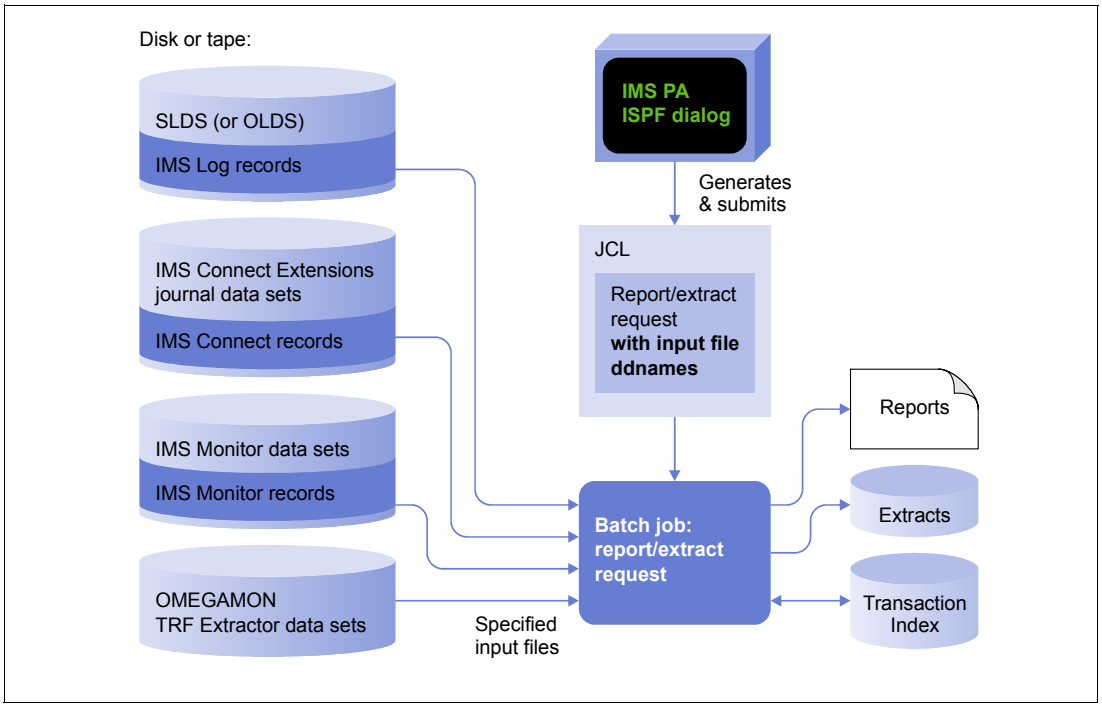

Figure 10-8 IMS PA at a glance

The reports provided by IMS PA can help to perform the following tasks:

- Daily monitoring, using dashboards for a daily system health check, transit response time reports to help identify problem transactions, or management exception reports, which identify when target service levels are not being met
- Long-term capacity planning and service levels, using the transaction history file, which accumulates transaction performance information, or loading into DB2 to build a performance database and to report on a host or workstation using your favorite SQL reporting tool
- Analysis of a performance problem and exploration with other reports, such as transit reports for bad response time, Resource Utilization reports for IMS resource constraint, or specialized traces to track specific events.

IMS Connect Extension

IMS Connect Extension for z/OS Version 2.2 comes with the pack or it can be ordered separately with product number 5655-S56. It enhances and augments the services of the IMS component IMS Connect.

IMS Connect Extension provides event collection and instrumentation for IMS Connect, and many features such as transaction routing and workload balancing, security feature such as ACEE caching for IMS Connect security, dynamic addition, reload, deletion, disabling or enabling of user exits, or even setting the transaction expiration time for OTMA transactions.

Figure 10-9 shows a general view of event processing with IMS Connect Extension.

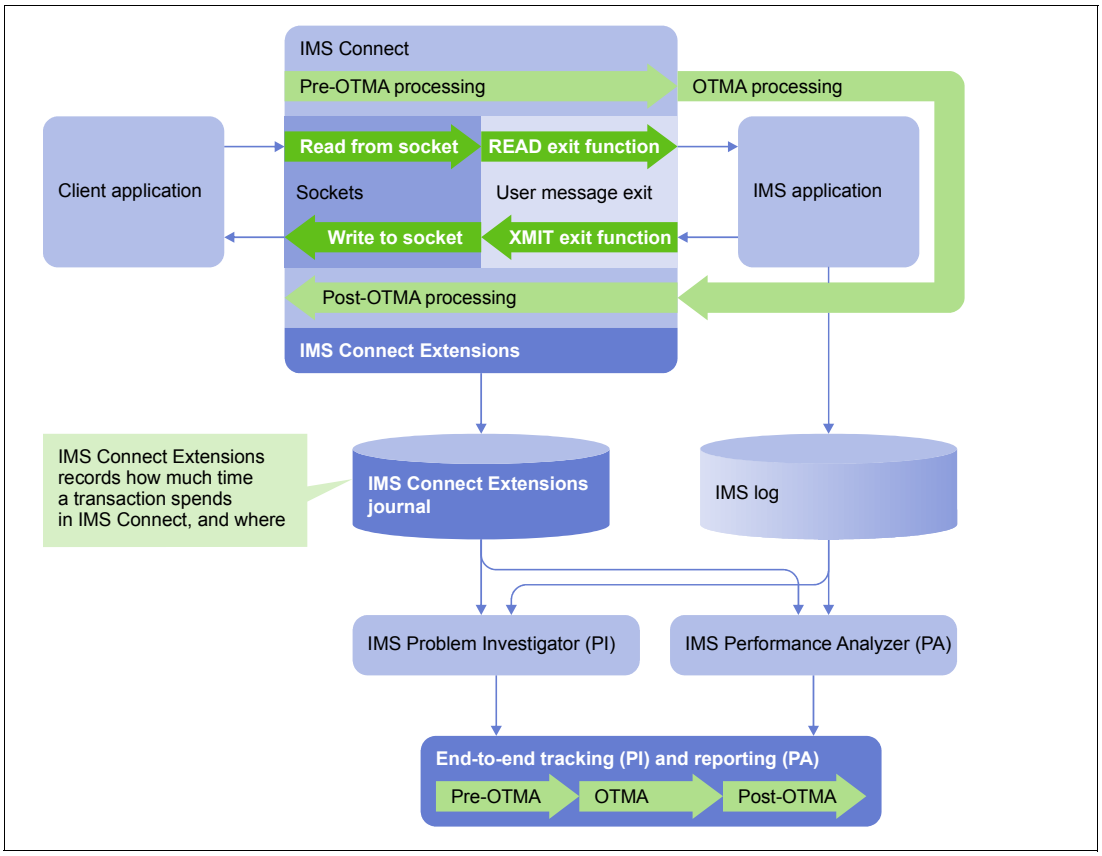

Figure 10-9 Event instrumentation with IMS Connect Extension

IMS Connect Extension provides a console to manage all your IMS Connect instances and data stores in a single view, from an ISPF interface or a GUI as shown in Figure 10-10.

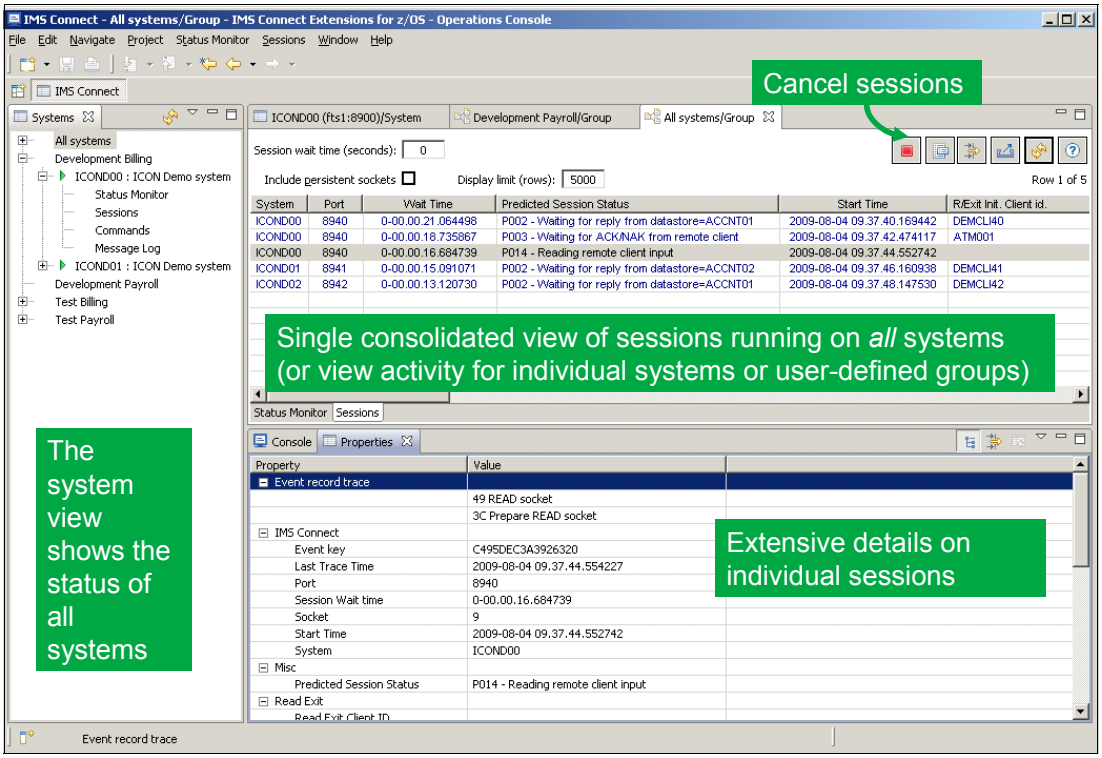

Figure 10-10 GUI operation console

You can see the activity on all systems, cancel sessions, stop or start IMS Connect, data stores or ports, or reload exits. Alternatively, you can also have an individual IMS Connect view. It is also easy to issue IMS Connect commands or IMS commands.

IMS Connect Extension has been updated to support new IMS 12 enhancement such as IMS Connect Multiple Systems Coupling link using TCP/IP or IMS Connect to IMS Connect communication. For more information, see 10.2.3, “IMS Connect Extension updated for IMS 12” on page 424.

IMS Connect Extension is integrated with IMS PI, IMS PA, and IBM Transaction Analysis Workbench.

10.1.8 Complementary products tools

The complementary tools presented in the following sections help reduce performance costs and simplify procedures:

- IMS Recovery Expert for z/OS 210
- IMS Sysplex Manager (5655-P01)
- IBM Transaction Analysis Workbench

IMS Recovery Expert for z/OS 210

The IMS Recovery Expert for z/OS 210 product has Version 2. It is not the same product as IMS Recovery Expert V1, which has been integrated to IMS Recovery Solution Pack and renamed to IMS Database Recovery Facility Extended functions.

Important: IMS Recovery Expert for z/OS 210 needs PM27126/UK67993 to support IMS 12. This product is not included in any pack and must be ordered separately with product number 5655-S98.

IMS Recovery Expert for z/OS 210 is a storage-aware backup and recovery solution. It integrates storage processor fast-replication facilities with IMS backup and recovery operations. It allows instantaneous backups with no application downtime, reduces recovery time, and simplifies disaster recovery procedures while using less CPU, I/O, and storage resources.

IMS Recovery Expert for z/OS 210 offers the following major benefits:

- Backup of the entire IMS systems instantaneously with no application downtime.
- Quick and easy recovery using intelligent recovery managers for local and remote recovery support.
- Effortless IMS backup and recovery management through an easy to use ISPF interface.
- Less CPU, I/O, and tape resource than image copy.
- Automatic backup validation to achieve successful recoveries every time.
- Use of one backup for multiple purposes.
- Transformation of disaster recovery into a disaster restart process, reducing recovery time objectives.
- Proof of compliance with internal or federal regulations.

IMS Sysplex Manager (5655-P01)

IMS Sysplex Manager is not included in a pack. You must order it separately with product number 5655-P01. The version to order is 130.

IMS Sysplex Manager offers a real-time management of the IMS sysplex environment. It is not a performance monitor.

IMS Sysplex Manager provides a single point of control to get a single system image of your sysplex through a simplified ISPF user interface. You can get through this interface displays of IMS resources or structures like the shared queue or the IRLM lock structure and you can drill down to display and manage for example lock or message information. You can issue global type1 command or OM type2 commands, z/OS commands such as SVC capture, get some z/OS performance basic information and get a dashboard of key system indicators and threshold monitoring.

IMS Sysplex Manager gives management functions to intercept system exceptions and generates console alerts. It can produce real-time IRLM Long Lock Report, can browse, delete and recover messages on Shared Queues, delete RM resource structure entries and assign affinity for transactions in shared queues environment.

IBM Transaction Analysis Workbench

The IBM Transaction Analysis Workbench tool is not included in a pack. You must order it separately with product number 5697-P37. The version to order is 110.

IBM Transaction Analysis Workbench tool is a performance tool, adapted to CICS or IMS Transaction Manager environments. This tool can provide an instantaneous view of z/OS logging information for a unit of work, whether it comes from CICS or IMS, including MQ and DB2 data. The tool is transaction-oriented and does not replace a DB2 log analysis tool such as the IBM product DB2 Log Analysis (product number 5655-T56).

Figure 10-11 illustrates how logging occurs everywhere in a z/OS environment. IBM Transaction Analysis Workbench can format all this information into an interactive IMS PI-type view. It includes a large part of IMS PI and extends its function to CICS SMF records and enhances SMF formatting. The IBM Transaction Analysis Workbench tool has an automatic selection for data coming from DB2 or SMF.

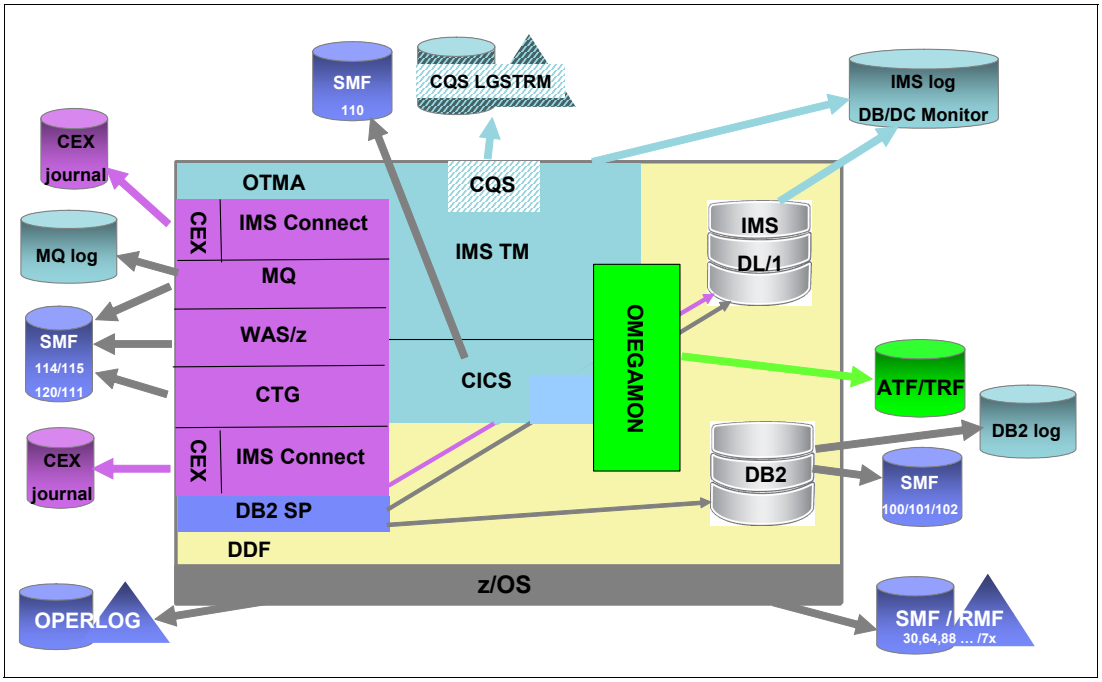

Figure 10-11 Transaction Analysis Workbench reading all information in a z/OS environment

The IBM Transaction Analysis Workbench tool has an ISPF session environment, which allows you to share information with other users and to write down tags to explain details. The tool is fully compatible with IMS Performance Analyzer and CICS Performance Analyzer, so that you can edit reports combining all of this information.

Important: IBM Transaction Analysis Workbench does not include IMS Performance Analyzer. It also does not include CICS Performance Analyzer or IMS Connect Extension, but it is integrated with them.

You do not need IMS PI to run IBM Transaction Analysis Workbench. In IBM Transaction Analysis Workbench, IMS PI functions are strengthened and expanded to support CICS transactions in this product. IBM Transaction Analysis Workbench is better integrated with z/OS logging and provides a way to share information with other users. For example, it can run without IMS, in a CICS or DB2 environment.

10.2 Examples of specific product updates for IMS 12 support

Four products are presented in this section to show how they support IMS 12 new functions: IMS High Performance Fast Path Utilities; Library Integrity Utilities for IMS 12 Fast Path Secondary Index new function; IMS Connect Extension for IMS Connect to IMS Connect communication; and Multiple Systems Coupling link using TCP/IP and IMS PA for miscellaneous system enhancements seen through the reports.

10.2.1 High Performance Fast Path Utilities updated for IMS 12

High Performance Fast Path Utilities is included in “IMS Fast Path Solution Pack”. This part has been updated to support the Fast Path Secondary Index function in IMS 12. For information about this pack, see 10.1.4, “IMS Fast Path Solution Pack for z/OS (5655-W14)” on page 390.

Table 10-5 lists the utilities included in this pack and indicates whether they are available online in Fast Path Online (FPO), or offline in Fast Path Basic (FPB) or Fast Path Advanced (FPA) components.

Important: PM21939/UK62545 provides support for the following new functions:

- **`FPA INDEXBLD`** function efficiently builds a secondary index database. It can also concurrently build multiple secondary index databases for one or more areas of a DEDB.
- **`FPA ANALYZE`** function is enhanced to verify the integrity of the pointer segments in secondary index databases, in addition to verifying the integrity of all IMS pointer values in DEDB Areas.

For more information about maintenance, see Table 10-5.

Table 10-5 Fast Path Solution Pack utilities

Solution	Function	FPA (offline)	FPB (offline)	FPO (online)
Reorganizing	**Unload**	UNLOAD	DEDB Unload	Online Data Extract (ODE)
	Reload	RELOAD	DEDB Reload	
	Change	CHANGE		
	Reorganize	REORG		Online Expert Reorganization (OER)
	Extend			Online Area Extender (OAE)
	Build FP Secondary Index	INDEXBLD		
Analyzing	**Integrity verification and analysis**	ANALYZE -DEDB AREAs -Secondary Index DBs	DEDB Pointer Checker - DEDB AREAs	Online Pointer Checker (OPC) -DEDB AREAs
	Print DMAC information	DMACPRT		Online DMAC Print (ODM)
Extracting	**Extract segments**	EXTRACT	Use Unload/Reload user exit routines	Online Data Extract (ODE)
Other tool	**Tuning Aid**		DEDB Tuning Aid	

Fast Path Secondary Index support

In FPA, the FPSI function provides build and analyze capabilities for the Fast Path Secondary Index databases that are supported in IMS V12. It supports IMS V12 Fast Path Secondary Index databases with the following features:

- HISAM/SHISAM Secondary Index databases
- Unique Key/Non-Unique Key
- Sparse Indexing
- Symbolic Pointer
- Multiple Secondary Index Segments
- Partition Selection

For information about the Fast Path Secondary Index function in IMS 12, see 3.3.4, “Fast Path DEDB secondary index support” on page 78.

FPA INDEXBLD function

The **INDEXBLD** function of FPA component is a new function brought by PM21939. It efficiently builds one or more secondary index databases. It concurrently scans multiple DEDB areas and builds multiple secondary indexes databases in a single job step.

IMS and the FPA **INDEXBLD** function support two database structures for Fast Path secondary indexes: HISAM and SHISAM.

Both secondary index database structures offer sequential key access to primary DEDB databases. This function builds the specific secondary index databases in case of system failures, rebuilds secondary index databases faster than initially loading data to a DEDB, and reduces the amount of time that it takes to build multiple secondary index databases using both parallel sorting and parallel loading.

Moreover the FPA **INDEXBLD** function provides two new reports, a “Secondary Index Definition Report” and a “Secondary Index Processing Report.”

New INDEXBLD command in HFPSYSIN

FPA runs the Build Index function as a standard z/OS batch job. You need to specify an EXEC statement and DD statements that define the input and output data sets in your JCL.

Specify the EXEC statement in the following format:

```
//INDEXBLD EXEC PGM=HFPMAINO,REGION=rrrrM,
// PARM='DBRCGRP=dbrcgrp,GSGNAME=gsgname,IMSPLEX=imsplex'
```

For more information about the parameters, see *IBM Fast Path Solution Pack for z/OS V1R1, IMS High Performance Fast Path Utilities User’s Guide*, SC19-2914.

The **INDEXBLD** command has been added in sysin HFPSYSIN, as shown in Example 10-1.

Example 10-1 JCL for the INDEXBLD command

```
//*************************************
//** BUILDING SECONDARY INDEX DB(S) **
//*************************************
//INDEXBLD EXEC PGM=HFPMAINO
//*
//STEPLIB DD DISP=SHR,DSN=HPFP.SHFPLMDO
// DD DISP=SHR,DSN=IMSVS.SDFSRESL
//IMSACB DD DISP=SHR,DSN=IMSVS.ACBLIB
//HFPPRINT DD SYSOUT=A
//HFPRPTS DD SYSOUT=A
//*
//HFPSYSIN DD *
GLOBAL DBRC=NO
INDEXBLD
DBD=IVPDB3
/*
//DFSIVD3A DD DISP=OLD,DSN=IMSVS.DFSIVD31
//DFSIVD3B DD DISP=OLD,DSN=IMSVS.DFSIVD33
```

```
//SINDEXA DD DISP=OLD,DSN=IMSVS.SINDEXA
//SINDEXB DD DISP=OLD,DSN=IMSVS.SINDEXB
//*
```

The **INDEXBLD** command has the parameters shown in Figure 10-12.

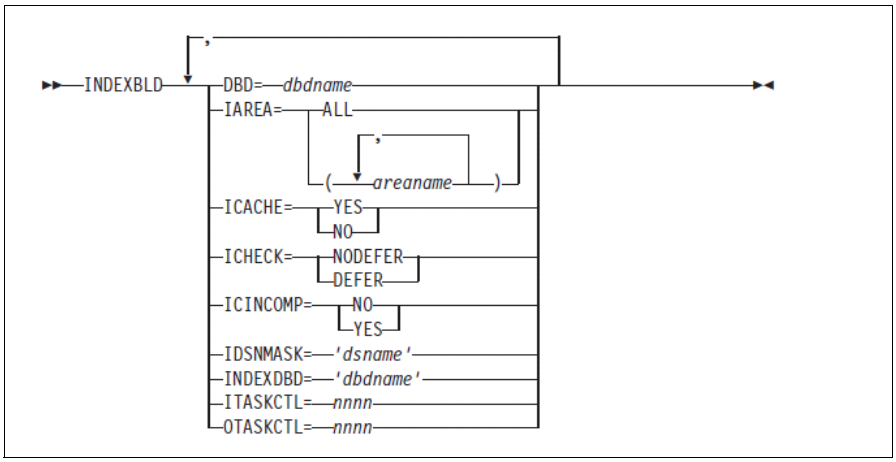

Figure 10-12 INDEXBLD command syntax

Only the **INDEXDBD** parameter is new. The other parameters were still existing for other functions and have the same meaning:

- **DBD** identifies the DBD that contains the areas that are to be processed.
- **INDEXDBD** specifies the DBD for building or processing secondary index databases.

Two user scenarios with FPA INDEXBLD function

You can run the FPA **INDEXBLD** function in several ways. The provided user scenarios show some of the typical ways that you can use. By studying and understanding these scenarios, you can learn the technique to use and to effectively run FPA.

FPA INDEXBLD user scenario 1

Scenario 1 builds all FPSI databases of DEDB areas when the secondary indexes are defined against the existing DEDB (Figure 10-13).

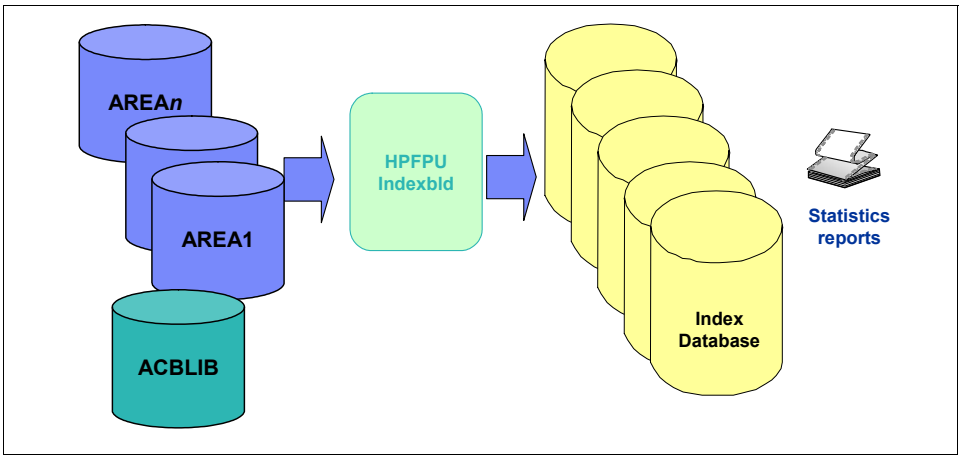

Figure 10-13 FPA INDEXBLD user scenario 1

To run this scenario, you complete the following steps:

1. Run the **DBDGEN**, **PSBGEN**, or **ACBGEN** utility for the DEDB and FPSI databases.
2. Define VSAM data sets for FPSI databases.
3. Change the access of DEDB to “Read Only” or take DEDB offline.
4. Run the FPA **INDEXBLD** function with a JCL (see Example 10-2).

Example 10-2 FPA INDEXBLD user scenario 1 JCL

```
//HFP      EXEC PGM=HFPMAINO
//STEPLIB  DD DISP=SHR,DSN=HPFP.SHFPLMDO
//         DD DISP=SHR,DSN=IMSVS.SDFSRESL
//         DD DISP=SHR,DSN=IMSVS.PGMLIB
//IMSACB   DD DISP=SHR,DSN=IMSVS.ACBLIB
//IMSDALIB DD DISP=SHR,DSN=IMSVS.MDALIB
//IMS      DD DISP=SHR,DSN=IMSVS.DBDLIB
//HFPSYSIN DD *
  GLOBAL DBRC=YES
  INDEXBLD DBD=DEDBJN22,ITASKCTL=4,
  IAREA=ALL,INDEXDBD=ALL
/*
```

5. If step 3 is “change the access of DEDB to “Read Only,” take DEDB offline.
6. Make an online change to use the new ACBLIB.
7. Start the DEDB and FPSI databases for IMS online access.

FPSI data set names are identified with the member in the DFSMDA library. You can also specify in the JCL DD statements.

The **NOTIFY.REORG** command is issued for FPSI databases.

FPA INDEXBLD user scenario 2

Scenario 2 builds some FPSI databases of DEDB areas when some broken FPSI databases are detected (Figure 10-14).

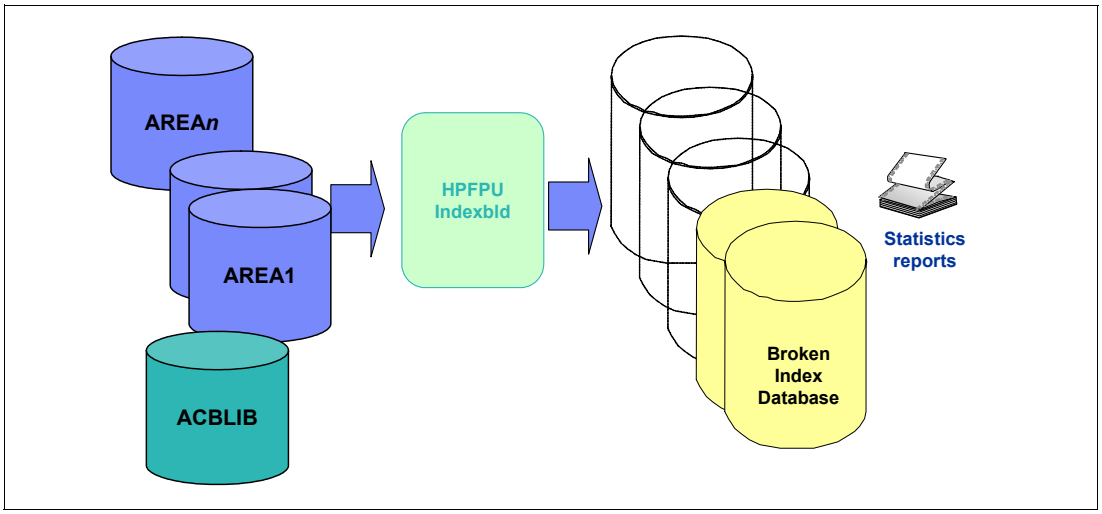

Figure 10-14 FPA INDEXBLD user scenario 2

To run this scenario, you complete the following steps:

1. Run the **FPA ANALYZE** command to detect some FPSI databases are broken. See “FPA ANALYZE function” on page 416.
2. Stop some broken FPSI databases.
3. Delete and define VSAM data sets for FPSI databases.
4. Change the access of DEDB to “Read Only” or take DEDB offline.
5. Run the **FPA INDEXBLD** function with a JCL (see Example 10-3).

Example 10-3 FPA INDEXBLD scenario 2 JCL

```
//HFP      EXEC PGM=HFPMAIN0
//STEPLIB  DD DISP=SHR,DSN=HPFP.SHFPLMD0
//         DD DISP=SHR,DSN=IMSVS.SDFSRESL
//         DD DISP=SHR,DSN=IMSVS.PGMLIB
//IMSACB   DD DISP=SHR,DSN=IMSVS.ACBLIB
//IMSDALIB DD DISP=SHR,DSN=IMSVS.MDALIB
//IMS      DD DISP=SHR,DSN=IMSVS.DBDLIB
//HFPSYSIN DD *
  GLOBAL DBRC=YES
  INDEXBLD DBD=DEDBJN22,ITASKCTL=4,
  IAREA=ALL,INDEXDBD=(IDXDB1,IDXDB2)
/*
```

6. Start the DEDB and FPSI databases for IMS online access.

FPSI data set names are identified with the member in the DFSMDA library or can be identified by JCL DD statements.

The **NOTIFY.REORG** command is issued for FPSI databases.

If a DEDB area to build the broken FPSI databases is identified, you can specify its name in the **HFPSYSIN IAREA** parameter.

Reports provided by FPA INDEXBLD function

Figure 10-15 and Figure 10-16 shows examples of the two reports provided by the FPA INDEXBLD function. Figure 10-15 shows a secondary index definition report.

```
IMS HPFP UTILITIES - FPA INDEXBLD                          "Secondary Index Definition Report"
5655-W14 V1R1
  - PRIMARY DEDB NAME            : DEDBJN21
  - NUMBER OF SEC. INDEXES       :   1


DEFINITION OF SEC. INDEX (XDFLD) : XNAME7   (TARGET SEG.: ROOTSEG1, SOURCE SEG.: DD1     )

  ATTRIBUTES:

  - DB ORGANIZATION     : HISAM
  - POINTER SEG. NAME   : DD1X
  - NULLVAL             : X'E8'
  - MULTISEG            : NO
  - INDEX MAINTENANCE EXIT ROUTINE   : INDEXXIT
  - PARTITION SELECTION EXIT ROUTINE : DBFPSEYM
  - PARTITION SELECTION OPTION       : SNGL

  SEC. INDEX DBD/DDNAMES:

                      OVFL                              OVFL                              OVFL
   DBDNAME   DDNAME   DDNAME    DBDNAME   DDNAME   DDNAME    DBDNAME   DDNAME   DDNAME
   --------  -------- --------  --------  -------- --------  --------  -------- --------
   DEDBGS25  GS25KSDS GS25ESDS  DEDBGS26  GS26KSDS GS26ESDS  DEDBGS27  GS27KSDS GS27ESDS
   DEDBGS28  GS28KSDS GS28ESDS


  RECORD LAYOUT:

    OFFSET  LENGTH  FIELD
    ------  ------  ----------------
         0       4  DUP. KEY POINTER
         4       1  DELETE BYTE
         5      11  SEARCH
        16       0  SUBSEQ
        16       0  DDATA
        16      12  SYMBOLIC POINTER
        28       3  USER DATA
```

```
DEDB DBD
.....
ROOTSEG  SEGM  NAME=ROOTSEG1, PARENT=0, BYTES=(50,20)
ROOTFLD1 FIELD NAME=(ROOTKEY1,SEQ,U), BYTES=12, START=3, TYPE=C
.....
LCHILD NAME=(DD1X,(DEDBGS25,DEDBGS26,DEDBGS27,DEDBGS28)),
         PTR=SYMB
XDFLD  NAME=XNAME7,SRCH=DD1F1,PSELRTN=DBFPSEYM,
         SEGMENT=DD1, PSELOPT=SNGL,NULLVAL=C'Y' ,EXTRTN=INDEXXIT
```

Figure 10-15 Secondary index definition report

Figure 10-16 shows a secondary index processing report.

```
IMS HPFP UTILITIES - FPA INDEXBLD                          "Secondary Index Processing Report"
5655-W14 V1R1
  - PRIMARY DEDB NAME            : DEDBJN21
  - NUMBER OF SEC. INDEX DATABASE:      6(PARTITION INCLUDED)

SEC. INDEX DATABASE INFORMATION:
    PARTITION                      ALLOC                                                  LOADED          SUPP
    GROUP      DBDNAME   DDNAME    TYPE   DSNAME                                          SEGMENTS        SEGMENT
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
               DEDBGS21  GS21KSDS   JCL   EASY02.SHINO.IMS12.GS21KSDS                          150,000
                         GS21ESDS   JCL   EASY02.SHINO.IMS12.GS21ESDS                          240,000
                                                                              (TOTAL)          390,000           1,272
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
    DEDBGS25   DEDBGS25  GS25KSDS   JCL   EASY02.SHINO.IMS12.GS25KSDS                          200,000
                         GS25ESDS   JCL   EASY02.SHINO.IMS12.GS25ESDS                          400,000
                                                                              (TOTAL)          600,000
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
    DEDBGS25   DEDBGS26  GS26KSDS   JCL   EASY02.SHINO.IMS12.GS26KSDS                          250,000
                         GS26ESDS   JCL   EASY02.SHINO.IMS12.GS26ESDS                          250,000
                                                                              (TOTAL)          500,000          50,000
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
    DEDBGS25   DEDBGS27  GS27KSDS   JCL   EASY02.SHINO.IMS12.GS27KSDS                          100,000
                         GS27ESDS   JCL   EASY02.SHINO.IMS12.GS27ESDS                          300,000
                                                                              (TOTAL)          400,000         200,000
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
    DEDBGS25   DEDBGS28  GS28KSDS   JCL   EASY02.SHINO.IMS12.GS28KSDS                          200,000
                         GS28ESDS   JCL   EASY02.SHINO.IMS12.GS28ESDS                                0
                                                                              (TOTAL)          200,000
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
    DEDBGS25                                                          (GROUP TOTAL)        1,700,000         250,000
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
               DEDBGS4$  GS4$KSDS   JCL   EASY02.SHINO.IMS12.GS4$KSDS                            1
                         GS4$ESDS   JCL   EASY02.SHINO.IMS12.GS4$ESDS                        1,271
                                                                              (TOTAL)          1,272               0
    ---------  --------  --------  -----  ---------------------------------------------  --------------  --------------
```

By NULLVAL or Index maintenance exit

Figure 10-16 Secondary Index processing report

FPA ANALYZE function

The **FPA ANALYZE** function has been enhanced with APAR PM21939 to verify the integrity of the pointer segments in secondary index databases. It verifies DEDB areas and their secondary index databases at the same time.

The following data of pointer segments are verified:

- Delete byte
- Search
- Subsequence
- Duplicate data
- Concatenated key

When errors are detected, the **FPA ANALYZE** function issues error messages and shows the errors in a report. It provides two new reports:

- A secondary index analysis report

  The secondary index analysis report shows the number of verified pointer segments in each secondary index database, as you can see in Figure 10-17.

```
IMS HPFP UTILITIES - FPA ANALYZE                "Secondary Index Analysis Report"

    - PRIMARY DEDB NAME               : DEDBJN21
    - NUMBER OF SEC. INDEX DATABASE   :      6(PARTITION INCLUDED)

SEC. INDEX DATABASE INFORMATION:

  *:ERRORS DETECTED

  PARTITION                          ALLOC                                                    POINTER         SOURCE
  GROUP     DBDNAME  DDNAME          TYPE      DSNAME                                         SEGMENTS        SEGMENTS
  --------- -------- ---------       -----  ---------------------------------------- --------------- ----------------
            DEDBGS21  GS21KSDS        JCL   EASY02.SHINO.IMS12.GS21KSDS                      150,000
                      GS21ESDS        JCL   EASY02.SHINO.IMS12.GS21ESDS                      240,000
                                                                                (TOTAL)        390,000          390,000
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
  DEDBGS25  DEDBGS25  GS25KSDS        JCL   EASY02.SHINO.IMS12.GS25KSDS                      200,000
                      GS25ESDS        JCL   EASY02.SHINO.IMS12.GS25ESDS                      400,000
                                                                                (TOTAL)        600,000
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
  DEDBGS25  DEDBGS26  GS26KSDS        JCL   EASY02.SHINO.IMS12.GS26KSDS                      250,000
                      GS26ESDS        JCL   EASY02.SHINO.IMS12.GS26ESDS                      250,000
                                                                                (TOTAL)        450,000
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
  DEDBGS25  DEDBGS27  GS27KSDS        JCL   EASY02.SHINO.IMS12.GS27KSDS                      100,000
                      GS27ESDS        JCL   EASY02.SHINO.IMS12.GS27ESDS                      300,000
                                                                                (TOTAL)        100,000
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
  DEDBGS25  DEDBGS28  GS28KSDS        JCL   EASY02.SHINO.IMS12.GS28KSDS                      200,000
                      GS28ESDS        JCL   EASY02.SHINO.IMS12.GS28ESDS                            0
                                                                                (TOTAL)        200,000
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
  DEDBGS25                                                          (GROUP TOTAL)        1,350,000        1,350,000
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
           *DEDBGS4$  GS4$KSDS        JCL   EASY02.SHINO.IMS12.GS4$KSDS                          1
                      GS4$ESDS        JCL   EASY02.SHINO.IMS12.GS4$ESDS                         10
                                                                                (TOTAL)         11            1,272
  --------- -------- --------  -----  ---------------------------------------- --------------- ----------------
```

No. of segments in area

No. of segments in sec.index

Error !

Figure 10-17 Secondary Index Analysis Report

- A pointer segment dump report, which is available if you install APAR PM47338

  The pointer segment dump report, shown on Figure 10-18, provides the pointer segment information by categorizing the errors based on the following:

  - THE FOLLOWING POINTER SEGMENTS ARE NOT FOUND
  - THE TARGET SEGMENTS THAT ARE POINTED BY THE FOLLOWING POINTER SEGMENTS ARE NOT FOUND

```
IMS HPFP UTILITIES                              "Pointer Segment Dump report"                                  PAGE: 1
5655-W14 V1R1                                                                                          2011-08-12 17:22:49

DBDNAME: INDEX1     DDNAME: INDEXK1     DSNAME: HPFP.INDEXK1

 THE RELATED AREA IS AREA NO:      1   AREANAME: DB21AR0
  THE FOLLOWING POINTER SEGMENTS ARE NOT FOUND:
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------
     SEARCH        0000  06781005 C8C6D7C1 40404040                                                *....HFPA                        *
     SYMBOLIC PTR  000C  02000000 00010002 6A300108 5C5C5C40 C1C2C3C4 C5C6C7C8 407BF0F1 60F0F440  *............*** ABCDEFGH #01-04 *
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------
     SEARCH        0000  06781005 C8C6D7C1 40404040                                                *....HFPA                        *
     SYMBOLIC PTR  000C  02000000 00010002 6A300108 5C5C5C40 C1C2C3C4 C5C6C7C8 407BF0F1 60F0F440  *............*** ABCDEFGH #01-04 *
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------

  THE TARGET SEGMENTS THAT ARE POINTED BY THE FOLLOWING POINTER SEGMENTS ARE NOT FOUND:
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------
     SEARCH        0000  06781005 C8C6D7C1 40404040                                                *....HFPA                        *
     SYMBOLIC PTR  000C  02000000 00010002 6A300108 5C5C5C40 C1C2C3C4 C5C6C7C8 407BF0F1 60F0F440  *............*** ABCDEFGH #01-04 *
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------

 THE RELATED AREA IS AREA NO:      2   AREANAME: DB21AR1
  THE FOLLOWING POINTER SEGMENTS ARE NOT FOUND:
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------
     SEARCH        0000  06781005 C8C6D7C1 40404040                                                *....HFPA                        *
     SYMBOLIC PTR  000C  02000000 00010002 6A300108 5C5C5C40 C1C2C3C4 C5C6C7C8 407BF0F1 60F0F440  *............*** ABCDEFGH #01-04 *
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------

DBDNAME: INDEX2     DDNAME: INDEXK2     DSNAME: HPFP.INDEXK2

 THE RELATED AREA IS AREA NO:      1   AREANAME: DB21AR0
  THE FOLLOWING POINTER SEGMENTS ARE NOT FOUND:
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------
     SEARCH        0000  06781005 C8C6D7C1 40404040                                                *....HFPA                        *
     SYMBOLIC PTR  000C  02000000 00010002 6A300108 5C5C5C40 C1C2C3C4 C5C6C7C8 407BF0F1 60F0F440  *............*** ABCDEFGH #01-04 *
     ------------  ----  ------------------------------------------------------------------------  ---------------------------------
```

Figure 10-18 Pointer Segment Dump Report

Figure 10-19 shows the syntax of the **ANALYZE** command. **IAREA**, **IDXTASCTL** and **INDEXDBD** are new parameters. **REPORT** and **THRESHOLD** are new subcommands. For more information about the parameters, see *IBM Fast Path Solution Pack for z/OS V1R1, IMS High Performance Fast Path Utilities User's Guide*, SC19-2914.

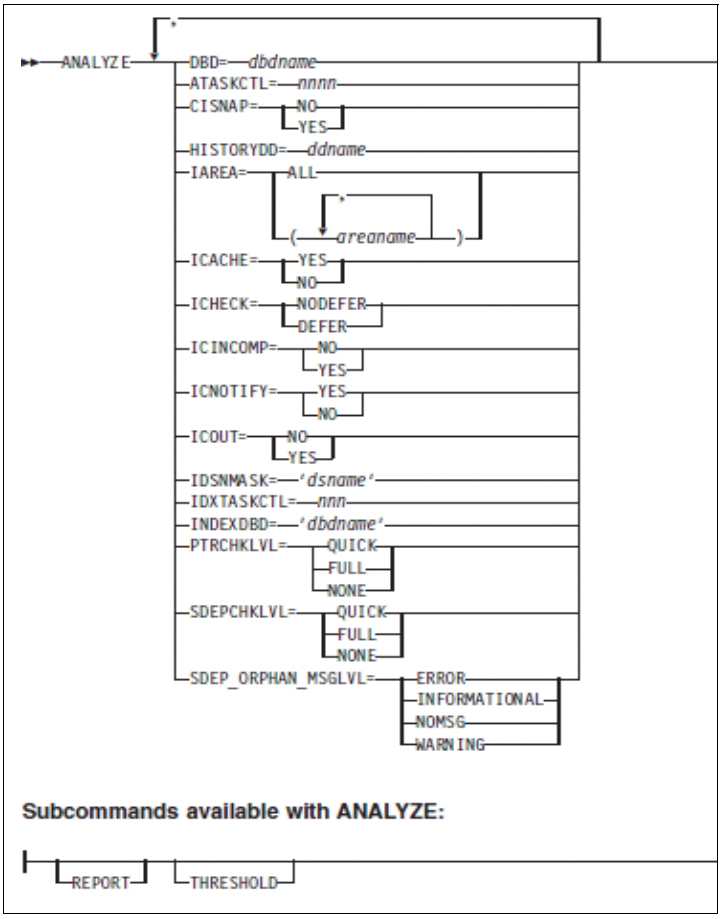

Figure 10-19 FPA ANALYZE command syntax

You can use the **FPA ANALYZE** function in a lot of scenarios. Three of them are presented in the following sections.

FPA ANALYZE user scenario 1

Scenario 1 verifies pointer segments between DEDB areas and all FPSI databases (Figure 10-20).

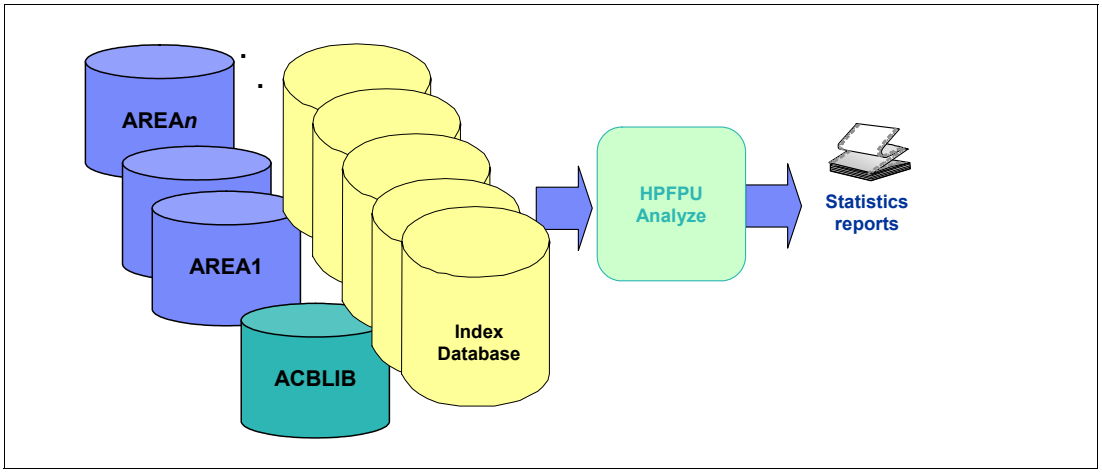

Figure 10-20 FPA ANALYZE user scenario 1

To run this scenario, complete the following steps:

1. Change the access of DEDB to “Read Only” or take DEDB offline.
2. Run the **FPA ANALYZE** function with a JCL similar to Example 10-4.

Example 10-4 JCL for FPA ANALYZE function user scenario 1

```
//HFP      EXEC PGM=HFPMAINO
//STEPLIB  DD DISP=SHR,DSN=HPFP.SHFPLMDO
//         DD DISP=SHR,DSN=IMSVS.SDFSRESL
//         DD DISP=SHR,DSN=IMSVS.PGMLIB
//IMSACB   DD DISP=SHR,DSN=IMSVS.ACBLIB
//IMSDALIB DD DISP=SHR,DSN=IMSVS.MDALIB
//HFPSYSIN DD *
  GLOBAL DBRC=YES
  ANALYZE
    DBD=DEDBJN22,PTRCHKLVL=FULL,
    IAREA=ALL,INDEXDBD=ALL
  REPORT
/*
```

The **FPA ANALYZE** function with a JCL verifies DEDB areas and pointer segments for FPSI as described in Figure 10-21.

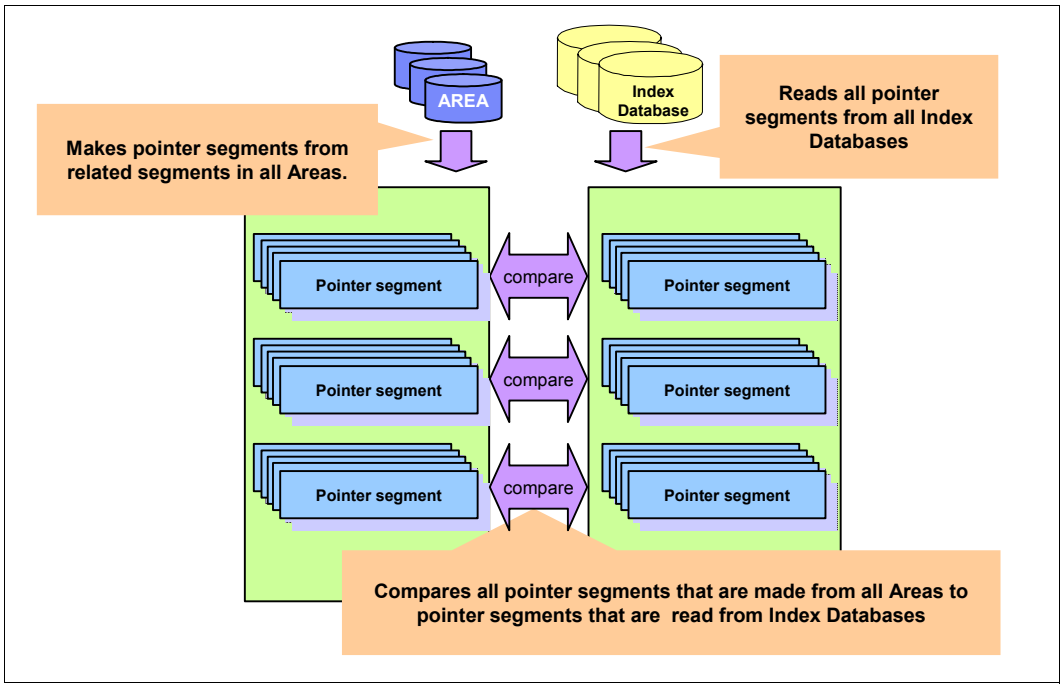

Figure 10-21 FPA ANALYZE function verification in user scenario 1

3. Start DEDB for IMS online access.

FPA ANALYZE user scenario 2

Scenario 2 verifies pointer segments between a specified DEDB area and all FPSI databases as shown in Figure 10-22.

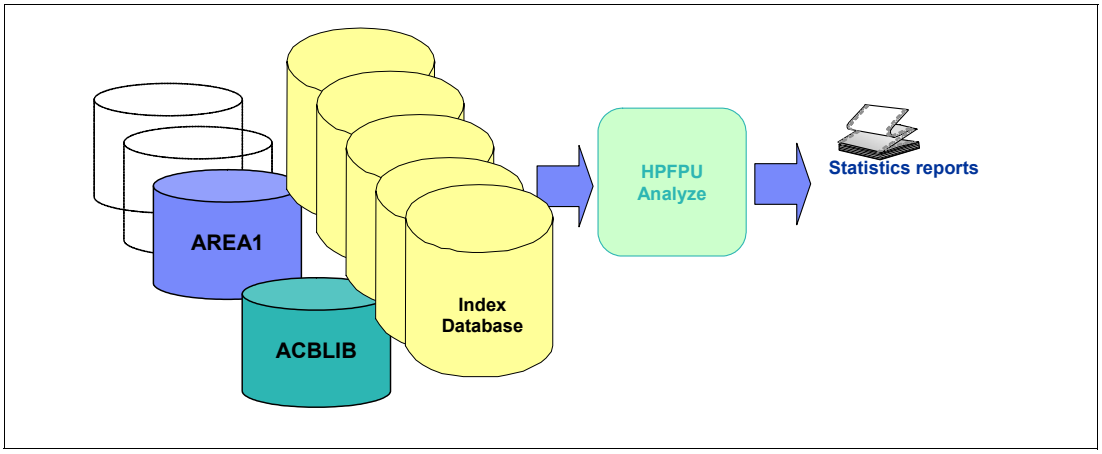

Figure 10-22 FPA ANALYZE function user scenario 2

To run this scenario, complete the following steps:

1. Take a specified DEDB area offline.
2. Run the **FPA ANALYZE** function for a specified DEDB area with a JCL similar to Example 10-5 on page 421.

Example 10-5 JCL for FPA ANALYZE function user scenario 2

```
//HFP      EXEC PGM=HFPMAINO
//STEPLIB  DD DISP=SHR,DSN=HPFP.SHFPLMDO
//         DD DISP=SHR,DSN=IMSVS.SDFSRESL
//         DD DISP=SHR,DSN=IMSVS.PGMLIB
//IMSACB   DD DISP=SHR,DSN=IMSVS.ACBLIB
//IMSDALIB DD DISP=SHR,DSN=IMSVS.MDALIB
//HFPSYSIN DD *
  GLOBAL DBRC=YES
  ANALYZE
    DBD=DEDBJN22,PTRCHKLVL=FULL,
    IAREA=AREA1,INDEXDBD=ALL
/*
```

The **FPA ANALYZE** function with JCL verifies DEDB area and pointer segments for FPSI databases as shown in Figure 10-23.

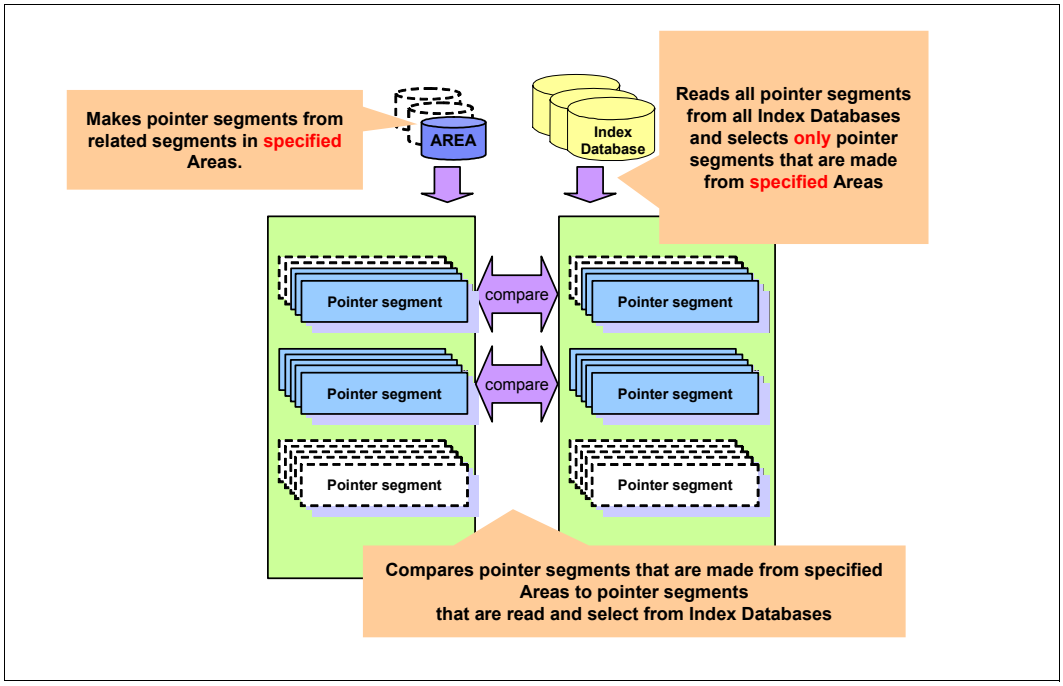

Figure 10-23 FPA ANALYZE verification in user scenario 2

3. Start a specified DEDB area for IMS online access.

FPA ANALYZE user scenario 3

Scenario 3 verifies all DEDB areas and a specified secondary index (Figure 10-24).

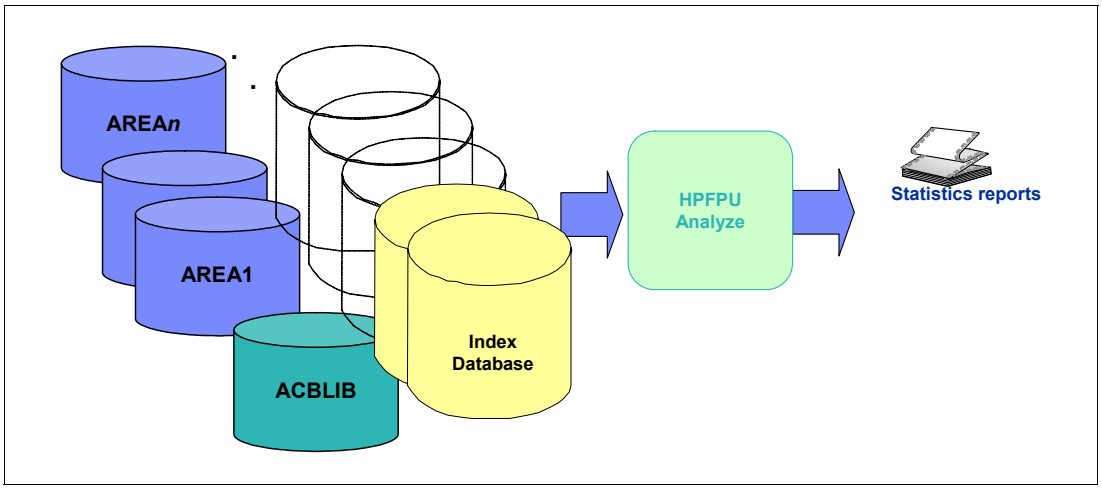

Figure 10-24 FPA ANALYZE function user scenario 3

To run this scenario, complete the following steps:

1. Process FPA INDEXBLD scenario 2 as explained in “FPA INDEXBLD user scenario 2” on page 413.
2. Change the access of DEDB to “Read Only” or take DEDB offline.
3. Run the **FPA ANALYZE** function to confirm FPA indexbld result with a JCL similar to Example 10-6.

Example 10-6 JCL for FPA ANALYZE function user scenario 3

```
//HFP      EXEC PGM=HFPMAIN0
//STEPLIB  DD DISP=SHR,DSN=HPFP.SHFPLMD0
//         DD DISP=SHR,DSN=IMSVS.SDFSRESL
//         DD DISP=SHR,DSN=IMSVS.PGMLIB
//IMSACB   DD DISP=SHR,DSN=IMSVS.ACBLIB
//IMSDALIB DD DISP=SHR,DSN=IMSVS.MDALIB
//HFPSYSIN DD *
  GLOBAL DBRC=YES
  ANALYZE
    DBD=DEDBJN22,PTRCHKLVL=FULL,
    IAREA=ALL,INDEXDBD=(IDXDB1,IDXDB2)
/*
```

Tip: If areas are identified, you can specify only identified area names in the IAREA parameter.

It verifies DEDB areas and verifies pointer segments for FPSI database as shown in Figure 10-25.

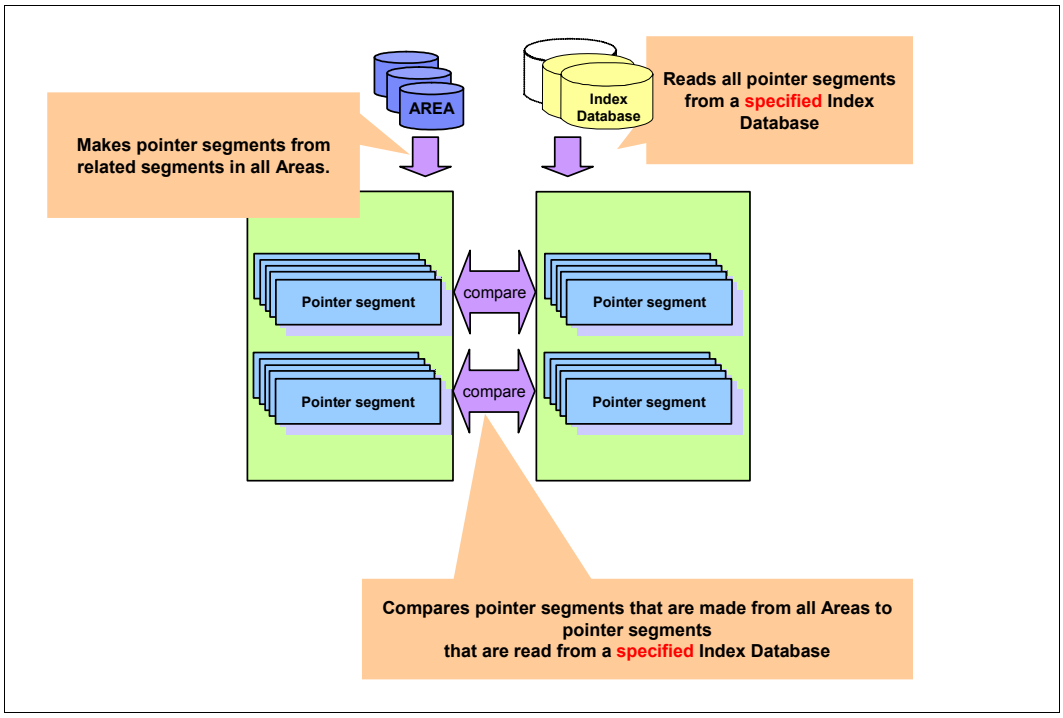

Figure 10-25 FPA ANALYZE function verification in user scenario 3

4. Start DEDB for IMS online access.

10.2.2 Library Integrity Utilities updated for IMS 12

LIU is part of the Fast Path Solution Pack and the Database Solution Pack, or can be ordered separately. For a brief description of the basic functions, see “Library Integrity Utility” on page 393, or see *IMS Library Integrity Utilities for z/OS, V2R1, User's Guide,* SC19-2479. LIU supports IMS 12 new functions with APARs PM21961 and PM46494. For more information, see Table 10-1 on page 391.

Fast Path Secondary Index support

LIU supports Fast Path Secondary indexes as follows:

- Integrity Checker
  - It verifies that the correct DMB control block is used for indexed DEDB and Fast Path secondary index database definition.
  - It verifies that a correct user partition selection exit, specified by DEDB with a user data partition group of the FP secondary index, is used.
  - LIU creates RDEs when the INDEXBLD function of Fast Path Advanced Tool (FPA) of IMS High Performance Fast Path Utilities succeeds. The RDE or Registered DMB Entry is the information about the DMB that IMS used to load the database.
  - It restores RDEs when IMS Database Recovery Facility (DRF) of IMS Recovery Solution Pack performs a time-stamp recovery of FP secondary index and its primary DEDB area.

- Consistency Checker

  It verifies the consistency of indexed DEDB and FP secondary index database definition and referencing PSBs.

- DBD/PSB/ACB Compare

  It reports differences between two control blocks (DBDs, PSBs, or ACBs) of indexed DEDB and FP secondary index database definition and referencing PSBs.

- DBD/PSB/ACB Mapper

  It produces a map and reports of indexed DEDB and FP secondary index database definition and referencing PSBs.

- DBD/PSB/ACB Reversal

  It converts DBD/PSB/ACB control blocks of indexed DEDB and FP secondary index database definition and referencing PSBs back into IMS **DBDGEN** and IMS **PSBGEN** utility control statements.

- Advanced **ACBGEN**

  It generates ACB members of indexed DEDB and FP secondary index database definition.

- ACBLIB Analyzer

  It analyzes ACB members of indexed DEDB and FP secondary index database definition.

10.2.3 IMS Connect Extension updated for IMS 12

IMS Connect Extension has been updated to support IMS 12. Its new capabilities include:

- Recording of events and real-time statistics related to new IMS Connect Multiple Systems Coupling (MSC) TCP/IP link (see 6.2, “Multiple Systems Coupling using TCP/IP” on page 170) and IMS Connect to IMS Connect communication (see 6.1, “OTMA support for asynchronous IMS to IMS communications” on page 162).
- Graphical user interface enhancements to support IMS V12, including support for new type-2 commands and enhanced monitoring of workloads. See 6.4, “IMS Connect type-2 Single Point of Control commands” on page 195.

This support comes with APAR PM24860 and PM32394.

IMS Connect Extension captures all the IMS Connect log records related to the new workloads supported by IMS 12. This way you can analyze activity in IMS Performance Analyzer and IMS Problem Investigator or IBM Transaction Analysis Workbench.

Examining MSC TCP/IP transactions

Having recorded new MSC events in IMS Connect Extension, you can analyze and isolate problems for these MSC transactions in IMS Problem Investigator. IMS Problem Investigator provides a log browser that you can use to merge logs from multiple IMS systems, incorporating the information collected by IMS Connect Extension.

By merging these log data sources together, you can track and view MSC activity from across multiple systems and identify latencies. For example, are they within the processing of a given IMS, or are these latencies in the transmission of messages between IMS systems?

The IMS Problem Investigator panel (Figure 10-26) shows MSC activity in two IMS systems, and two IMS Connect systems, including the life cycle of the transaction.

```
  File  Menu  Edit  Mode  Navigate  Filter  Time  Labels  Options  Help
-------------------------------------------------------------------------------
BROWSE    CEX000.QADATA.MSC.ICON.LOCAL.D110728       Record 00000235 More: < >
Command ===>                                                 Scroll ===> CSR
   Forwards / Backwards . . 00.00.00.000100    Time of Day . . 08.28.20.388036
   Code Description                Date 2011-07-28 Thursday   Time (Relative)
/  ---- ------------------------------------------------------ ----------------

__ 01   Input Message TranCode=PRT1      1                      12.53.59.184840

__ 35   Input Message Enqueue TranCode=PRT1                          +0.000027
__ 31   Comms GU for SMB TranCode=PRT1                             +0.000104
__ 66   Standard 3600                                              +0.000156

__ A07D ICON to ICON start of session        2                     +0.002094

__ A078 MSC message received from MSC Msgtype=REQUEST              +0.002117
__ A0A3 Event Collection OTMA Trace                                +0.002220
__ A03D Message Exit called for XMIT                               +0.002253
__ A0A6 Event Recording EXIT Output Message Trace                  +0.002292
__ A03E Message Exit returned from XMIT                            +0.002297
__ A079 MSC message sent to remote ICON Msgtype=REQUEST    3       +0.002450

__ A049 READ Socket          4                                     +0.002812

__ A049 READ Socket                                                +0.002870
__ A0A4 Event Collection IRM Trace                                 +0.002909
__ A03D Message Exit called for READ                               +0.002928
__ A0A3 Event Collection OTMA Trace                                +0.002971
__ A03E Message Exit returned from READ                            +0.002976
__ A07D ICON to ICON start of session                              +0.002991
__ A07A MSC message received from remote ICON Msgtype=REQUEST      +0.002998
__ A07B MSC message sent to MSC Msgtype=REQUEST                    +0.003210
__ 66   Standard 3600                                              +0.003376

__ 01   Input Message TranCode=PRT1      5                         +0.005225

__ 35   Input Message Enqueue TranCode=PRT1                        +0.005245
__ 08   Application Start TranCode=PRT1 Region=0002                +0.006278
__ 5607 Start of UOR Program=DFSSAM31 Region=0002                  +0.006279
__ 31   DLI GU TranCode=PRT1 Region=0002                           +0.006315
__ 5616 Start of protected UOW Region=0002                         +0.006726
__ 66   Standard 3600                                              +0.006931
__ A078 MSC message received from MSC Msgtype=REQRESP              +0.008082
__ A0A3 Event Collection OTMA Trace                                +0.008193
__ A03D Message Exit called for XMIT                               +0.008200
__ A0A6 Event Recording EXIT Output Message Trace                  +0.008229
__ A03E Message Exit returned from XMIT                            +0.008252
__ A079 MSC message sent to remote ICON Msgtype=REQRESP            +0.008362
__ A07E ICON to ICON end of session                                +0.008375
__ A049 READ Socket                                                +0.008533
```

Figure 10-26 MSC transaction life cycle under IMS PI

1. The first IMS system begins processing the message (Origin IMS OLDS).
2. It is picked up by the local IMS Connect system (Origin CEX journal).
3. The local IMS Connect sends a message to the remote IMS Connect (Origin CEX journal).
4. The remote IMS Connect begins processing the message (Target CEX journal).
5. The message is sent to the remote IMS system (Target IMS OLDS).

Notice that each step described here is captured in a separate log file, but IMS Problem Investigator provides a time-sequence merged view of this activity.

IMS Problem Investigator tracking can further connect the log records on the local and remote IMS systems. With tracking, you can filter out log records that are not part of a single logical

transaction. By using tracking you can see only those log records for a given transaction, but from both IMS systems. You can then use the merged view to display event latencies, which can be used to identify the source of delays: local or remote IMS, or IMS Connect communication.

When you have identified the locality of the problem, you can drill down to view individual log records. Figure 10-27 shows that IMS Connect Extension journal events have been modified to include new information related to MSC TCP/IP.

```
Command ===> ____________________________________________________ Scroll ===> CSR
 Form    ===> ________ +   _  Use Form in Filter                   Format ===> FORM
 ******************************** Top of data ********************************
 +0004  Code... A0A4  Event Collection IRM Trace
 +03CA  STCK... C822A3CB3FB72582      LSN.... 0000000000000049
        Date... 2011-07-28 Thursday   Time... 12.53.59.193458.344

 +0000  CERE_A4_LL......... 03DA
 +0002  CERE_A4_ZZ......... 0000
 +0004  CERE_A4_RECID...... A0  CERE_A4_EVTID...... A4
 +0006  CERE_A4_PFXLL...... 0014
 +0008  CERE_A4_EFLAG...... 00  CERE_A4_VER#....... 22
 +000A  CERE_A4_TASKID..... ID of task recording event
 +000A  CERE_A4_COL#....... 01  CERE_A4_TKS#....... 04
 +000C  CERE_A4_EVKEY...... C822A3BE8E208F63
 +0014  CERE_A4_BASE_LL.... 000E
 +0016  CERE_A4_APAR....... 0001
 +0018  CERE_A4_CONT....... 0C  CERE_A4_CODE....... 09
 +001A  CERE_A4_OEVTID..... 3D  CERE_A4_#SEG....... 0002
 +001E  CERE_A4_4LL........ 000003AC

 +0022  IRMMask.... IRM IMS Request Message section
 +0022  IRM_Len.... 00A8        IRM_ARCH... 04          IRM_F0..... 00
 +0026  IRM_Id..... '*HWSMSC*'
                      1
   IRM_PARTNER........ 'QT '
                      2

 +0032  IRM_F5..... 00          IRM_TIMER.......... 00  IRM_SOCT... 10
 +0035  IRM_ES..... 00          IRM_CLIENTID....... 'MSC9DE00'
                                                     3

 +003E  IRM_F1..... 00          IRM_F2..... 40          IRM_F3..... 01
 +0041  IRM_F4..... 'S'         IRM_RMTIMSID....... 'ICDJ    '
                                                     4

 +004A  IRM_RMTPLKID....... 'MSC18   '
                              5

 +0052  IRM_RETCODE........ 00000000
 +0056  IRM_RESCODE........ 00000000

 +005A  IRM_UsrDat......... User Security Data
 +005A  IRM_RACF_USERID.... 0000000000000000
 +0062  IRM_RACF_GRNAME.... 0000000000000000
 +006A  IRM_RACF_PW........ '********'
 +0072  IRM_APPL_NM........ 0000000000000000
 +007A  IRM_MSC.... Special IRM fields for ICON to ICON MSC.
 +007A  IRM_GENIMSID....... '        '
 +0082 IRM_LCLIMSID....... 'ICDH  '
```

Figure 10-27 Detail of a log record with MSC connection information

1. Exit name, in this case, is the new MSC IMS Connect message exit.
2. This is the partner ID that ties the two systems together.
3. This is the system-generated identifier for the client IMS Connect system.
4. This is the IMS ID of the remote client using the IMS Connect system to make the connection.
5. This is the physical link to which this logical link is assigned.

You can also drill down to individual fields, as shown in Figure 10-28.

```
---------------------- Field Zoom --------------------------------
  File  Menu  Help
----------------------------------------------------------------------
BROWSE    CEX000.QADATA.MSC.ICON.LOCAL.D110728              Line 00000000
Command ===> _____________________________________________ Scroll ===> CSR
****************************** Top of data ******************************
+0024  IRM_ARCH... 04   Architecture Level

 Off   IRM_ARCH0.......... 00   Pre Reroute support
 Off   IRM_ARCH1.......... 01   Support - IRM_REROUT_NM/
                                         IRM_RT_ALTCID to be in the
                                transmitted IRM
 Off   IRM_ARCH2.......... 02   Support - IRM_REROUT_NM
                                        - IRM_RT_ALTCID
                                        - IRM_TAG_ADAPT
                                        - IRM_TAG_MAP to be in the
                                transmitted IRM
 Off   IRM_ARCH3.......... 03   Support for SYNCH CALLOUT CORTKN -
                                includes all previous fields
 On    IRM_ARCH4.......... 04   ICON to ICON support including MSC -
                                includes all previous fields
****************************** End of data ******************************
```

Figure 10-28 Detail of a field showing ICON to ICON support

View version 12 workloads in the GUI

Figure 10-29 shows some of the statistics that are available through the IMS Connect Extension GUI.

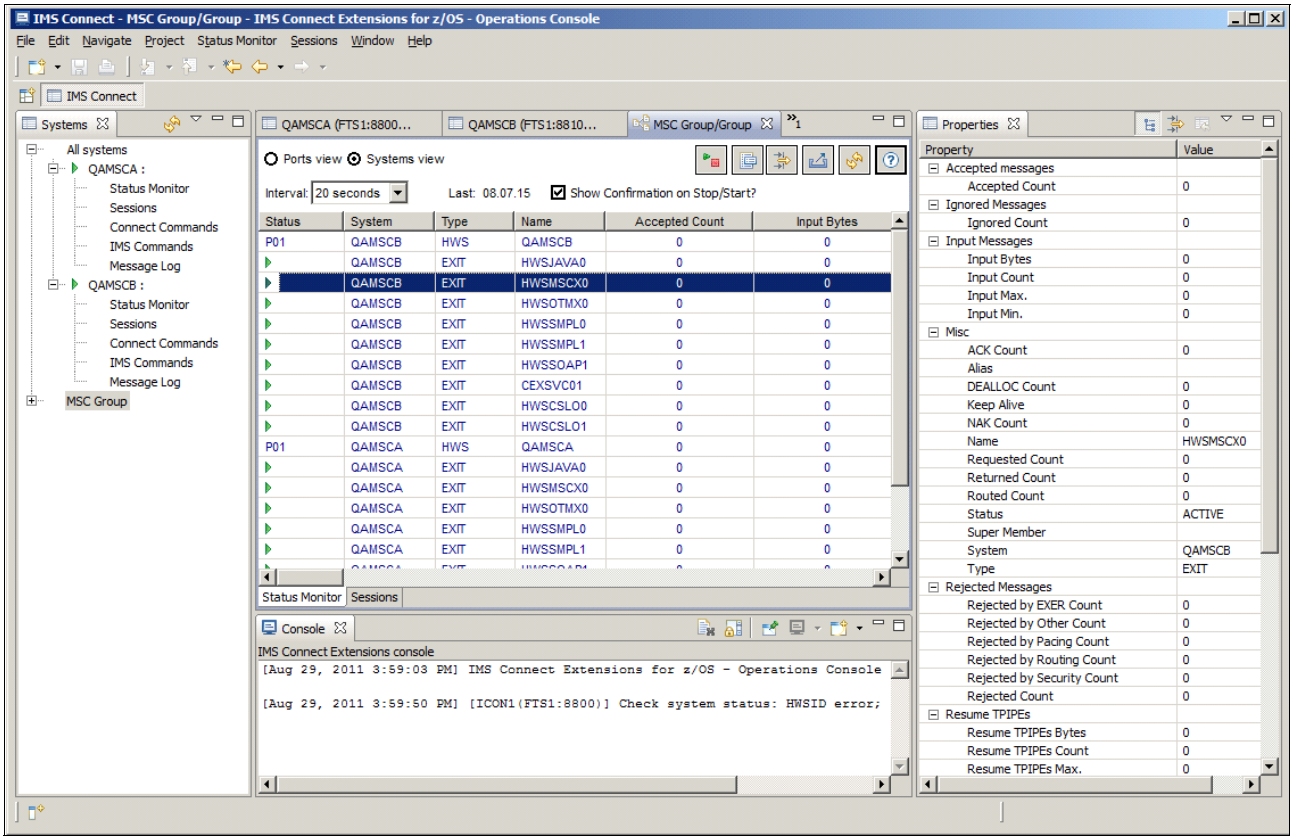

Figure 10-29 IMS CEX console GUI view with IMS 12

Figure 10-29 shows a merged view of activity for a logical collection of IMS systems. With the statistics provided for each message exit, you can view message rates and volumes for new workload types. In addition to viewing summary statistics, you can view in-flight sessions, including the communication between IMS Connect systems in a single aggregated view.

10.2.4 IMS Performance Analyzer updated for IMS 12

IMS PA has been updated to reflect the write-ahead data set (WADS) information in the Internal Resource Usage Report (IRUR).

The standard IMS PA transit analysis reports that provide response time breakdown and resource usage have not changed for IMS V12, but it is worthwhile recapping other recent enhancements in case you are not aware of them.

Logical logger

WADS processing in IMS V12 has been improved as explained in 2.5, “IMS logger” on page 41. The instrumentation in the type 4507 statistics record has also improved. The Logical Logger report in the Internal Resources Usage Report is enhanced to report WADS I/O times (Figure 10-30).

```
                                                    IMS Performance Analyzer V4.2

                                                    Internal Resource Usage - IMSP
          Logger Statistics                                                        Interval : 12 minutes
                                                          Count /Transact   /Second
Logical Logger:   Records Written                       268,367     44.93  4,887.50
                  Check Write requests                   37,405      6.26    681.22
                  Waits for Writes                       10,567      1.77    192.45
                  Buffer Waits: CHKPT Invokers               61       .01      1.11
                  Buffer Waits: Non-CHKPT Invokers            0       .00       .00
                  Buffer Waits: Transient                     1       .00       .02
                  AWE submitted on Wrt                    2,852       .48     51.94
Physical Logger:  WADS EXCPVRs                            9,780      1.64    178.11
                  4K Segment Writes initiated            31,052      5.20    565.52
                  OLDS Writes initiated                   6,751      1.13    122.95
                  OLDS Reads initiated                      193       .03      3.51
                  Internal Check Write requests               0       .00       .00
                  Cumulative WTWT Wait Time              45.693
                  OLDS Block Size                        22,528
                  Log Buffers                               100
                  Tracks on the WADS                        225
                                    WADS blocks/track                          12

  Cumulative primary WADS write I/O time                  9.893              0.001 Average per write
  Cumulative secondary WADS write I/O time                0.000              0.000 Average per write
     Cumulative primary OLDS write I/O time                  35.037              0.005 Average per write
          Cumulative secondary OLDS write I/O time                0.000              0.000 Average per write
```

Figure 10-30 Logger Statistics in IRUR report with IMS 12

List of transactions

The report in Figure 10-31 shows a list of transactions with their performance characteristics. Notice the database I/O and locking times on the right side of the report. They provide insight into how application database calls are performing.

```
                                                    IMS Performance Analyzer V4.2

                                                IMS V12 Transaction List

LIST0001 Printed at 14:09:05 25Aug2011     Data from 12.00.02 12Aug2011

IMS Tran
 Start           Trancode          CPU    InputQ  Process  OutputQ    Total  DB Call    DB IO  DB Lock
 11.11.19.630968 ORDER1    PST     Time      Time     Time     Time IMS Time    Count     Time     Time
 11.11.20.344759 INQUIRY    49 0.096589 0.001158 0.403111 0.000000 0.404269       12 0.138300 0.040908
 11.11.20.944888 ORDER4      7 0.020045 0.026232 0.053847 0.001330 0.081409       34 0.002073 0.000000
 11.11.19.556276 DEBIT      72 0.010482 0.002265 0.088212 0.000000 0.090477        8 0.028338 0.000170
 11.11.19.638251 CREDIT     46 0.010484 0.007017 0.088466 0.000000 0.095483        6 0.003618 0.000000
 11.11.20.259686 ORDER2     71 0.030846 0.015915 0.162369        - 0.178205       15 0.046730 0.000169
 11.11.21.019302 STOCK      44 0.006333 0.001018 0.022178 0.000000 0.023196        6 0.005249 0.010670
 11.11.19.298489 ORDER5     43 0.019248 0.015754 0.137182 0.000000 0.152936       10 0.045357 0.014709
```

Figure 10-31 Transaction list report

Transaction summary

The summary report is based on the summary report form. The form is customized to display the information you need to see in the report. Notice the statistical functions, in particular the new RANGE function that reports the percentage of transactions exceeded the specified threshold.

Figure 10-32 shows the sample report generated by the form.

```
                                                        IMS Performance Analyzer V4.2

                                                  IMS V12 transaction summary

SUMM0001 Printed at 14:09:05 25Aug2011     Data from 12.00.02 12Aug2011 to 12.12.27 12Aug2011

                    Avg       Avg      >1.0       Max       Avg      >1.0       Max       Avg       Avg       Max       Avg       Max
           Tran     CPU     InputQ    InputQ    InputQ   Process   Process   Process   DB Call     DB IO     DB IO   DB Lock   DB Lock
Trancode  Count    Time      Time      Time      Time      Time      Time      Time     Count      Time      Time      Time      Time
DEBIT        77 0.071474 0.142351     2.60% 1.926484 0.449301     3.90% 1.273803        12 0.143757 0.239690 0.115140 0.828762
CREDIT       76 0.064885 0.110116     1.32% 1.336226 0.488499     6.58% 2.067948        12 0.142218 0.253004 0.155761 0.897495
INQUIRY      61 0.068369 0.055915     0.00% 0.576881 0.416315     1.64% 1.000078        12 0.141126 0.307672 0.096347 0.401015
ORDER1       75 0.069100 0.090177     0.00% 0.935750 0.439957     2.67% 1.639714        12 0.141532 0.213003 0.122320 0.501924
ORDER2       81 0.067513 0.158074     3.70% 1.696349 0.521486     8.64% 2.439268        12 0.140062 0.217337 0.199445 1.145306
ORDER3       77 0.010437 0.004651     0.00% 0.057456 0.063084     0.00% 0.352568         9 0.006178 0.018066 0.007178 0.036744
ORDER4       73 0.014389 0.003081     0.00% 0.054293 0.066289     0.00% 0.267417         9 0.006174 0.023644 0.006984 0.054332
STOCK        56 0.013033 0.006077     0.00% 0.142264 0.066195     0.00% 0.308798         6 0.004719 0.043581 0.005047 0.058183
```

Figure 10-32 Transaction summary report

From the report we can determine that 6.5% of CREDIT transactions took longer than one second to process. Also, some of the average and maximum database I/O times seem high, especially because so few DLI DB calls were issued.

A

Environment description

This appendix provides information about the configuration that we used for IBM Information Management System (IMS) 12, IMS Connect, and the IMS repository during this project.

This appendix includes the following sections:

- Hardware and z/OS configuration
- IMS configuration
- IMS repository
- IMS Connect
- Shared queues

A.1 Hardware and z/OS configuration

To run our IMS 12 system we allocated two z/OS logical partitions (LPARs) and two integrated coupling facility LPARs on an IBM System z9 2094-S18 EC machine.

Sysplex SC63 had two general use central processors (CPs), two System z9 Integrated Information Processors (IBM zIIPs) and two System z Application Assist Processors (zAAPs). SC64 had four general use CPs, one zIIP and one zAAP. Example A-1 shows the LPAR configuration on z/OS.

Example A-1 z/OS LPAR configuration

```
SC63     RESPONSES ---------------------------------------
IEE174I 14.08.46 DISPLAY M 622
PROCESSOR STATUS
ID  CPU                  SERIAL
00  +                     04991E2094
01  +                     04991E2094
02  +A                    04991E2094
03  +A                    04991E2094
04  +I                    04991E2094
05  +I                    04991E2094

CPC ND = 002094.S18.IBM.02.00000002991E
CPC SI = 2094.710.IBM.02.000000000002991E
         Model: S18
CPC ID = 00
CPC NAME = SCZP101
LP NAME = A04        LP ID =  4
CSS ID  = 0
MIF ID  = 4

+ ONLINE    - OFFLINE    . DOES NOT EXIST    W WLM-MANAGED
N NOT AVAILABLE

A        APPLICATION ASSIST PROCESSOR (zAAP)
I        INTEGRATED INFORMATION PROCESSOR (zIIP)
CPC ND  CENTRAL PROCESSING COMPLEX NODE DESCRIPTOR
CPC SI  SYSTEM INFORMATION FROM STSI INSTRUCTION
CPC ID  CENTRAL PROCESSING COMPLEX IDENTIFIER
CPC NAME CENTRAL PROCESSING COMPLEX NAME
LP NAME  LOGICAL PARTITION NAME
LP ID    LOGICAL PARTITION IDENTIFIER
CSS ID   CHANNEL SUBSYSTEM IDENTIFIER
MIF ID   MULTIPLE IMAGE FACILITY IMAGE IDENTIFIER
SC64     RESPONSES -----------------------------------
IEE174I 14.08.46 DISPLAY M 227
PROCESSOR STATUS
ID  CPU                  SERIAL
00  +                     06991E2094
01  +                     06991E2094
02  +                     06991E2094
03  +                     06991E2094
04  +A                    06991E2094
05  +I                    06991E2094
06  -
08  -A
09  -I
```

```
CPC ND = 002094.S18.IBM.02.00000002991E
CPC SI = 2094.710.IBM.02.000000000002991E
         Model: S18
CPC ID = 00
CPC NAME = SCZP101
LP NAME = A06        LP ID =  6
CSS ID  = 0
MIF ID  = 6

+ ONLINE    - OFFLINE    . DOES NOT EXIST    W WLM-MANAGED
N NOT AVAILABLE

A        APPLICATION ASSIST PROCESSOR (zAAP)
I        INTEGRATED INFORMATION PROCESSOR (zIIP)
CPC ND  CENTRAL PROCESSING COMPLEX NODE DESCRIPTOR
CPC SI  SYSTEM INFORMATION FROM STSI INSTRUCTION
CPC ID  CENTRAL PROCESSING COMPLEX IDENTIFIER
CPC NAME CENTRAL PROCESSING COMPLEX NAME
LP NAME  LOGICAL PARTITION NAME
LP ID    LOGICAL PARTITION IDENTIFIER
CSS ID   CHANNEL SUBSYSTEM IDENTIFIER
MIF ID   MULTIPLE IMAGE FACILITY IMAGE IDENTIFIER
```

We also used two interface control checks (IFCC) coupling facility LPARs on the same machine (Example A-2).

Example A-2 Coupling facility configuration

```
IXL150I  14.12.51  DISPLAY CF 713
COUPLING FACILITY 002094.IBM.02.00000002991E
                  PARTITION: 0F  CPCID: 00
                  CONTROL UNIT ID: FFF5
NAMED CF1
COUPLING FACILITY SPACE UTILIZATION
 ALLOCATED SPACE                  DUMP SPACE UTILIZATION
  STRUCTURES:      271360 K        STRUCTURE DUMP TABLES:          0 K
  DUMP SPACE:        2048 K                TABLE COUNT:          0
 FREE SPACE:      1732608 K       FREE DUMP SPACE:             2048 K
TOTAL SPACE:      2006016 K      TOTAL DUMP SPACE:             2048 K
                                MAX REQUESTED DUMP SPACE:          0 K
   VOLATILE:           YES        STORAGE INCREMENT SIZE:        512 K
    CFLEVEL:            15
    CFCC RELEASE 15.00, SERVICE LEVEL 02.12
    BUILT ON 09/14/2010 AT 13:00:00
    COUPLING FACILITY HAS 0 SHARED AND 1 DEDICATED PROCESSORS
    DYNAMIC CF DISPATCHING: OFF

CF REQUEST TIME ORDERING: REQUIRED AND ENABLED

COUPLING FACILITY SPACE CONFIGURATION
                          IN USE            FREE           TOTAL
CONTROL SPACE:          273408 K       1732608 K       2006016 K
NON-CONTROL SPACE:           0 K             0 K             0 K

SENDER PATH       PHYSICAL              LOGICAL      CHANNEL TYPE
  D1               ONLINE                ONLINE       ICP
  D3               ONLINE                ONLINE       ICP

COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   14   IN USE:   14   NOT USING:    0   NOT USABLE:    0
```

```
 OPERATIONAL DEVICES / SUBCHANNELS:
     FF1C / 5018     FF1D / 5019     FF1E / 501A     FF1F / 501B
     FF20 / 501C     FF21 / 501D     FF22 / 501E     FF2A / 501F
     FF2B / 5020     FF2C / 5021     FF2D / 5022     FF2E / 5023
     FF2F / 5024     FF30 / 5025

REMOTELY CONNECTED COUPLING FACILITIES
       CFNAME          COUPLING FACILITY
       --------        -------------------------
       CF2             002094.IBM.02.00000002991E
                       PARTITION: 1D  CPCID: 00

                       CHPIDS ON CF1 CONNECTED TO REMOTE FACILITY
                       RECEIVER:   CHPID    TYPE
                                   D0       ICP
                                   D2       ICP

                       SENDER:     CHPID    TYPE
                                   D0       ICP
                                   D2       ICP


COUPLING FACILITY 002094.IBM.02.00000002991E
                  PARTITION: 1D  CPCID: 00
                  CONTROL UNIT ID: FFF6
NAMED CF2
COUPLING FACILITY SPACE UTILIZATION
 ALLOCATED SPACE                 DUMP SPACE UTILIZATION
   STRUCTURES:      359936 K        STRUCTURE DUMP TABLES:          0 K
   DUMP SPACE:        2048 K                 TABLE COUNT:          0
  FREE SPACE:      1644032 K       FREE DUMP SPACE:              2048 K
 TOTAL SPACE:      2006016 K      TOTAL DUMP SPACE:              2048 K
                                 MAX REQUESTED DUMP SPACE:          0 K
    VOLATILE:           YES        STORAGE INCREMENT SIZE:        512 K
     CFLEVEL:            15
     CFCC RELEASE 15.00, SERVICE LEVEL 02.12
     BUILT ON 09/14/2010 AT 13:00:00
     COUPLING FACILITY HAS 0 SHARED AND 1 DEDICATED PROCESSORS
     DYNAMIC CF DISPATCHING: OFF

 CF REQUEST TIME ORDERING: REQUIRED AND ENABLED

 COUPLING FACILITY SPACE CONFIGURATION
                           IN USE            FREE           TOTAL
 CONTROL SPACE:          361984 K       1644032 K       2006016 K
 NON-CONTROL SPACE:           0 K             0 K             0 K

 SENDER PATH       PHYSICAL              LOGICAL      CHANNEL TYPE
   D0               ONLINE                ONLINE       ICP
   D2               ONLINE                ONLINE       ICP
COUPLING FACILITY SUBCHANNEL STATUS
 TOTAL:   14   IN USE:   14   NOT USING:    0   NOT USABLE:    0
 OPERATIONAL DEVICES / SUBCHANNELS:
     FF23 / 5026     FF24 / 5027     FF25 / 5028     FF26 / 5029
     FF27 / 502A     FF28 / 502B     FF29 / 502C     FFB3 / 502D
     FFB4 / 502E     FFB5 / 502F     FFB6 / 5030     FFB7 / 5031
     FFB8 / 5032     FFB9 / 5033

REMOTELY CONNECTED COUPLING FACILITIES
        CFNAME          COUPLING FACILITY
```

```
--------        -------------------------
CF1             002094.IBM.02.00000002991E
                PARTITION: 0F  CPCID: 00

                CHPIDS ON CF2 CONNECTED TO REMOTE FACILITY
                RECEIVER:   CHPID    TYPE
                            D1       ICP
                            D3       ICP

                SENDER:     CHPID    TYPE
                            D1       ICP
                            D3       ICP
```

Both systems were running z/OS 1.12 with JES2 in a multiple access spool (MAS) configuration. Both systems were also accessible from anywhere within the IBM intranet using a TCP/IP connection.

A.2 IMS configuration

Figure A-1 shows the basic configuration of our IMS 12 IMSplex with four IMS systems that each have an IMS Connect.

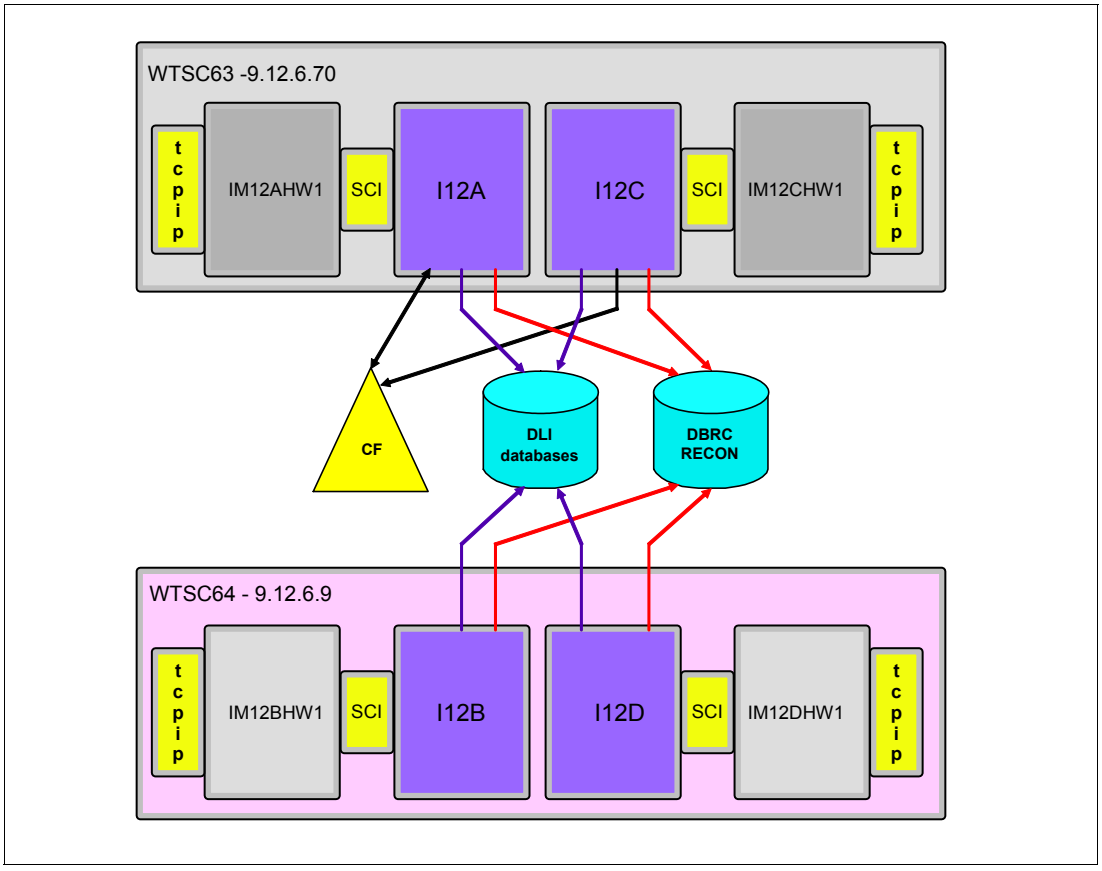

Figure A-1 IMSplex configuration

We omitted the internal resource lock manager (IRLM), Common Queue Server (CQS), Operations Manager (OM), Resource Manager (RM), Structured Call Interface (SCI) address spaces, and IMS repository server from the diagram for clarity.

Our IMS system is an IMSPlex, composed of four control regions. Two of the systems have shared queues and all four use shared databases and a single shared recovery control (RECON). The systems were remotely located on two LPARs systems named WTSC63 and WTSC64.

Starting with a simple IMS built from the IMS 12 Install or the Installation Verification Program (IVP), we updated the stage1 so that each system had a unique **SUF=x** and **MSVID=nnn** value. That change was also reflected in the IMS.PROCLIB(DFSPBxxx) member.

Each IMS had Virtual Telecommunications Access Method (VTAM) Multiple Systems Coupling (MSC) links defined to connect to the other three systems. (MSC is redundant with shared queues but the links were included in the IMS stage1 system generation anyway.)

A single IRLM region is running on each LPAR to reduce complexity. There is an SCI running on each LPAR. Each system has its own local OM. There is one shared RM (running without using a RM coupling facility structure).

A.2.1 TCP/IP MSC links

The first change to the configuration was for the connectivity enhancements. The change made was to add MSC physical links, logical links and MSNAME using TCP/IP. As part of that testing, a NUCLEUS generate was done for each system to add the new stage1 parameters for **TYPE=TCPIP** MSC links. You must run a NUCLEUS stage1 or stage2 system definition and restart the system to add the support for MSC using TCP/IP, even if VTAM MSC links already exist in the system.

Example A-3, Example A-4, Example A-5, and Example A-6 show the definitions for each of the four IMS systems. For each link the partner ID and the suffix on the MSPLINK name match one another. As a convention, we defined a VTAM link with **PARTNER=*local/remote*** (for example, **PARTNER=AB** for I12A connected to I12B) and a TCPIP link with **PARTNER=*remote/local*** (for example, **PARTNER=BA** for I12A connected to I12B). The same naming scheme was used for link names, partner IDs, and MSNAMEs.

The MSC system identifier (SYSID) values are defined as shown in the following example. The SYSID values used for TCP/IP simply had 100 added to the value assigned for a VTAM link.

- As shown in Example A-3, IMS I12A uses 1 (VTAM) and 101 (TCP/IP).

Example A-3 Stage 1 macros for MSC in IMS system I12A

```
*---------------------------------*
* I12A LOCAL  SYSID: 1, 101       *
* I12B REMOTE SYSID: 2, 102       *
* I12C REMOTE SYSID: 3, 103       *
* I12D REMOTE SYSID: 4, 104       *
*---------------------------------*
*
*---------------------------------*
*    VTAM MSC FROM I12A TO I12B   *
*---------------------------------*
LINKAB   MSPLINK TYPE=VTAM,NAME=APPLI12B,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=AB,MSPLINK=LINKAB
```

```
MSCAB    MSNAME  SYSID=(2,1)
*
*---------------------------------*
*   TCP/IP MSC FROM I12B TO I12A   *
*---------------------------------*
LINKBA   MSPLINK TYPE=TCPIP,NAME=I12B,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWSI12A1,                                      X
               LCLPLKID=MSC2A2B
         MSLINK  PARTNER=BA,MSPLINK=LINKBA
MSCBA    MSNAME  SYSID=(102,101)
*
*---------------------------------*
*    VTAM MSC FROM I12A TO I12C    *
*---------------------------------*
LINKAC   MSPLINK TYPE=VTAM,NAME=APPLI12C,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=AC,MSPLINK=LINKAC
MSCAC    MSNAME  SYSID=(3,1)
*
*---------------------------------*
*   TCP/IP MSC FROM I12C TO I12A   *
*---------------------------------*
LINKCA   MSPLINK TYPE=TCPIP,NAME=I12C,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWSI12A1,                                      X
               LCLPLKID=MSC2A2C
         MSLINK  PARTNER=CA,MSPLINK=LINKCA
MSCCA    MSNAME  SYSID=(103,101)
*
*---------------------------------*
*    VTAM MSC FROM I12A TO I12D    *
*---------------------------------*
LINKAD   MSPLINK TYPE=VTAM,NAME=APPLI12D,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=AD,MSPLINK=LINKAD
MSCAD    MSNAME  SYSID=(4,1)
*
*---------------------------------*
*   TCP/IP MSC FROM I12D TO I12A   *
*---------------------------------*
LINKDA   MSPLINK TYPE=TCPIP,NAME=I12D,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWSI12A1,                                      X
               LCLPLKID=MSC2A2D
         MSLINK  PARTNER=DA,MSPLINK=LINKDA
MSCDA    MSNAME  SYSID=(104,101)
```

- As shown in Example A-4, IMS I12B uses 2 (VTAM) and 102 (TCP/IP).

Example A-4 Stage 1 macros for MSC in IMS system I12B

```
*---------------------------------*
* I12A REMOTE SYSID: 1, 101       *
* I12B LOCAL  SYSID: 2, 102       *
* I12C REMOTE SYSID: 3, 103       *
* I12D REMOTE SYSID: 4, 104       *
*---------------------------------*
*
*---------------------------------*
*    VTAM MSC FROM I12A TO I12B    *
```

```
*---------------------------------*
LINKAB   MSPLINK TYPE=VTAM,NAME=APPLI12A,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=AB,MSPLINK=LINKAB
MSCAB    MSNAME  SYSID=(1,2)
*
*---------------------------------*
*   TCP/IP MSC FROM I12B TO I12A   *
*---------------------------------*
LINKBA   MSPLINK TYPE=TCPIP,NAME=I12A,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWSI12B1,                                       X
               LCLPLKID=MSC2B2A
         MSLINK  PARTNER=BA,MSPLINK=LINKBA
MSCBA    MSNAME  SYSID=(101,102)
*
*---------------------------------*
*    VTAM MSC FROM I12B TO I12C    *
*---------------------------------*
LINKBC   MSPLINK TYPE=VTAM,NAME=APPLI12C,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=BC,MSPLINK=LINKBC
MSCBC    MSNAME  SYSID=(3,2)
*
*---------------------------------*
*   TCP/IP MSC FROM I12C TO I12B   *
*---------------------------------*
LINKCB   MSPLINK TYPE=TCPIP,NAME=I12C,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWSI12B1,                                       X
               LCLPLKID=MSC2B2C
         MSLINK  PARTNER=CB,MSPLINK=LINKCB
MSCCB    MSNAME  SYSID=(103,102)
*
*---------------------------------*
*    VTAM MSC FROM I12B TO I12C    *
*---------------------------------*
LINKBD   MSPLINK TYPE=VTAM,NAME=APPLI12D,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=BD,MSPLINK=LINKBD
MSCBD    MSNAME  SYSID=(4,2)
*
*---------------------------------*
*   TCP/IP MSC FROM I12D TO I12B   *
*---------------------------------*
LINKDB   MSPLINK TYPE=TCPIP,NAME=I12D,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWSI12B1,                                       X
               LCLPLKID=MSC2B2D
         MSLINK  PARTNER=DB,MSPLINK=LINKDB
MSCDB    MSNAME  SYSID=(104,102)
```

- As shown in Example A-5, IMS I12C uses 3 (VTAM) and 103 (TCP/IP).

Example A-5 Stage 1 macros for MSC in IMS system I12C

```
*---------------------------------*
* I12A REMOTE SYSID: 1, 101       *
* I12B REMOTE SYSID: 2, 102       *
* I12C LOCAL  SYSID: 3, 103       *
* I12D REMOTE SYSID: 4, 104       *
*---------------------------------*
```

```
*
*---------------------------------*
*    VTAM MSC FROM I12A TO I12C    *
*---------------------------------*
LINKAC   MSPLINK TYPE=VTAM,NAME=APPLI12A,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=AC,MSPLINK=LINKAC
MSCAC    MSNAME  SYSID=(1,3)
*
*---------------------------------*
*   TCP/IP MSC FROM I12C TO I12A   *
*---------------------------------*
LINKCA   MSPLINK TYPE=TCPIP,NAME=I12A,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12C1,                                       X
               LCLPLKID=MSC2C2A
         MSLINK  PARTNER=CA,MSPLINK=LINKCA
MSCCA    MSNAME  SYSID=(101,103)
*
*---------------------------------*
*    VTAM MSC FROM I12B TO I12C    *
*---------------------------------*
LINKBC   MSPLINK TYPE=VTAM,NAME=APPLI12B,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=BC,MSPLINK=LINKBC
MSCCB    MSNAME  SYSID=(2,3)
*
*---------------------------------*
*   TCP/IP MSC FROM I12C TO I12B   *
*---------------------------------*
LINKCB   MSPLINK TYPE=TCPIP,NAME=I12B,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12C1,                                       X
               LCLPLKID=MSC2C2B
         MSLINK  PARTNER=CB,MSPLINK=LINKCB
MSCBC    MSNAME  SYSID=(102,103)
*
*---------------------------------*
*    VTAM MSC FROM I12C TO I12D    *
*---------------------------------*
LINKCD   MSPLINK TYPE=VTAM,NAME=APPLI12D,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=CD,MSPLINK=LINKCD
MSCCD    MSNAME  SYSID=(4,3)
*
*---------------------------------*
*   TCP/IP MSC FROM I12D TO I12C   *
*---------------------------------*
LINKDC   MSPLINK TYPE=TCPIP,NAME=I12D,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12C1,                                       X
               LCLPLKID=MSC2C2D
         MSLINK  PARTNER=DC,MSPLINK=LINKDC
MSCDC    MSNAME  SYSID=(104,103)
```

- As shown in Example A-6, IMS I12D uses 4 (VTAM) and 104 (TCP/IP).

Example A-6 Stage1 macros for MSC in IMS system I12D

```
*---------------------------------*
* I12A REMOTE SYSID: 1, 101       *
* I12B REMOTE SYSID: 2, 102       *
* I12C REMOTE SYSID: 3, 103       *
* I12D LOCAL  SYSID: 4, 104       *
*---------------------------------*
*
*---------------------------------*
*    VTAM MSC FROM I12A TO I12D   *
*---------------------------------*
LINKAD   MSPLINK TYPE=VTAM,NAME=APPLI12A,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=AD,MSPLINK=LINKAD
MSCAD    MSNAME  SYSID=(1,4)
*
*---------------------------------*
*   TCP/IP MSC FROM I12D TO I12A  *
*---------------------------------*
LINKDA   MSPLINK TYPE=TCPIP,NAME=I12A,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12D1,                                       X
               LCLPLKID=MSC2D2A
         MSLINK  PARTNER=DA,MSPLINK=LINKDA
MSCDA    MSNAME  SYSID=(101,104)
*
*---------------------------------*
*    VTAM MSC FROM I12B TO I12D   *
*---------------------------------*
LINKBD   MSPLINK TYPE=VTAM,NAME=APPLI12B,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=BD,MSPLINK=LINKBD
MSCBD    MSNAME  SYSID=(2,4)
*
*---------------------------------*
*   TCP/IP MSC FROM I12D TO I12B  *
*---------------------------------*
LINKDB   MSPLINK TYPE=TCPIP,NAME=I12B,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12D1,                                       X
               LCLPLKID=MSC2D2B
         MSLINK  PARTNER=DB,MSPLINK=LINKDB
MSCDB    MSNAME  SYSID=(102,104)
*
*---------------------------------*
*    VTAM MSC FROM I12C TO I12D   *
*---------------------------------*
LINKCD   MSPLINK TYPE=VTAM,NAME=APPLI12C,SESSION=2,BUFSIZE=2048
         MSLINK  PARTNER=CD,MSPLINK=LINKCD
MSCCD    MSNAME  SYSID=(3,4)
*
*---------------------------------*
*   TCP/IP MSC FROM I12D TO I12C  *
*---------------------------------*
```

```
LINKDC   MSPLINK TYPE=TCPIP,NAME=I12C,SESSION=2,BUFSIZE=2048,          X
               LCLICON=HWCF12D1,                                      X
               LCLPLKID=MSC2D2C
         MSLINK  PARTNER=DC,MSPLINK=LINKDC
MSCDC    MSNAME  SYSID=(103,104)
```

Example A-7 shows the complete MSC link network using the IMS MSC Verification Utility.

Example A-7 MSC links (output from the MSC Verification Utility)

```
       |    MS001    |    MS002    |    MS003    |    MS004    |
-------------------------------------------------------------------
 0001  |    LOCAL    |    001 AB   |    001 AC   |    001 AD   |
 0002  |    002 AB   |    LOCAL    |    002 BC   |    002 BD   |
 0003  |    003 AC   |    003 BC   |    LOCAL    |    003 CD   |
 0004  |    004 AD   |    004 BD   |    004 CD   |    LOCAL    |
 0101  |    LOCAL    |    001 BA   |    001 CA   |    001 DA   |
 0102  |    002 BA   |    LOCAL    |    002 CB   |    002 DB   |
 0103  |    003 CA   |    003 CB   |    LOCAL    |    003 DC   |
 0104  |    004 DA   |    004 DB   |    004 DC   |    LOCAL    |
-------------------------------------------------------------------
 VTAM  |   AB 001--------AB 001    |             |             |
 VTAM  |   AC 003----------------------AC 001    |             |
 VTAM  |   AD 005-------------------------------------AD 001   |
  TCP  |   BA 002--------BA 002    |             |             |
  TCP  |   CA 004----------------------CA 002    |             |
  TCP  |   DA 006-------------------------------------DA 002   |
 VTAM  |             |   BC 003--------BC 003    |             |
 VTAM  |             |   BD 005----------------------BD 003    |
  TCP  |             |   CB 004--------CB 004    |             |
  TCP  |             |   DB 006----------------------DB 004    |
 VTAM  |             |             |   CD 005--------CD 005    |
  TCP  |             |             |   DC 006--------DC 006    |
-------------------------------------------------------------------
```

We also added a set of transactions (Example A-8) that were defined as local in one system and as remote in each of the other three systems. The xMSC transaction was assigned to the VTAM MSC links. The xMSC1 transaction was assigned to the TCP/IP MSC link.

The COBOL program that the transaction runs simply makes some IMS INQY calls and builds a six-line reply with the data returned from those calls.

Example A-8 Application and transaction definitions (only I12A shown)

```
*---------------------------------*
* I12A LOCAL  SYSID: 1, 101       *
* I12B REMOTE SYSID: 2, 102       *
* I12C REMOTE SYSID: 3, 103       *
* I12D REMOTE SYSID: 4, 104       *
*---------------------------------*
*
* Local
*
         APPLCTN  GPSB=MSCI12A,LANG=ASSEM
         TRANSACT CORANSACT CODE=AMSC1,PRTY=(7,10,2),INQUIRY=NO,MODE=SNGL,      X
               MSGTYPE=(SNGLSEG,NONRESPONSE),EDIT=ULC
*
* Remote in I12B
*
```

```
         APPLCTN  PSB=MSCV12B,SYSID=(2,1)
         TRANSACT CODE=BMSC,PRTY=(7,10,2),INQUIRY=NO,MODE=SNGL,        X
               MSGTYPE=(SNGLSEG,RESPONSE),EDIT=ULC,                    X
               SYSID=(2,1)
         APPLCTN  PSB=MSCT12B,SYSID=(102,101)
         TRANSACT CODE=BMSC1,PRTY=(7,10,2),INQUIRY=NO,MODE=SNGL,       X
               MSGTYPE=(SNGLSEG,NONRESPONSE),EDIT=ULC,                 X
               SYSID=(102,101)
*
* Remote in I12C
*
         APPLCTN  PSB=MSCV12C,SYSID=(3,1)
         TRANSACT CODE=CMSC,PRTY=(7,10,2),INQUIRY=NO,MODE=SNGL,        X
               MSGTYPE=(SNGLSEG,RESPONSE),EDIT=ULC,                    X
               SYSID=(3,1)
         APPLCTN  PSB=MSCT12C,SYSID=(103,101)
         TRANSIDLE ACTV SEC
I12A            2 BA          11      0      0      0     10 IDLE ACTV PRI
I12A            3 AC           0      0      0      0      0 PSTOPPED IDLE ERE
I12A            4 CA           0      0      0      0      0 PSTOPPED IDLE COLD
I12A            5 AD           3      0      0      0      3 IDLE ACTV PRI
I12A            6 DA           0      0      0      0      0 PSTOPPED IDLE COLD
I12A         *11222/174556*
I12B         LINK PARTNER   RECD  ENQCT  DEQCT    QCT   SENT
I12B            1 AB           1      1      1      0      1 IDLE ACTV PRI
I12B            2 BA          11     10     10      0     10 IDLE ACTV SEC
I12B            3 BC           2      2      2      0      2 IDLE ACTV PRI
I12B            4 CB           0      2      0      2      0 PSTOPPED IDLE COLD
I12B            5 BD           5      5      5      0      5 IDLE ACTV PRI
I12B            6 DB           0      0      0      0      0 PSTOPPED IDLE COLD
I12B         *11222/174556*
I12C         LINK PARTNER   RECD  ENQCT  DEQCT    QCT   SENT
I12C            1 AC           0      0      0      0      0 PSTOPPED IDLE ERE
I12C            2 CA           0      0      0      0      0 PSTOPPED IDLE COLD
I12C            3 BC           2      0      0      0      2 IDLE ACTV SEC
I12C            4 CB           0      0      0      0      0 PSTOPPED IDLE COLD
I12C            5 CD           1      0      0      0      1 IDLE ACTV SEC
I12C            6 DC           0      0      0      0      0 PSTOPPED IDLE COLD
I12C         *11222/174556*
I12D         LINK PARTNER   RECD  ENQCT  DEQCT    QCT   SENT
I12D            1 AD           3      3      3      0      3 IDLE ACTV SEC
I12D            2 DA           0      0      0      0      0 PSTOPPED IDLE COLD
I12D            3 BD           5      5      5      0      5 IDLE ACTV SEC
I12D            4 DB           0      0      0      0      0 PSTOPPED IDLE COLD
I12D            5 CD           1      1      1      0      1 IDLE ACTV PRI
I12D            6 DC           0      0      0      0      0 PSTOPPED IDLE COLD
I12D         *11222/174556*
```

A.2.2 Base Primitive Environment Database Recovery Control

The Database Recovery Control (DBRC) procedures for all systems were updated to use Base Primitive Environment (BPE)-based DBRC (Example A-9).

Example A-9 DBRC job control language (JCL) using BPE

```
//DBRC    PROC RGN=OM,SOUT=A,
//             SYS1='IMS12A.',
//             BPECFG=BPECONFG,
//             DBRCINIT=12X,
```

```
//             IMSID=I12A,
//             PARM1='BPEINIT=DSPBINI0'
//*
//DBRCPROC   EXEC PGM=BPEINI00,REGION=&RGN,
// PARM='BPECFG=&BPECFG,DBRCINIT=&DBRCINIT,IMSID=&IMSID,&PARM1'
//*
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//         DD  DSN=IMS12Q.&SYS1.SDFSRESL,DISP=SHR
//         DD  DSN=SYS1.CSSLIB,DISP=SHR
//PROCLIB  DD  DSN=IMS12Q.PROCLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=&SOUT
//SYSUDUMP DD  SYSOUT=&SOUT
//JCLPDS   DD DSN=IMS12Q.PROCLIB,DISP=SHR
```

The DBRC initialization member is shown in Example A-10. The DBRC exit DSPSCIX0 was installed so that the IMSPLEX and GROUPID parameters were set automatically. Using that exit also meant that Automatic RECON Loss Notification (ARLN) was active. The RECON was updated to have `MINVERS('12.1')`.

Example A-10 IMS.PROCLIB member DSPBII2X

```
*-------------------------------------------------------------------*
* DBRC INITIALIZATION PROCLIB MEMBER.                               *
*-------------------------------------------------------------------*
IMSPLEX(NAME=IM12X)           /* IMSPLEX NAME (CSLIM12X) */
DBRCGRP=D12
VSAMBUFF(INDEX=60,DATA=120)
*-------------------------------------------------------------------*
* END OF MEMBER DSPBI12X                                            *
*-------------------------------------------------------------------*
```

A.3 IMS repository

We created an IMS repository using phase U of the IMS Installation and Verification Program (IVP). See 8.5.5, “Changes to the IVP for IMS 12” on page 302 for more information about this topic. One system I12D was updated to use the repository rather than MODBLKS or RDDS data sets. Example A-11 shows the repository JCL.

Example A-11 Repository JCL

```
//IM12XREP PROC RGN=128M,BPECFG=BPERECFN,
// FRPCFG=FRP12XRP,SOUT='*'
//*
//RESPPROC EXEC PGM=BPEINI00,REGION=&RGN,
// PARM='BPEINIT=FRPINI00,BPECFG=&BPECFG,FRPCFG=&FRPCFG'
//*
//STEPLIB DD DSN=IMS12Q.SDFSRESL,DISP=SHR
//*
//PROCLIB DD DSN=IMS12Q.PROCLIB,DISP=SHR
//*
//FRPPRINT DD SYSOUT=&SOUT
//CATION_RETRY=32
MBR_CORE_MAX=1024
IMSPLEX(NAME=IM12X)
RSNAME=IMS12X
PRIMARY_CATALOG_REPOSITORY_INDEX=IMS12Q.IMS12X.REPO.CATPRI.RID
PRIMARY_CATALOG_REPOSITORY_MEMBER=IMS12Q.IMS12X.REPO.CATPRI.RMD
```

```
SECONDARY_CATALOG_REPOSITORY_INDEX=IMS12Q.IMS12X.REPO.CATSEC.RID
SECONDARY_CATALOG_REPOSITORY_MEMBER=IMS12Q.IMS12X.REPO.CATSEC.RMD
VSAM_BUFNO=128
VSAM_BUFSIZE=8
XCF_GROUP_NAME=IM12XREP
AUDIT=NO
AUDIT_FAIL=CONTINUE
AUDIT_LEVEL=HIGH
AUDIT_DEFAULT=NOAUDIT
```

A.4 IMS Connect

The JCL used to run IMS Connect was identical for each system. Only the parameters defining the configuration members were different in each case. See Example A-12.

The BPE configuration had minor differences for the recorder trace data set. IMS Connect configuration members had definitions that were unique to each system.

Example A-12 IMS Connect JCL

```
//*********************************************************************
//*     IMS 12.1
//* HWS PROCEDURE IM12xHW1
//* FUNCTION: START IMS CONNECT REGION WITH IMS Connect Extensions 2.2
//*    PARAMETERS:
//*         BPECFG           BPE TRACE,SOAP PARAMETERS
//*         HWSCFG           IMS CONNECT CONFIGURATION
//*********************************************************************
//IM12BHW1 PROC RGN=OM,TME=1440,SOUT=*,
//             BPECFG=BPEHWS2x,HWSCFG=HWCF12x1
//*
//HWSREGN  EXEC PGM=HWSHWS00,REGION=&RGN,TIME=&TME,
//             PARM='BPECFG=&BPECFG,HWSCFG=&HWSCFG'
//STEPLIB  DD   DSN=CEX.V2R2M0.SCEXLINK,DISP=SHR
//         DD   DSN=FUN.V2R2M0.SFUNLINK,DISP=SHR
//         DD   DSN=IMS12Q.SDFSRESL,DISP=SHR
//PROCLIB  DD   DSN=IMS12Q.PROCLIB,DISP=SHR
//SYSPRINT DD   SYSOUT=&SOUT
//SYSUDUMP DD   SYSOUT=&SOUT
//*HWSRCORD DD   DSN=IMS12Q.HWSRCDR,DISP=SHR   /* Not used */
//CEXREPOS DD   DSN=CEX.V2R2M0.IMS12Q.REPOS,DISP=SHR
//CEXPRINT DD   SYSOUT=&SOUT
```

The BPE configuration in Example A-13 has the new recorder trace. The HWSRCORD was removed from JCL.

Example A-13 IMS Connect BPE configuration

```
********************************************************************
* CONFIGURATION FILE FOR BPE WITH SOAP GATEWAY                     *
********************************************************************
LANG=ENU                              /* LANGUAGE FOR MESSAGES     */
                                      /* (ENU = U.S. ENGLISH)      */
#
# DEFINITIONS FOR BPE SYSTEM TRACES
#
TRCLEV=(*,HIGH,BPE,PAGES=20)          /* DEFAULT TRACES TO HIGH    */
```

```
TRCLEV=(STG,MEDIUM,BPE)             /* STORAGE TRACE             */
TRCLEV=(CBS,MEDIUM,BPE)             /* CONTROL BLK SRVCS TRACE   */
TRCLEV=(DISP,HIGH,BPE)              /* DISPATCHER TRACE          */
TRCLEV=(AWE,HIGH,BPE)               /* AWE SERVER TRACE          */
TRCLEV=(SSRV,HIGH,BPE)              /* SYSTEM SERVICE TRACE      */
#
# DEFINITIONS FOR HTM TRACES
#
TRCLEV=(HACT,HIGH,HTM)              /* HTM-ADM COMM TRACE        */
TRCLEV=(SHCT,HIGH,HTM)              /* SERVER-HTM COMM TRACE     */
#
# DEFINITIONS FOR IMS CONNECT TRACES
#
TRCLEV=(*,HIGH,HWS,PAGES=20)        /* DEFAULT TRACES TO HIGH    */
TRCLEV=(HWSI,HIGH,HWS,PAGES=100)    /* OTMA COMM ACTIVITY TRACE  */
TRCLEV=(HWSN,HIGH,HWS,PAGES=100)    /* LOCAL OPT DRIVER ACTIVITY */
TRCLEV=(HWSW,HIGH,HWS,PAGES=100)    /* TCP/IP DRIVER ACTIVITY    */
TRCLEV=(OTMA,HIGH,HWS,PAGES=100)    /* XCF CALLS TRACE           */
TRCLEV=(TCPI,HIGH,HWS,PAGES=100)    /* TCP/IP CALLS TRACE        */
#
# DEFINITION FOR NEW STYLE RECORDER TRACE
#
TRCLEV=(RCTR,MEDIUM,HWS,EXTERNAL=YES)
#
EXTTRACE(
  GDGDEF(
    DSN(IMS12Q.IMS12x.HWS.RCTR)
    UNIT(SYSALLDA)
    VOLSER(SBOXI5)
    SPACE(15)
    SPACEUNIT(TRK)
    BLKSIZE(32760)
  )
  COMP(HWS)
)
EXITMBR=(HWSEXITO,HWS)
# DEFINITIONS FOR SOAP GATEWAY
```

Example A-14, Example A-15, Example A-16, and Example A-17 show the HWSCFG members for each copy of IMS Connect. Example A-14 is shown with comments to document each parameter. SSLPORT is not used.

Example A-14 IMS Connect IM12AHW1 configuration

```
*  ------------HWS  MEMBER FOR IMS12A     HWCF12A1-------------
*  --------------------------HWS-----------------------------
*   ID=
*   PSWDMC=N   MIXED-CASE PASSWORDS DISABLED
*   CMOATOQ    NAME OTMA CMO ACK TIMEOUT QUEUES(DEF DFS&&TOQ)
*         CAN BE OVERRIDED BY DATASTORE
*   RACF=N     DISABLES SECURITY SUPPORT BY RACF
*   RRS=Y      RESOURCE RECOVERY SERVICES ENABLED
*   SMEMBER    SUPERMEMBER
*  #UIDAGE=    REFRESH INTERVAL FOR CACHED RACF USER IDS IN SECS
*  #UIDCACHE=Y IMS CONNECT CACHES VERIFIED RACF USER IDS FOR REUSE
*   XIBAREA=   NUMBER OF FULLWORDS ALLOCATED FOR THE XIB USER AREA
HWS=(ID=HWSI12A1,PSWDMC=R,RACF=N,RRS=Y,
SMEMBER=I12S,
UIDCACHE=Y,UIDAGE=500,XIBAREA=50)
*  ------------------------TCP/IP-----------------------------
```

```
*   EXIT       NAMES OF ONE OR MORE IMS MESSAGE EXIT ROUTINES
*         HWSJAVAO IS AUTOMATICALLY LOADED
*         IMS CONTROL CENTER REQUIRES HWSCSLOO AND HWSCSLO1
*   HOSTNAME   TCP/IP JOBNAME
*   PORTID     TCP/IP PORT ENABLES LOCAL OPTION CONNECTIONS
*        -- OR --
*   PORT       TCP/IP PORT
*   SSLPORT    TCP/IP PORT FOR SSL SUPPORT
*   SSLENVAR   NAME OF THE SSL INITIALIZATION FILE
TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=7100),
  PORT(ID=7101),PORT(ID=7102))
*  ------------------------DATASTORE --------------------------
*--DATASTORE ADDRESSES IMS CONTROL REGION VIA OTMA
*     GROUP     XCF(OTMA) FROM GRNAME IN DFSPBXXX
*     ID        DATA STORE NAME (IN IRM REQUEST)
*     MEMBER    XCF MEMBER NAME THAT IDENTIFIES IMS CONNECT
*        IF SAME GROUP, NAME MUST BE UNIQUE WITHIN DATASTORE
*     TMEMBER   THE XCF MEMBER NAME FOR IMS
*     OAAV=     (ACEE) AGING VALUE, IN SECONDS (DEFAULT 999999)
*     MAXI=     INPUT MESSAGE FLOOD CONTROL VALUE
*     CMOATOQ=  OTMA CMO ACK TIMEOUT QUEUE (DEF DFS££TOQ)
*     APPL=     TCP/IP APPL NAME DEFINED TO RACF IN PTKTDATA
*     DRU=      OWN OTMA DESTINATION RESOLUTION USER EXIT NAME
*     RRNAME=   NAME OF AN ALTERNATE DESTINATION SPECIFIED IN A CLIENT
*    #ACKTO=    TIMEOUT INTERVAL FOR OUTPUT ACKS.CM0,CM1..IMS TO IMS
*        (DEFAULT 120)
*        REROUTE FOR IMS TO IMS TO THE DEFAULT TIMEOUT QUEUE, DFS££TOQ
*     SMEMBER   SUPERMEMBER
*
*     -TO  I12A
DATASTORE=(GROUP=I12XOTMA,ID=I12A,MEMBER=HWBI12A1,TMEMBER=I12AOTMA,
  OAAV=300,SMEMBER=I12S)
*  -------------------------ADAPTER----------------------------
*   XML=Y     XML ADAPTER SUPPORT SHOULD BE ENABLED (SOAP GATEWAY)
ADAPTER=(XML=Y)
*  -------------------------IMSPLEX----------------------------
*  -- REGISTERS IMS CONNECT AS A MEMBER OF AN IMPLEX
*  -- ENABLES BOTH IMS TYPE-2 COMMAND SUPPORT FOR IMS CONNECT
*  --   COMM BETWEEN IMS CONNECT AND OTHER MEMBERS OF THE IMSPLEX.
*     MEMBER    NAME THAT IDENTIFIES IMS CONNECT IN THE IMSPLEX
*     TMEMBER   IMSPLEX THAT IMSCON IS JOINING, IMSPLEX(NAME= )
IMSPLEX=(MEMBER=HWSI12A1,TMEMBER=IM12X)
*  ------------------------ODACCESS--------------------------
*     DRDAPORT  PORT NUMBER, TCP/IP KEEP ALIVE VALUE,
*        (ID       PORTNR
*         KEEPAV   TCP/IP LAYER SENDS A PACKET ON IDLE CONS
*         PORTTMOT AMOUNT TIME IMS CONNECT WAITS FOR NEXT INPUT)
*     ODBMAUTOCONN SPECIFIES WHETHER IMS CONNECT AUTOMATICALLY
*        NEW AND EXISTING INSTANCES OF ODBM WITHIN AN IMSPLEX.
ODACCESS=(DRDAPORT=(ID=6100,KEEPAV=0,PORTTMOT=18000),
  DRDAPORT=(ID=6101,KEEPAV=0,PORTTMOT=18000),
  ODBMAUTOCONN=Y)
*####-------------------------MSC----NEW IN IMS 12----------
*     GENIMSID= MSC TCP/IP GENERIC IMS ID (OPTIONAL)
*         ALSO SPECIFIED ON THE GENIMSID IN DFSDCxxx
*     IMSPLEX (MEMBER, TMEMBER)
*         THIS NAME MUST MATCH THE NAME SPECIFIED ON THE LCLICON
*         PARM OF THE MSPLINK MACRO DEFINITION OF THE LOCAL IMS SYSTEM
*     LCLIMS= IMS ID OF THE LOCAL IMS SYSTEM AS REGISTERED WITH SCI
*           ==>QUERY IMSPLEX     ?? C
```

```
*     LCLPKLID= LOCAL NAME OF THE MSC PHYSICAL LINK
*     RMTIMS= IMS ID OF THE REMOTE IMS SYSTEM AS REGISTERED WITH SCI
*           ==>QUERY IMSPLEX     ?? C
*     RMTIMSCON= REMOTE IMS CONNECT CONNECTION TO USE FOR MSC MESSAGES
*        MUST MATCH ID PARAMETER OF ONE OF THE
*        RMTIMSCON STATEMENTS SPECIFIED IN THE LOCAL IMS CONNECT
*     RMTPLKID=  NAME MSC PHYSICAL LINK IN REMOTE LCLPLKID
*
MSC=(LCLPLKID=MSC2A2B,RMTPLKID=MSC2B2A,LCLIMS=I12A,RMTIMS=I12B,
  GENIMSID=ACIM,
  IMSPLEX=(MEMBER=HWSI12A1,TMEMBER=IM12X),RMTIMSCON=HWSI12B1)
MSC=(LCLPLKID=MSC2C2B,RMTPLKID=MSC2B2C,LCLIMS=I12C,RMTIMS=I12B,
  GENIMSID=ACIM,
  IMSPLEX=(MEMBER=HWSI12A1,TMEMBER=IM12X),RMTIMSCON=HWSI12B1)
*
*####----------------------RMTIMSCON---NEW IN IMS/VS 12--------
* -CONNECTION DEFINED BY RMTIMSCON CAN BE USED FOR EITHER OTMA
* - OR MSC MESSAGES, BUT NOT BOTH
*      :OTMA REQUIRES IMSCON STATEMENT BY SENDING IMSCONN
*      :MSC REQUIRES CORRESPONDING RMTIMSCON IN OTHER HWSCFGXX
*     APPL=      APPLICATION NAME TO USE IN A RACF PASSTICKET
*     ID         IDENTIFIES THIS DEFINITION OF A CONNECTION
*     AUTOCONN=  CONNECTS TO REMOTE IMSCON DURING STARTUP (DEF=N)
*     IDLETO=    OPEN SOCKET CONNECTIONS IDLE TIME
*       *EITHER THE IPADDR OR THE HOSTNAME PARAMETER
*       IPADDR=    IP_ADDRESS  OF OTHER IMS CONNECT
*       HOSTNAME   THE HOST NAME OF THE REMOTE IMS CONNECT
*     PERSISTENT=DEFINES SOCKETS USED FOR CONNECTION AS PERSIST
*     PORT=      PORTNR OF LISTENING PORT
*     RESVSOC=   NUMBER OF SEND SOCKETS THAT IMS CONNECT RESERVES
*      TO  I12A VIA TCP/IP
*
*  -USED BY MSC
RMTIMSCON=(ID=HWSI12B1,HOSTNAME=WTSC64.ITSO.IBM.COM,
   PORT=7202,AUTOCONN=Y,RESVSOC=10)
*---**************** END   HWCF12A1   DEFINITION--------------
```

Example A-15 shows the IMS Connect IM12BHW1 configuration.

Example A-15 IMS Connect IM12BHW1 configuration

```
*  ------------HWS  MEMBER FOR IMS12B     HWCF12B1-------------
HWS=(ID=HWSI12B1,PSWDMC=R,RACF=N,RRS=Y,
SMEMBER=I12S,
UIDCACHE=Y,UIDAGE=500,XIBAREA=50)
*
TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=7200),
  PORT(ID=7201),PORT(ID=7202))
*
DATASTORE=(GROUP=I12XOTMA,ID=I12A,MEMBER=HWBI12A2,TMEMBER=I12AOTMA,
OAAV=0,SMEMBER=I12S)
DATASTORE=(GROUP=I12XOTMA,ID=I12B,MEMBER=HWBI12B2,TMEMBER=I12BOTMA)
*
ADAPTER=(XML=Y)
*
IMSPLEX=(MEMBER=HWSI12B1,TMEMBER=IM12X)
*
ODACCESS=(DRDAPORT=(ID=6200,KEEPAV=0,PORTTMOT=18000),
  DRDAPORT=(ID=6201,KEEPAV=0,PORTTMOT=18000),ODBMAUTOCONN=Y)
*
```

```
MSC=(LCLPLKID=MSC2B2A,RMTPLKID=MSC2A2B,LCLIMS=I12B,RMTIMS=ACIM,
  IMSPLEX=(MEMBER=HWSI12B1,TMEMBER=IM12X),RMTIMSCON=HWSI12A1)
*
RMTIMSCON=(ID=HWSI12A1,HOSTNAME=WTSC63.ITSO.IBM.COM,
  PORT=7102,AUTOCONN=Y,RESVSOC=10)
```

Example A-16 shows the IMS Connect IM2CHW1 configuration.

Example A-16 IMS Connect IM12CHW1 configuration

```
*  ------------HWS  MEMBER FOR IMS12C     HWCF12C1-------------
HWS=(ID=HWSI12C1,PSWDMC=R,RACF=N,RRS=Y,
UIDCACHE=Y,UIDAGE=500,XIBAREA=50)
*
TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=7300),
PORT(ID=7301),PORT(ID=7302))
*
DATASTORE=(GROUP=I12XOTMA,ID=I12A,MEMBER=HWBI12A3,TMEMBER=I12AOTMA,
OAAV=600)
DATASTORE=(GROUP=I12XOTMA,ID=I12C,MEMBER=HWBI12C3,TMEMBER=I12COTMA)
*
ADAPTER=(XML=Y)
*
IMSPLEX=(MEMBER=HWSI12C1,TMEMBER=IM12X)
*
ODACCESS=(DRDAPORT=(ID=6300,KEEPAV=0,PORTTMOT=18000),
DRDAPORT=(ID=6301,KEEPAV=0,PORTTMOT=18000),ODBMAUTOCONN=Y)
*
RMTIMSCON=(ID=HWSI12D1,HOSTNAME=WTSC64.ITSO.IBM.COM,
   PORT=7401,AUTOCONN=Y,PERSISTENT=Y,IDLETO=60000,RESVSOC=10)
```

Example A-17 shows the IMS Connect IM2DHW1 configuration.

Example A-17 IMS Connect IM12DHW1 configuration

```
*  ------------HWS  MEMBER FOR IMS12D     HWCF12D1-------------
HWS=(ID=HWSI12D1,PSWDMC=R,RACF=N,RRS=Y,
SMEMBER=I12S,
UIDCACHE=Y,UIDAGE=500,XIBAREA=50)
*
TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=7400),
  PORT(ID=7401),PORT(ID=7402))
*
DATASTORE=(GROUP=I12XOTMA,ID=I12D,MEMBER=HWBI12D4,TMEMBER=I12DOTMA,
   SMEMBER=I12S)
*
ADAPTER=(XML=Y)
*
IMSPLEX=(MEMBER=HWSI12D1,TMEMBER=IM12X)
*
ODACCESS=(DRDAPORT=(ID=6400,KEEPAV=0,PORTTMOT=18000),
  DRDAPORT=(ID=6401,KEEPAV=0,PORTTMOT=18000),ODBMAUTOCONN=Y)
*
RMTIMSCON=(ID=HWSI12C1,HOSTNAME=WTSC63.ITSO.IBM.COM,
   PORT=7301,AUTOCONN=Y,PERSISTENT=Y,IDLETO=60000,RESVSOC=10)
```

For the SOAP gateway, we added an extra instance of IMS Connect using application transparent-transaction layer security (AT-TLS) to provide a Secure Sockets Layer (SSL). See Example A-18.

Example A-18 IMS Connect configuration for IMS SOAP Gateway

```
HWS=(ID=HWSI12A2,PSWDMC=N,RACF=N,RRS=Y,UIDCACHE=Y,XIBAREA=50)
TCPIP=(EXIT=(HWSSMPL1,HWSSOAP1),HOSTNAME=TCPIP,PORT(ID=5100),
  PORT(ID=5101),PORT(ID=5102))
DATASTORE=(GROUP=I12XOTMA,ID=I12A,MEMBER=HWBI12A2,TMEMBER=I12AOTMA)
ADAPTER=(XML=Y)
IMSPLEX=(MEMBER=HWSI12A2,TMEMBER=IM12X)
ODACCESS=(DRDAPORT=(ID=4100,KEEPAV=0,PORTTMOT=18000),
  DRDAPORT=(ID=4101,KEEPAV=0,PORTTMOT=18000),
  ODBMAUTOCONN=Y)
```

A.5 Shared queues

Shared queues were set up between the two IMS systems running on WTSC63. Example A-19 shows the coupling facility structures we defined.

Example A-19 IMS shared queues coupling facility structures

```
STRUCTURE NAME(I12X_IRLM) SIZE(32768)
       PREFLIST(CF2,CF1)
       REBUILDPERCENT(1)

STRUCTURE NAME(I12X_MSGQ)
       SIZE(16000)
       INITSIZE(8000)
       MINSIZE(8000)
       PREFLIST(CF2,CF1)
       REBUILDPERCENT(1)
       ALLOWAUTOALT(YES)
       FULLTHRESHOLD(60)

STRUCTURE NAME(I12X_MSGQOFLW)
       SIZE(8000)
       MINSIZE(8000)
       PREFLIST(CF2,CF1)
       REBUILDPERCENT(1)
       ALLOWAUTOALT(YES)
       FULLTHRESHOLD(60)

STRUCTURE NAME(I12X_EMHQ)
       SIZE(16000)
       INITSIZE(10000)
       MINSIZE(10000)
       PREFLIST(CF2,CF1)
       REBUILDPERCENT(1)
       ALLOWAUTOALT(YES)
       FULLTHRESHOLD(60)

STRUCTURE NAME(I12X_EMHQOFLW)
       SIZE(8000)
       MINSIZE(8000)
       PREFLIST(CF2,CF1)
       REBUILDPERCENT(1)
```

```
       ALLOWAUTOALT(YES)
       FULLTHRESHOLD(60)

STRUCTURE NAME(I12X_LOGRMSGQ)
       SIZE(16000)
       INITSIZE(11000)
       PREFLIST(CF2,CF1)

STRUCTURE NAME(I12X_LOGREMHQ)
       SIZE(4000)
       PREFLIST(CF2,CF1)
       REBUILDPERCENT(1)


STRUCTURE NAME(I12X_RSC)
       SIZE(16000)
       INITSIZE(8000)
       MINSIZE(8000)
       ALLOWAUTOALT(YES)
       FULLTHRESHOLD(60)
       DUPLEX(ALLOWED)
       PREFLIST(CF2,CF1)
```

A z/OS log stream is needed for IMS CQS as shown in Example A-20.

Example A-20 IMS shared queues z/OS log streams

```
DEFINE STRUCTURE NAME(I12X_LOGRMSGQ)
       LOGSNUM(1)
       AVGBUFSIZE(4096)
       MAXBUFSIZE(65272)
DEFINE LOGSTREAM NAME (SYSLOG.MSGQL.LOGOFFLD)
       STRUCTNAME(I12X_LOGRMSGQ)
       LS_MGMTCLAS(NO_LS_MGMTCLAS)
       LS_SIZE(200)
       HLQ(LOGR)

DEFINE STRUCTURE NAME(I12X_LOGREMHQ)
       LOGSNUM(1)
       AVGBUFSIZE(4096)
       MAXBUFSIZE(65272)
DEFINE LOGSTREAM NAME (SYSLOG.EMHQL.LOGOFFLD)
       STRUCTNAME(I12X_LOGREMHQ)
       LS_MGMTCLAS(NO_LS_MGMTCLAS)
       LS_SIZE(200)
       HLQ(LOGR)
```

Example A-21 shows the JCL used for IMS CQS. The CQSINIT and SSN parameters were suffixed with the IMS ID letter (for example `CQSINIT=12A` and `SSN=C12A`).

Example A-21 IMS CQS JCL

```
//*-------------------------------------------------------------------*
//*     PARAMETERS:                                                   *
//*     BPECFG  - NAME OF BPE MEMBER                                  *
//*     CQSINIT - Suffix for your CQSIPxxx member                     *
//*     PARM1   - other override parameters                           *
//*               SSN     - CQS subsystem name                        *
//*               STRDEFG - Suffix for CQSSGxxx member                *
//*               STRDEFL - Suffix for CQSSLxxx member                *
```

```
//*                                                                   *
//*              example:                                             *
//*              PARM1='SSN=CQS1,STRDEFG=190,STRDEFL=191'             *
//*-------------------------------------------------------------------*
//*
//IEFPROC  EXEC PGM=CQSINIT0,REGION=3000K,
//  PARM=('BPECFG=BPECONFG','CQSINIT=12x','SSN=C12x')
//*
//STEPLIB  DD  DSN=IMS12Q.SDFSRESL,DISP=SHR
//*
//PROCLIB  DD  DSN=IMS12Q.PROCLIB,DISP=SHR
//*
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//*
```

The following examples show the parameters for IMS CQS proclib members:

- Example A-22 shows the parameters for CQSSGI2X.

Example A-22 CQSSG12X global shared queues configuration

```
************************* STRUCTURE DEFINITION PROCLIB MEMBER
*
*********************************************************************
*-------------------------------------------------*
* DEFINITION FOR IMS MESSAGE QUEUE STRUCTURES     *
*-------------------------------------------------*
STRUCTURE (
  STRNAME=I12X_MSGQ,
  OVFLWSTR=I12X_MSGQOFLW,
  SRDSDSN1=IMS12Q.IMS12X.MSGQ.SRDS1,
  SRDSDSN2=IMS12Q.IMS12X.MSGQ.SRDS2,
  LOGNAME=SYSLOG.MSGQL.LOGOFFLD,
  OBJAVGSZ=1024)
*-------------------------------------------------*
* DEFINITION FOR IMS EMH QUEUE STRUCTURES         *
*-------------------------------------------------*
STRUCTURE (
  STRNAME=I12X_EMHQ,
  OVFLWSTR=I12X_EMHQOFLW,
  SRDSDSN1=IMS12Q.IMS12X.EMHQ.SRDS1
  SRDSDSN2=IMS12Q.IMS12X.EMHQ.SRDS2
  LOGNAME=SYSLOG.EMHQL.LOGOFFLD,
  OBJAVGSZ=1024)
*-----------------------------------------------------------------*
* END OF MEMBER CQSSG12X                                          *
*-----------------------------------------------------------------*
```

- Example A-23 shows the parameters for CQSSLI2A.

Example A-23 CQSSL12A local shared queues configuration for I12A

```
*-----------------------------------------------------------------*
* LOCAL STRUCTURE DEFINITION PROCLIB MEMBER                       *
*-----------------------------*
* DEFINITION FOR IMS MESSAGE QUEUE STRUCTURE      *
*-------------------------------------------------*
```

```
STRUCTURE (
  STRNAME=I12X_MSGQ,
  CHKPTDSN=IMS12Q.IMS12A.MSGQ.CHKPT,
  SYSCHKPT=50000)
*-----------------------------------------------*
* DEFINITION FOR IMS EMH QUEUE STRUCTURE       *
*-----------------------------------------------*
STRUCTURE (
  STRNAME=I12X_EMHQ,
  CHKPTDSN=IMS12Q.IMS12A.EMHQ.CHKPT,
  SYSCHKPT=50000)
*---------------------------------------------------------------------*
* END OF MEMBER CQSSL12A                                              *
*---------------------------------------------------------------------*
```

- Example A-24 shows the parameters for CQSSLI2C.

Example A-24 CQSSL12C local shared queues configuration for I12C

```
*---------------------------------------------------------------------*
* LOCAL STRUCTURE DEFINITION PROCLIB MEMBER                           *
*---------------------------------------------------------------------*
*-----------------------------------------------*
* DEFINITION FOR IMS MESSAGE QUEUE STRUCTURE    *
*-----------------------------------------------*
STRUCTURE (
  STRNAME=I12X_MSGQ,
  CHKPTDSN=IMS12Q.IMS12C.MSGQ.CHKPT,
  SYSCHKPT=50000)
*-----------------------------------------------*
* DEFINITION FOR IMS EMH QUEUE STRUCTURE       *
*-----------------------------------------------*
STRUCTURE (
  STRNAME=I12X_EMHQ,
  CHKPTDSN=IMS12Q.IMS12C.EMHQ.CHKPT,
  SYSCHKPT=50000)
*---------------------------------------------------------------------*
* END OF MEMBER CQSSL12C                                              *
*---------------------------------------------------------------------*
```

- Example A-25 shows the parameters for CQSIP12A.

Example A-25 CQSIP12A CQS initialization parameters for I12A

```
*---------------------------------------------------------------------*
* CQS INITIALIZATION PROCLIB MEMBER.                                  *
*---------------------------------------------------------------------*
ARMRST=N               /* ARM SHOULD RESTART CQS ON FAILURE        */
CQSGROUP=CQSGX         /* GROUP NAME (XCF GROUP = GRUP1CQS)        */
SSN=C12A               /* CQS SUBSYSTEM NAME (CQSID = CQS1CQS)     */
STRDEFG=12X            /* GLOBAL STR DEFINITION MEMBER = CQSSG000  */
STRDEFL=12A           /* LOCAL STR DEFINITION MEMBER (CSLPLEX1)
*/
*---------------------------------------------------------------------*
* END OF MEMBER CQSIP12A                                              *
*---------------------------------------------------------------------*
```

- Example A-26 shows the parameters for CQSIP12C.

Example A-26 CQSIP12C CQS initialization parameters for I12C

```
*-------------------------------------------------------------------*
* CQS INITIALIZATION PROCLIB MEMBER.                                *
*-------------------------------------------------------------------*
ARMRST=N                /* ARM SHOULD RESTART CQS ON FAILURE        */
CQSGROUP=CQSGX          /* GROUP NAME (XCF GROUP = GRUP1CQS)        */
SSN=C12C                /* CQS SUBSYSTEM NAME (CQSID = CQS1CQS)     */
STRDEFG=12X             /* GLOBAL STR DEFINITION MEMBER = CQSSG000  */
STRDEFL=12C             /* LOCAL STR DEFINITION MEMBER  = CQSSL000  */
IMSPLEX(NAME=IM12X)     /* IMSPLEX NAME (CSLPLEX1)                  */
*-------------------------------------------------------------------*
* END OF MEMBER CQSIP12C                                            *
*-------------------------------------------------------------------*
```

The IMS startup member DFSPBxxx was also updated to point to the DFSSQxxx members using the **SHAREDQ=xxx** parameter. The DFSSQxxx member identifies the local CQS and the queue structures that IMS should use. Example A-27 shows the PROCLIB members for I12A.

Example A-27 IMS.PROCLIB member DFSSQ12A

```
CQS=IM12ACQS
CQSSSN=C12A,
EMHQ=I12X_EMHQ,
MSGQ=I12X_MSGQ,
SQGROUP=CQSGX
```

Example A-28 shows the PROCLIB members for I12C.

Example A-28 IMS.PROCLIB member DFSSQ12C

```
CQS=IM12CCQS,
CQSSSN=C12C,
EMHQ=I12X_EMHQ,
MSGQ=I12X_MSGQ,
SQGROUP=CQSGX
```

The checkpoint and structure recovery data sets were created by modifying the JCL from phase O of the IMS 12 Install/IVP to use our data set names.

B

Recent maintenance: IMS 12 APARs

With a new version of IBM Information Management System (IMS) reaching general availability, the maintenance stream becomes extremely important. Feedback from early users and development of additional functions cause a flux of APARs which enrich and improve the product code.

This appendix examines recent maintenance for IMS 12 that relates in a general way to new functionality and critical corrections.

Keep in mind that these lists of APARs represent a snapshot of current maintenance at the time of writing. As such, they may be incomplete or even incorrect by the time you read this publication; they are presented here simply to help identify areas of functional improvements. At the time of your installation, be sure to contact your IBM Service Representative for the most current maintenance. Also check RETAIN to determine the applicability of these APARs to your environment and to verify prerequisites and postrequisites.

Use the Consolidated Service Test (CST) as the base for service.

Table B-1 lists various APARs that provide functional enhancements to IMS 12. The list is not exhaustive, so check RETAIN and the IMS website for current information.

Table B-1 IMS 12 current function-related APARs

APAR #	Area	Text	PTF and notes
PK71135	OTMA	Activates the IMS synchronous callout function	UK50878
PM05243	DBRC	Coexistence IMS 10 to IMS 12	UK62970
PM05244	DBRC	Coexistence IMS 11 to IMS 12	UK62971
PM19025	Coexistence	Required for Common Service Layer (CSL) Resource Manager (RM) 1.3 on IMS 10	UK63960
PM19026	Coexistence	Required for CSL RM 1.4 on IMS 11	UK63964
PM23840	PSB changes	Apply to IMS 10 for coexistence with 12	UK64012

APAR #	Area	Text	PTF and notes
PM23843	PSB changes	Apply to IMS 12 for coexistence with 12	UK64013
PM24860	IMS Connect	Run under support	UK68052
PM26518		Internal APARs	UK62105
PM29809	Repository	Correct output of a **QUERY PGM NAME(*) SHOW(DEFN LOCAL)** command from RDDS	UK64166
PM31420	CICS	With the CCTL DRA Open Thread TCB enhancement, users of CCTL DRA (including CICS TS 4.2) are allowed DL/I processing on the application task control block (TCB)	UK70991
PM31779	Repository	Enablement of new functions for IMSRSC repository	UK68464
PM32390	GSAM	Apply to IMS 11 for coexistence with 12	UK65495
PM32394	IMS Connect	IMS Connect Extension (CEX) trace correction	UK65339
PM32548	GSAM	Apply to IMS 10 for coexistence with 12	UK65496
PM32766	Coexistence	Required for CSL RM 1.4 on IMS 11	UK68882
PM32805	Repository	Validate tran, routing code, and program attributes before writing to repository	OPEN
PM32951	Coexistence	Required for CSL RM 1.3 on IMS 10	UK68883
PM35503	Repository	**/CHECKPOINT FREEZE|DUMPQ|PURGE with LEAVEPLEX** interactions with the IMSRSC repository definitions	OPEN
PM37257	Repository	Add RM and **IMPORT** command preconditioning support for the Repository change list	UK70001
PM37894	DBRC	Enables IMS Database Recovery Facility (DRF) to build Fast Path Secondary Index databases from a data entry database (DEDB)	UK69302
PM41761	Repository	The **QUERY SHOW(DEFN)** command is showing extra incorrect information	UK70007
PM41952	Repository	Do not allow an RM enabled with Repository to come up if the Repository Server is not available	UK72427
PM42130	Repository	Enable change list support	OPEN
PM47327	CICS	Post requirement for PM31420	OPEN

Abbreviations and acronyms

ACB	application control block
ACBLIB	ACB library
ACEE	access control environment element
ACK	acknowledgement
AGN	Application Group Name
AIB	application interface block
AOI	Automated Operator Interface
AOP	automated operator program
AOS	APPC/OTMA SMQ
APF	authorized program facility
API	application programming interface
APPC	Advanced Program-to-Program Communication
APSB	allocate PSB
ARLN	Automatic RECON Loss Notification
ARM	Automatic Restart Manager
ASN	Abend Search and Notification
BMP	batch messaging program
BPE	Base Primitive Environment
BSAM	Basic Sequential Access Method
CA	certificate authority
CA	change accumulation
CA	control area
CBM	Component Business Modeling
CBPDO	Custom-built Product Delivery Option
CCF	Common Connector Framework
CCI	Common Client Interface
CCTL	coordinator controller
CDE	contents directory entry
CDSP	control block
CEX	Connect Extension
CGI	Common Gateway Interface
CI	Control Interval
CICS	Customer Information Control System
CLI	command-line interface
CLP	command-line processor
COMPID	component IDs
CPC	central processor complex
CP	central processor
CQS	Common Queue Server
CRL	certificate revocation list
CRSS	Conditional Reorganization Support Service
CSA	common storage area
CSL	Common Service Layer
CSM	Complete Status Message
CST	Consolidated Service Test
CSV	comma-separated value
CTG	CICS Transaction Gateway
DB2	Database 2
DBCTL	Database Control
DBD	database description
DBDS	database data sets
DBHDA	DB Historical Data Analyzer
DBMS	database management system
DBPCB	database PCB
DBRA	Database Resource Adapter
DBRC	Database Recovery Control
DBSR	Database Segment Restructure
DCCTL	Data Communications Control
DDEP	direct dependent
DDIR	database directory
DDM	Distributed Data Management
DEBs	data extent blocks
DEDB	data entry database
DLDP	DMB pool
DLET	Delete
DMB	data management block
DRA	database resource adapter
DRD	dynamic resource definition
DRDA	Distributed Relational Database Architecture
DRF	Database Recovery Facility
DSN	Data Source Name
DTP	distributed transaction processing
EAB	Enterprise Access Builder
EAI	enterprise application integration
EAS	extended addressing space
EAV	extended address volume

ECB event control block

ECNT extended communication name table

ECSA extended common service area

EINIT Early Initialization exit routine

EIS enterprise information system

EJB Enterprise JavaBeans

EMAC extended area control block

EMCS extended multiple console support

EMF Eclipse Modeling Framework

EOM End of Marketing

EOM end-of-memory

EOS end of support

EOT end-of-task

EPS extended pointer set

EPVT extended private

ESS Enterprise Storage Server

ETO Extended Terminal Option

EWLM Enterprise Workload Manager

EX6 execution phase 6

EXE execution

FDBR Fast Database Recovery

FIXCAT Fix Category

FMID function modification ID

FPA Fast Path Advanced

FPB Fast Path Basic Tools

FPO Fast Path Online

FPSI Fast Path Secondary Index

FT3 file tailoring phase 3

GA General Availability

GDG generation data set group

GEF Graphical Editor Framework

GN Get Next

GNP Get Next within Parent

GSAM generalized sequential access method

GU Get Unique

GUI graphical user interface

HALDB high availability large databases

HDAM hierarchical direct access method

HDC Hardware Data Compression

HDPC HD Pointer Checker

HDTA HD Tuning Aid

HIDAM hierarchical indexed direct access method

HPIC High Performance Image Copy

HPPC High Performance Pointer Checker

HSSR High Speed Sequential Retrieval

HTML Hypertext Markup Language

HTTP Hypertext Transfer Protocol

HTTPS HTTP Secure

IBM International Business Machines Corporation

IDE integrated development environment

IDRC improved data recording capability

IDp identity provider

IETF Internet Engineering Task Force

IFCC interface control checks

ILDS indirect list data set

ILK indirect list key

ILS isolated log sender

IMS Information Management System

IPCS Interactive Problem Control System

IPL initial program load

IRLM internal resource lock manager

IRM IMS request message

IRUR Internal Resource Usage Report

ISC intersystem communication

ISPF Interactive System Productivity Facility

ISRT Insert

ISV independent software vendor

ITKB IMS Tools Knowledge Base

ITSO International Technical Support Organization

IVP Installation Verification Program

IVPEX IVP Export Utility

J2C Java EE Connector Architecture

J2SE Java 2 Platform, Standard Edition

JAR Java archive

JBP Java batch processing

JCA Java Connector Architecture

JCC Java Common Client

JCL job control language

JDBC Java Database Connectivity

JDK Java Development Kit

JEE Java Platform, Enterprise Edition

JMP Java Message Program

JMS Java Message Service

JNDI	Java Naming and Directory Interface
JRE	Java Runtime Environment
JSP	JavaServer Pages
JTA	Java Transaction API
JTS	Java Transaction Service
JVM	Java Virtual Machine
Java EE	Java Platform Enterprise Edition
KBLA	Knowledge-Based Log Analysis
KSDS	key-sequenced data set
LAN	local area network
LDAP	Lightweight Directory Access Protocol
LDS	linear data set
LIU	Library Integrity Utility
LLLL	length value
LPAR	logical partition
LSQA	local system queue area
LU	logical unit
LU2	logical unit 2
LUNAME	logic unit name
MAS	multiple access spool
MCI	Message Control Information
MDB	message-driven bean
MFBP	message format buffer pool
MFS	Message Format Service
MOD	message output descriptor
MPP	message processing program
MR	Manage Resources
MSC	Multiple Systems Coupling
MSDB	main storage database
MTO	master terminal operator
MVS	Multiple Virtual System
NAK	negative acknowledgment
ODBA	Open Database Access
ODBC	Open Database Connectivity
ODBM	Open Database Manager
OLC	online change
OLDS	online data sets
OLDS	online log data set
OLR	Online Reorganization
OM	Operations Manager
OO	object-oriented
OSAM	overflow sequential access method
OTE	Open Transaction Environment
OTMA C/I	OTMA Callable Interface
OTMA	Open Transaction Manager Access
OTT	Open Thread TCB
PA	Performance Analyzer
PC	personal computer
PCB	program communication block
PCBs	program control blocks
PDIR	program directory
PDS	partitioned data set
PDU	Partition Definition Utility
PHIDAM	partitioned HIDAM
PI	problem investigator
PPT	program properties table
PRA	parallel RECON access
PSB	program specification block
PSP	Preventive Service Planning
PSSR	Physical Sequence Sort for Reload
PTF	program temporary fix
QoS	Quality of Service
RACF	Resource Access Control Facility
RAD	Rational Application Developer
RAR	resource adapter archive
RAS	Resource Access Security
RBA	relative byte address
RDDS	resource definition data set
RDS	repository data set
RDS	restart data set
RECON	recovery control
RLDS	recovery log data set
RM	Resource Manager
RMM	Request MOD Message
RRDS	relative record data set
RRS	Resource Recovery Services
RRS/MVS	Resource Recovery Services/MVS
RS	Repository Server
RSM	request status message
RSR	Remote Site Recovery
RVA	RAMAC Virtual Array
RYO	Roll-Your-Own
SAF	System Authorization Facility
SAML	Security Assertion Markup Language
SAS	secondary address space

SCI Structured Call Interface

SDEP sequential dependent segment

SDK software development kit

SEVT structure event trace table

SGML Standard Generalized Markup Language

SHISAM simple hierarchical sequential access method

SLA service level agreement

SLDS system log data set

SLSB stateless session bean

SMB scheduler message block

SMF System Management Facilities

SMP/E System Modification Program/Extended

SMQ shared message queue

SMU Security Maintenance Utility

SNA Systems Network Architecture

SOA service-oriented architecture

SOMA Service Oriented Modeling and Architecture

SPE small programming enhancement

SPI system programming interface

SPMN Space Monitor

SPOC single point of control

SQ shared queues

SQLJ SQL for Java

SRB service request block

SREL same System Release

SSA segment search argument

SSL Secure Sockets Layer

SSPM sysplex serialized program management

STE storage tracking element

STR structure trace table

STSN set and test sequence numbers

SVL Silicon Valley Laboratories

SXPL Standard User Exit Parameter List

SYSDEF system definition

SYSID system identifier

TCB task control block

TCB thread task control block

TCO Time-Controlled Operations

TCP/IP Transmission Control Protocol/Internet Protocol

TM Transaction Manager

TMRA Transaction Manager Resource Adapter

TMS Transport Manager System

TOSI Tools Online System Interface

TPIPE transaction pipe

TSO Time Sharing Option

TTL time to live

UI user interface

UML Unified Modeling Language

UOR Unit of Recovery

UOW unit of work

VIPA Virtual IP Addressing

VSAM Virtual Storage Access Method

VTAM Virtual Telecommunications Access Method

W3C World Wide Web Consortium

WADS write-ahead data set

WAN wide area network

WFI wait for input

WLM workload manager

WSDL Web Services Description Language

WTOR write to operator with reply

WWW World Wide Web

XCF cross-system coupling facility

XMI XML Metadata Interchange

XML Extensible Markup Language

zAAP z Application Assist Processor

zIIP z9 Integrated Information Processors

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Some publications referenced in this list might be available in softcopy only.

- *IBM CICS Scalability: New Features in V4.2*, REDP-4787
- *Federated Identity Management and Web Services Security with IBM Tivoli Security Solutions*, SG24-6394
- *IMS 11 Open Database*, SG24-7856
- *IMS Version 11 Technical Overview*, SG24-7807
- *IBM z/OS V1R12 Communications Server TCP/IP Implementation: Volume 4 Security and Policy-Based Networking*, SG24-7899

You can search for, view, download or order these documents and other Redbooks, Redpapers, Web Docs, draft and additional materials, at the following website:

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Other publications

These publications are also relevant as further information sources:

- *IBM Fast Path Solution Pack for z/OS V1R1, IMS High Performance Fast Path Utilities User's Guide,* SC19-2914
- *IMS and SOA Executive Overview*, GC19-2516
- *IMS High Performance Fast Path Utilities for z/OS,* SC18-9869-04
- *IMS Version 12 Application Programming*, SC19-3007
- *IMS Version 12 Application Programming APIs*, SC19-3008
- *IMS Version 12 Commands, Volume 1: IMS Commands A-M*, SC19-3009
- *IMS Version 12 Commands, Volume 2: IMS Commands N-V*, SC19-3010
- *IMS Version 12 Commands, Volume 3: IMS Component and z/OS Commands*, SC19-3011
- *IMS Version 12 Communications and Connections*, SC19-3012
- *IMS Version 12 Database Administration*, SC19-3013
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- *IMS Version 12 Diagnosis*. GC19-3015
- *IMS Version 12 Exit Routines*, SC19-3016
- *IMS Version 12 Installation,* GC19-3017

- *IMS Version 12 License Programming Specifications*, GC19-3024
- *IMS Version 12 Messages and Codes, Volume 1: DFS Messages*, GC18-9712
- *IMS Version 12 Messages and Codes, Volume 2: Non-DFS Messages*, GC18-9713
- *IMS Version 12 Messages and Codes, Volume 3: IMS Abend Codes*, GC19-9714
- *IMS Version 12 Messages and Codes, Volume 4: IMS Component Codes*, GC19-9715
- *IMS Version 12 Operations and Automation*, SC19-3018
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- *IMS Version 12 System Administration*, SC19-3020
- *IMS Version 12 System Definition*, GC19-3021
- *IMS Version 12 System Programming APIs*, SC19-3022
- *IMS Version 12 System Utilities*, SC19-3023

Online resources

These web sites are also relevant as further information sources:

- IBM Information Management Software for z/OS Solutions Information Center
  `http://publib.boulder.ibm.com/infocenter/dzichelp/v2r2/index.jsp`
- Whitepaper *WebSphere MQ for z/OS and IMS Transaction Expiration*
  `http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD105559`
- IMS Tools Product Page
  `https://www-304.ibm.com/support/docview.wss?uid=swg27020942`
- Product Lifecycle for DB2 and IMS Tools
  `https://www-304.ibm.com/support/docview.wss?rs=434&uid=swg27008621`

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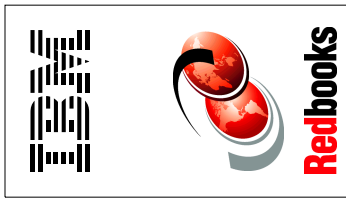

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