IBM® Information Management Software

IBM IMS Solutions for Automating Database Management

- Understand main DBA tasks
- Follow sample processes
- Apply the use of tools to simplify processes

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

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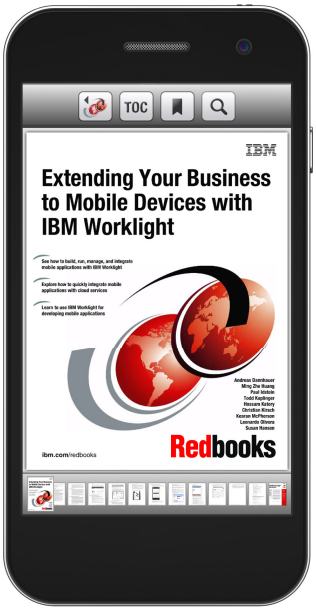

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Preface

Over the last few years, IBM® IMS™ and IMS tools have been modernizing the interfaces to IMS and the IMS tools to bring them more in line with the current interface designs. As the mainframe software products are becoming more integrated with the Windows and mobile environments, a common approach to interfaces is becoming more relevant. The traditional 3270 interface with ISPF as the main interface is no longer the only way to do some of these processes. There is also a need to provide more of a common looking interface so the tools do not have a product-specific interface. This allows more cross product integration.

Eclipse and web-based interfaces being used in a development environment, tooling using those environments provides productivity improvements in that the interfaces are common and familiar. IMS and IMS tools developers are making use of those environments to provide tooling that will perform some of the standard DBA functions. This book will take some selected processes and show how this new tooling can be used. This will provide some productivity improvements and also provide a more familiar environment for new generations DBAs. Some of the functions normally done by DBA or console operators can now be done in this eclipse-based environment by the application developers. This means that the need to request these services from others can be eliminated.

This IBM Redbooks® publication examines specific IMS DBA processes and highlights the new IMS and IMS tools features, which show an alternative way to accomplish those processes. Each chapter highlights a different area of the DBA processes like:

- PSB creation
- Starting/stopping a database in an IMS system
- Recovering a database
- Cloning a set of databases

Authors

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

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James Kelly is Senior Technical Services Professional based in California for IBM Global Services. Jim has over 35 years of experience as an application developer and designer and as a database administrator for the last 23 years supporting applications using IMS Full Function, IMS Fast Path, and DB2. He has worked at IBM for 7 years and previously worked for a large telecommunications company. He is a co-author of *IMS Version 7 High Availability Large Database Guide*, SG24-5751.

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1

IMS modernization and tools for autonomics

The mainframe platform has been changing over the years as business demands more and a variety of ways to access data. The back-office processes have been replaced or are being transformed into modern online, mobile, and “from everywhere, any time” processes to meet changing customer demand for data. IMS and IMS tools are also ongoing the same transformation. The batch-oriented processes to access data are being transformed into modern open database access processes.

These transformations in IMS terms include access from:

- Java based web services environments using SOA architecture
- Open database access architecture to allow real-time SQL access to IMS databases
- Business analytics processes like IBM Cognos® and other analytic engines to drive access to IMS data
- Mobile computing applications to allow a host of mobile devices to read and update IMS databases in real time.

In this chapter, we provide an overview of the evolution of tools and features of IMS.

In this book, we show some scenarios that are related to database administration tasks where we explore the autonomics provided by some of the tools. More details about the tools used in this book are provided in Appendix A, “Referenced IMS tools” on page 165.

1.1 Architecture changes

The architectures have fundamentally changed how IMS data needs to be available in real time as shown in Figure 1-1.

Figure 1-1 "New World" access environments for IMS data

The changes have not been limited to how IMS data is accessed. The newer generation of application developers is familiar with new tools and processes developed for the Internet and Java based application environment outside the mainframe. These tools are PC-based and make use of Eclipse and web browser developments environments. Mainframe programmers can now have access to this dynamic development environment with some of the new features of IMS and IMS tools and other IBM tools.

Mainframe application development environments are not common at universities or other advanced technical institutions. Application development education is mostly based around PC and web-based tooling.

The IBM tools are moving to a more autonomic process. The tools are able now to help highlight information and critical or potentially critical situations and help provide solutions for those issues.

IBM Tools Base for z/OS previously known as IBM IMS Tools Base for z/OS, contains common infrastructure used by IBM DB2 and IMS Tools for z/OS. Tools Base is a no-charge product that contains common infrastructure components Tools Base components to support autonomics, interface modernization, and other supplementary tools.

The common functionality provided by Tools Base is required by all IMS Tools solution packs and must be installed before the solution packs are used. Tools Base is not delivered as part of the solution packs and must be ordered separately. Tools Base exploits the Autonomics Director to support automation of tools execution for IMS Database Reorganization for z/OS and the web-based user interface from Administration Console to provide extended insight into the health and availability of IMS databases.

Figure 1-2 shows the IBM IMS tools solution packs included in this modernization.

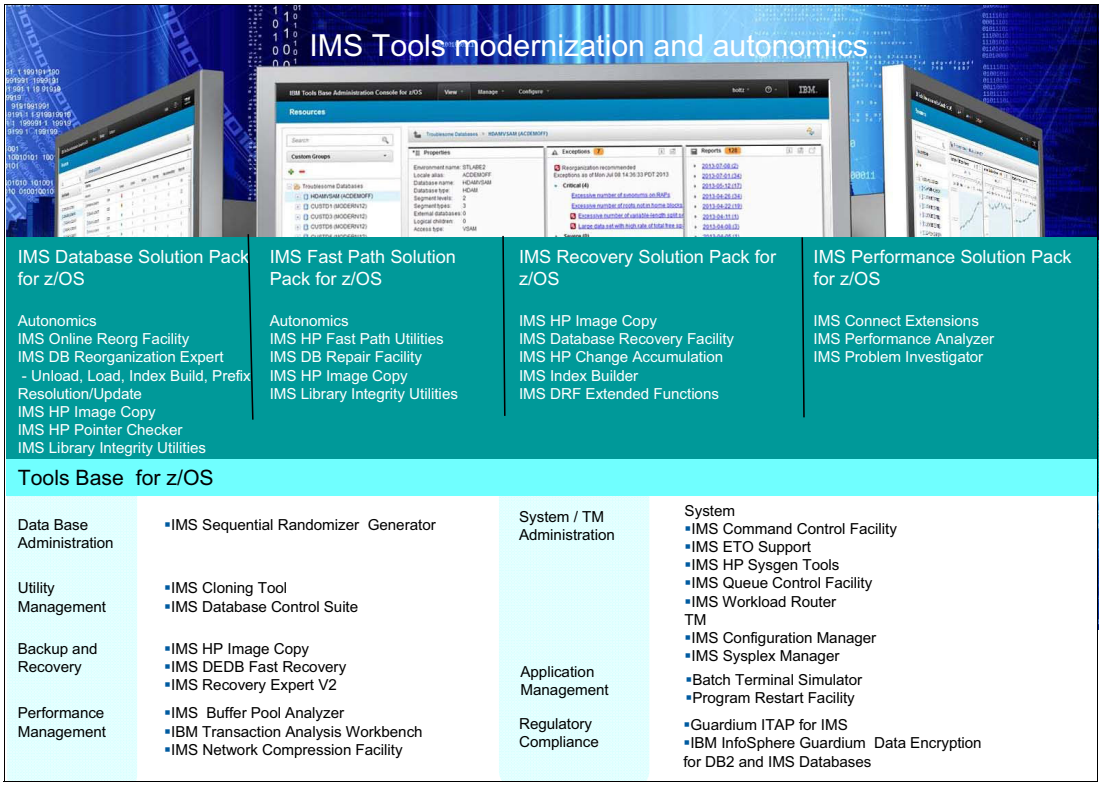

Figure 1-2 IMS modernization and tools for autonomics

1.2 Tools for IMS developers

Enhancements support open integration technologies to enable new application development and extend access to IMS transactions and data.

Figure 1-3 on page 4 shows some of these new features and tools including:

- Debug Tool for z/OS
- IMS Batch Terminal Simulator
- IBM Rational® Developer for System z®
- IMS Enterprise Suite Explorer for Development

IBM Debug Tool for z/OS enables you to examine, monitor, and control the execution of C, C++, COBOL, and PL/I programs providing multiple conditional and unconditional breakpoints, step mode debugging, and the ability to monitor and update variables and storage. Debug Tool is an interactive source-level debugging tool for compiled applications in various development environments supporting batch, TSO, IBM CICS®, DB2, DB2 stored procedures, IMS, and UNIX System Services.

IBM IMS Batch Terminal Simulator for z/OS is a powerful test facility with debugging features for IMS, DB2, and IBM WebSphere® MQ applications. It simulates transaction processing in batch mode and generates listings containing screen images of transactions including data, user identification information, and timestamp through an audit report program.

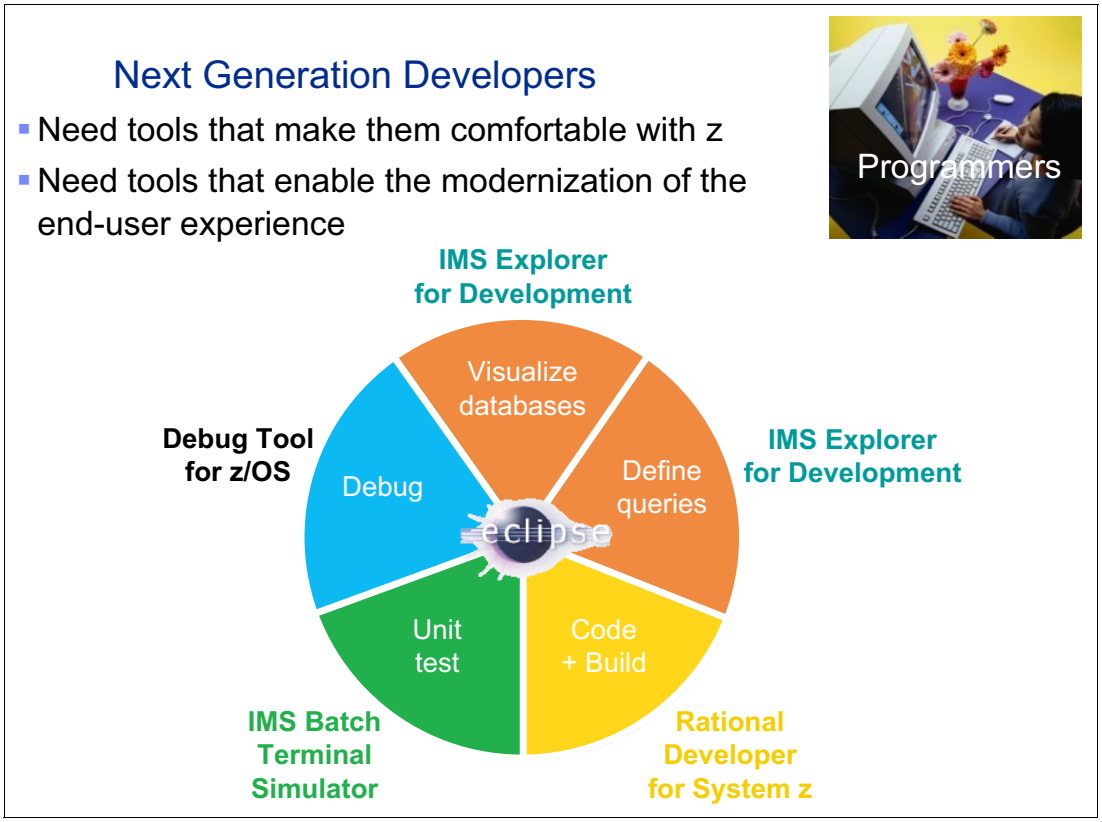

Figure 1-3 New features and tools

IBM Rational Developer for System z provides an enhanced toolset for creating and maintaining z/OS applications quickly and efficiently. This rich set of COBOL, PL/I, C++, assembler, and Java development tools designed for batch, CICS, IMS, and DB2 environments are optimized for the workstation-based Eclipse platform. Developers can take advantage of a modern, interactive, and integrated environment for enhanced productivity when creating high-quality mainframe applications.

Rational Developer for System z provides the following features depicted in Figure 1-4 on page 5:

- Modern, simple-to-use System z application development tools that support the design, creation, and maintenance of mainframe applications.
- A fully integrated source level debugger that enables users to step through the z/OS application, monitor, and modify variables, set breakpoints during or before a debug session, and inspect program memory.
- Optimized tooling support for IBM CICS, IMS, and DB2 runtimes.
- Source control and collaborative lifecycle management systems integration for streamlining development processes.
- Enhanced application structural and quality analysis tools that help to produce high-quality code more quickly.

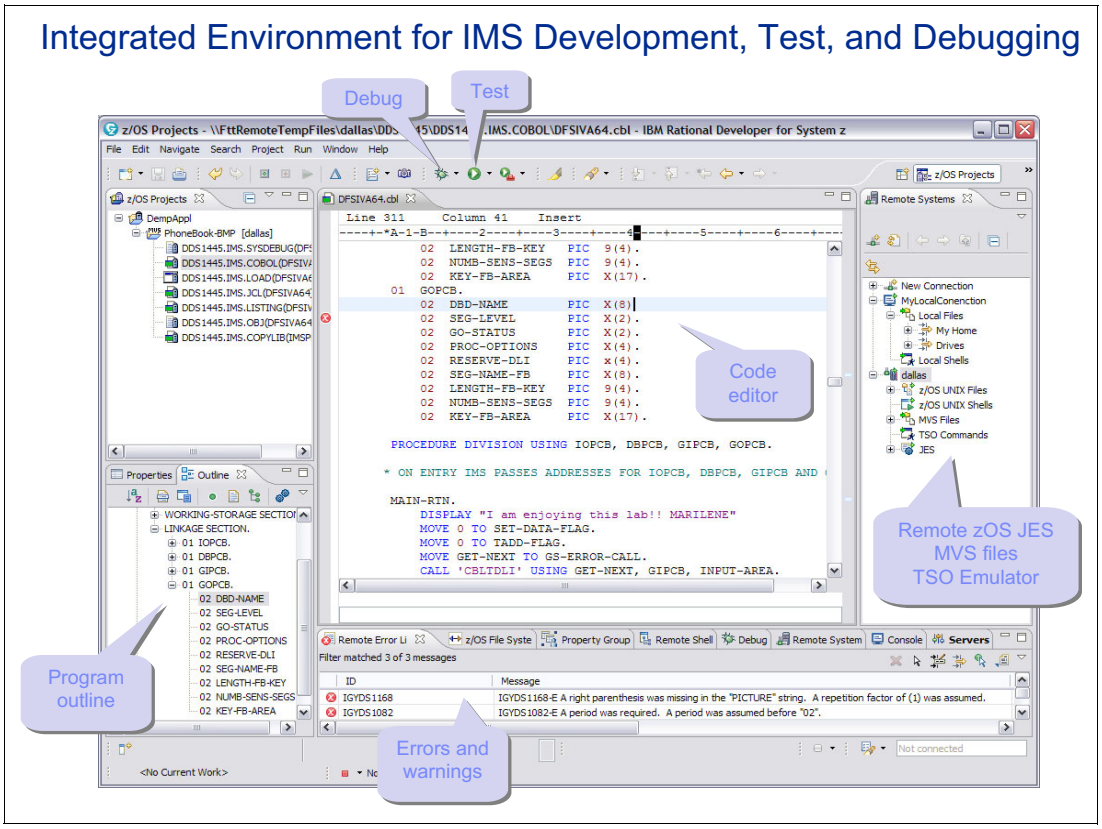

Figure 1-4 IBM Rational Developer for System z

The **IMS Explorer for Development** is an Eclipse-based tool that can be implemented in a stand-alone Eclipse environment or as shell sharing with Rational Developer for System z. The IMS Explorer for Development provides graphical interface to IMS database definitions. The DBA has a visual representation of the database structure. It can also be used to access IMS databases using an SQL interface. The SQL interface to retrieve data is much easier to code than the old DFSDDLT0[1] input control cards (see Figure 1-5 on page 6).

The use of IMS Explorer for Development is described in Chapter 2, “Defining a PSB” on page 13.

[1] DFSDDLT0 is an IMS application program test tool that issues calls to IMS based on control statement information.

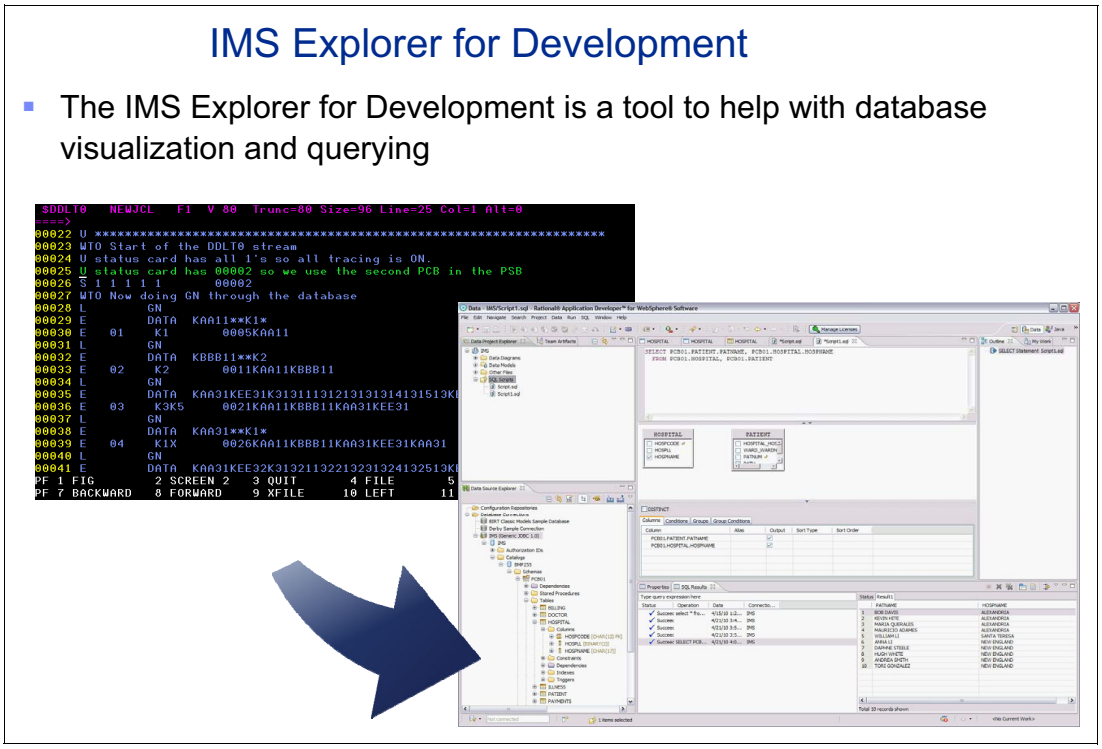

Figure 1-5 IMS Explorer for Development query interface

1.3 Tools for IMS system programmers

Not only is the application development environment going through a modernization but the systems administration and operations environments are also evolving.

The IBM Management Console for IMS and DB2 for z/OS is a web-based tool that allows IMS systems programmers and IMS operators to have a graphical view of the IMS and IMSplex environments. A single web page can contain a graphical view of multiple IMSplexs from multiple sysplexs. From this view, IMS resource status can be queried, changed, and detailed information be seen. IMS resources like IMS databases, RECON data sets, transactions, and related address space can all be viewed.

Figure 1-6 on page 7 shows an example of the Console web page of the Explorer for Administration feature.

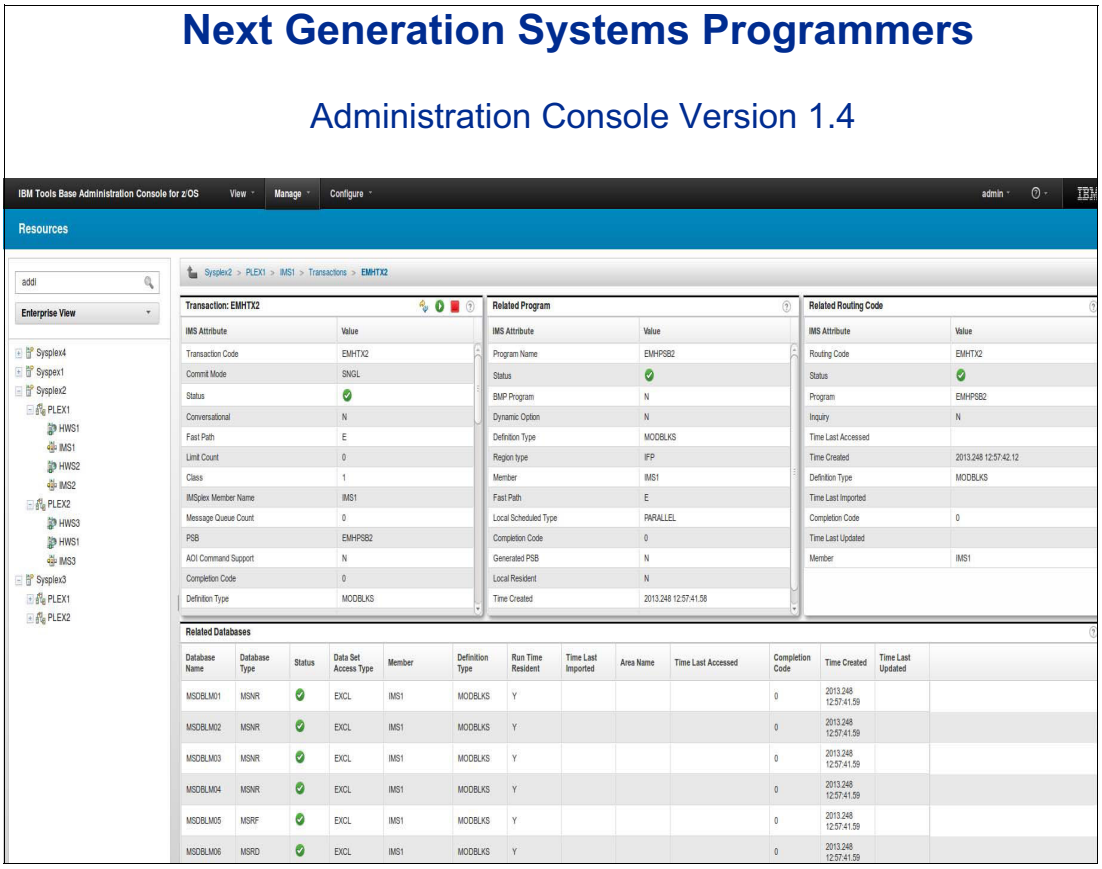

Figure 1-6 Explorer for Administration main panel

The Management Console provides a command interface that allows the operator to manage IMS systems and individual resources. The command interface makes use of the IMS type 2 commands to provide a robust operating environment. See Figure 1-7 on page 8.

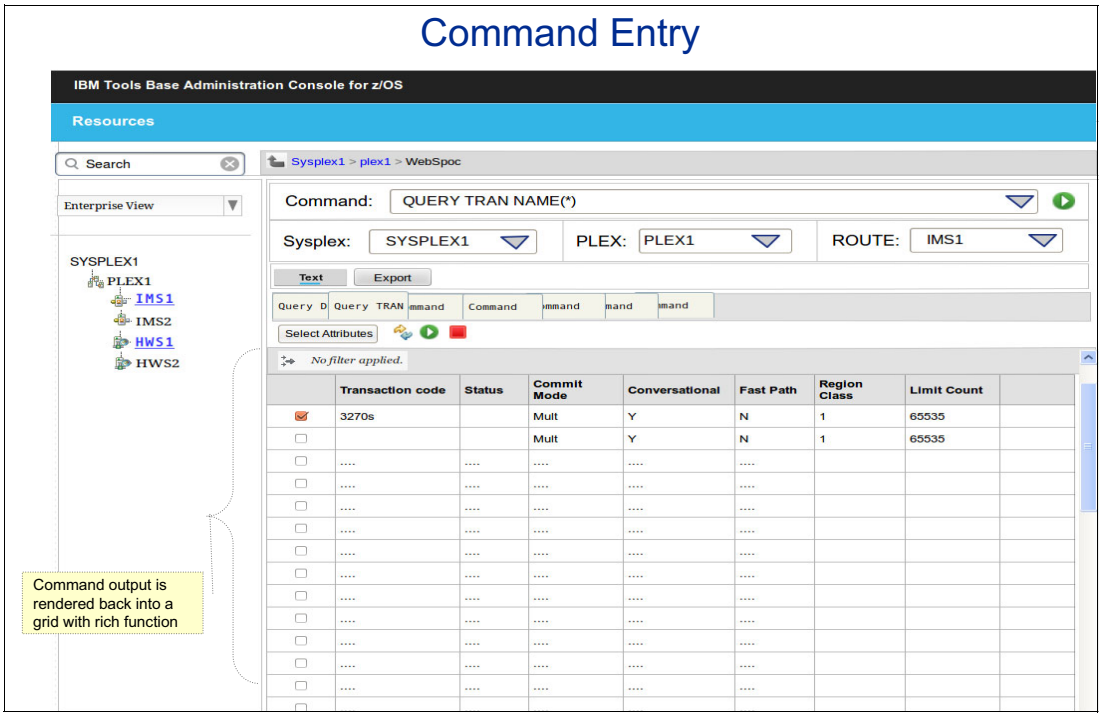

Figure 1-7 Explorer for Administration Command Interface

The Console can be used to modify the status of individual resources like a database. A panel-driven interface allows the operator to enter commands and sub-parameters as shown in Figure 1-8.

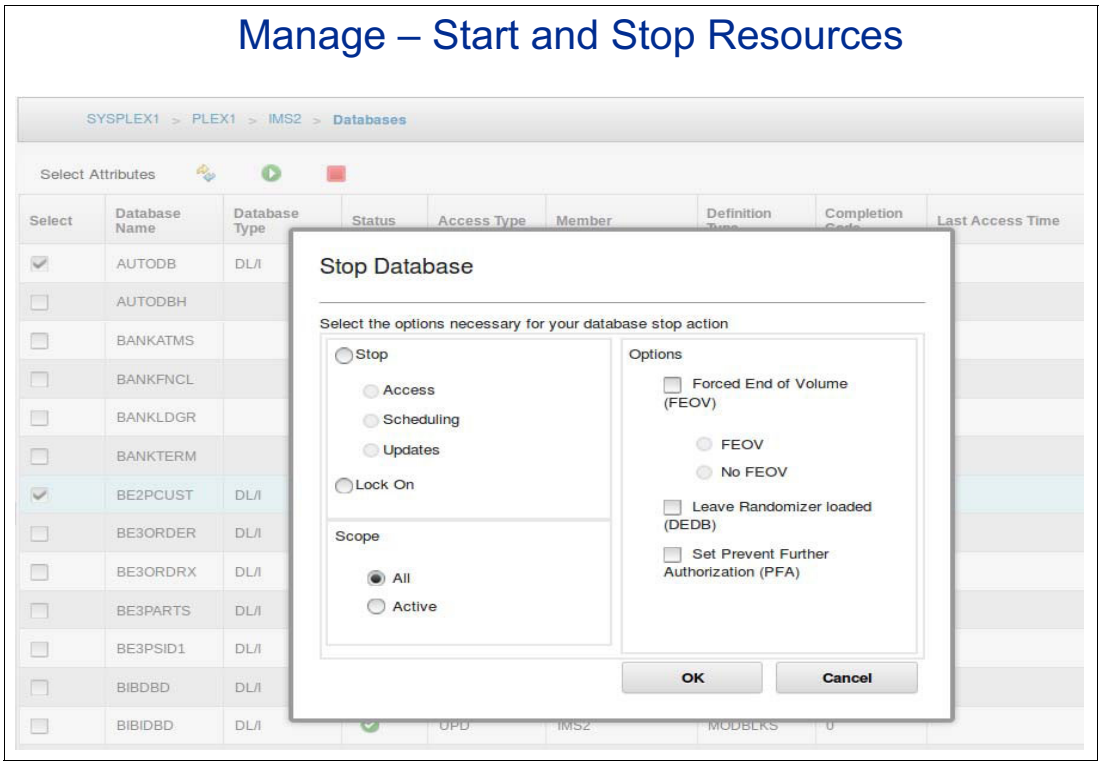

Figure 1-8 IMS Command interface - Stopping a database

1.4 Tools for IMS database administration

The DBA processes are also under the transformation. The DBA is having to do more with less. The number of IMS skilled DBAs is also shrinking as more DB2 and other platform DBAs are being given IMS responsibilities. The IBM IMS tool Knowledge Base provides an Autonomics Director and Administrations Console. The Interactive System Productivity Facility (ISPF) environment is still available but some of the new generations DBAs who are used to non-mainframe environments might find the consoles more familiar. See Figure 1-9.

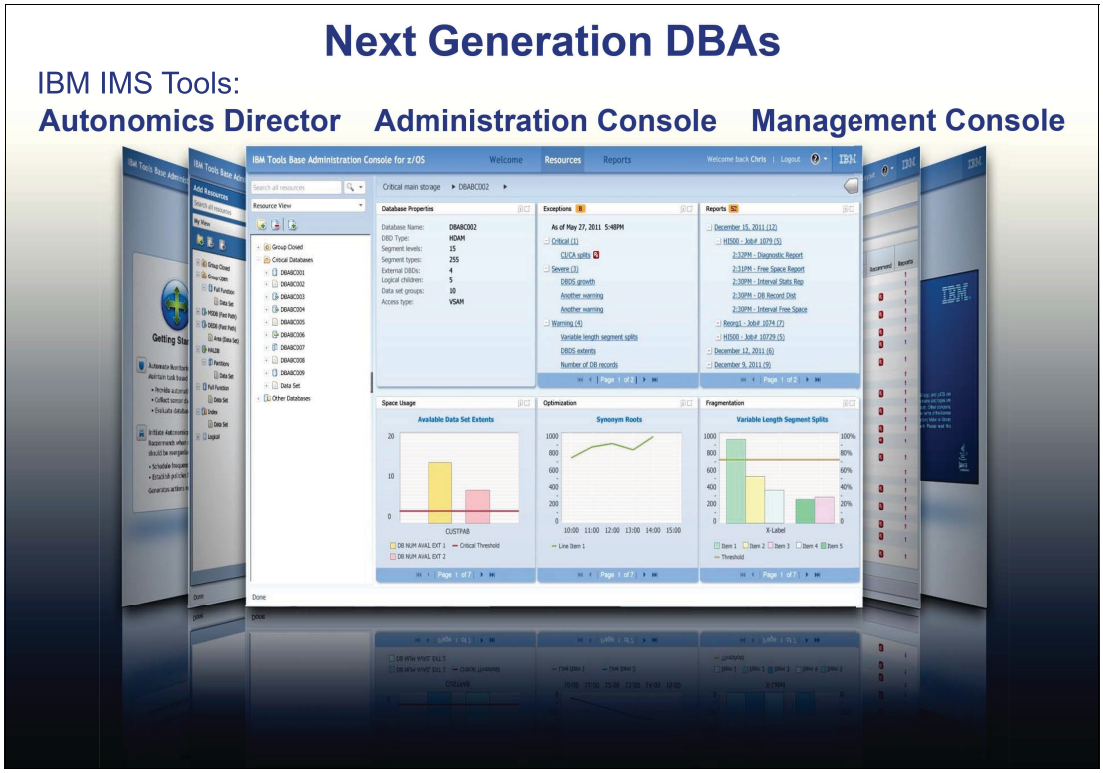

Figure 1-9 IBM IMS Tools Environments

The IBM Management Console for IMS and DB2 of z/OS provides a complete integrated environment for IMS and the IMS tools to give the DBA complete views. The following slides give a quick overview of the integration capabilities. See Figure 1-10 on page 10 and Figure 1-11 on page 11. Some of the features are discussed in Chapter 7, “Health management for IMSplex” on page 143.

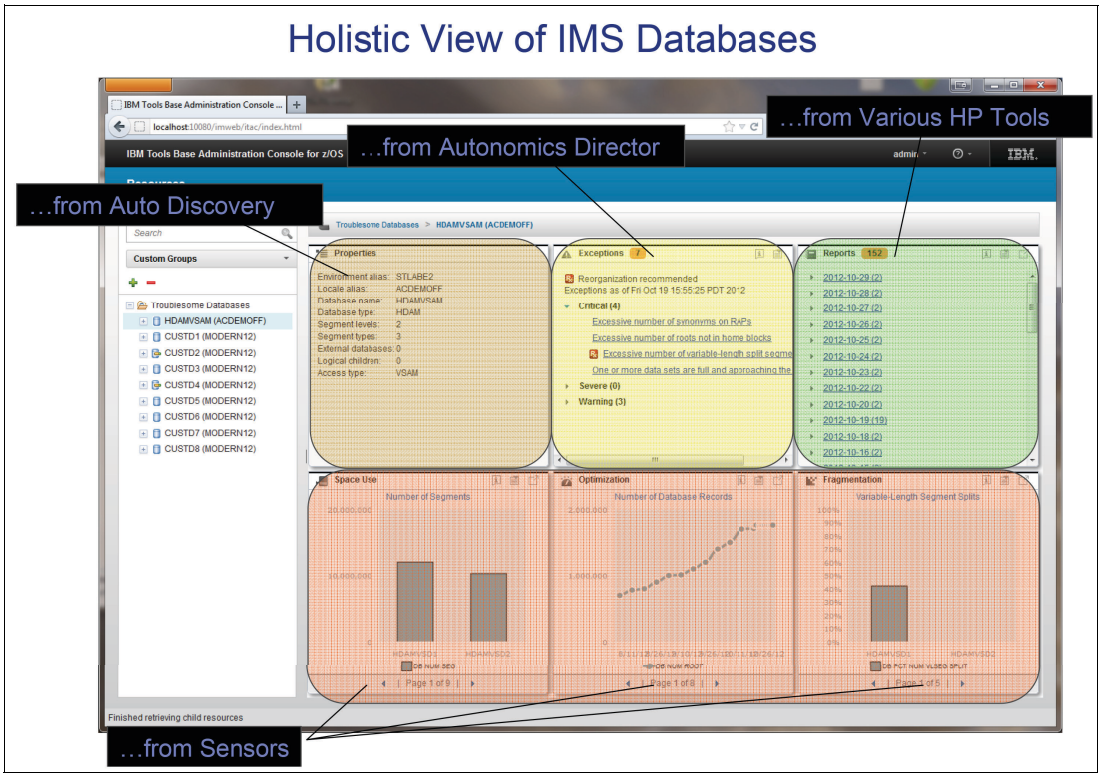

Figure 1-10 Database view from the Management Console

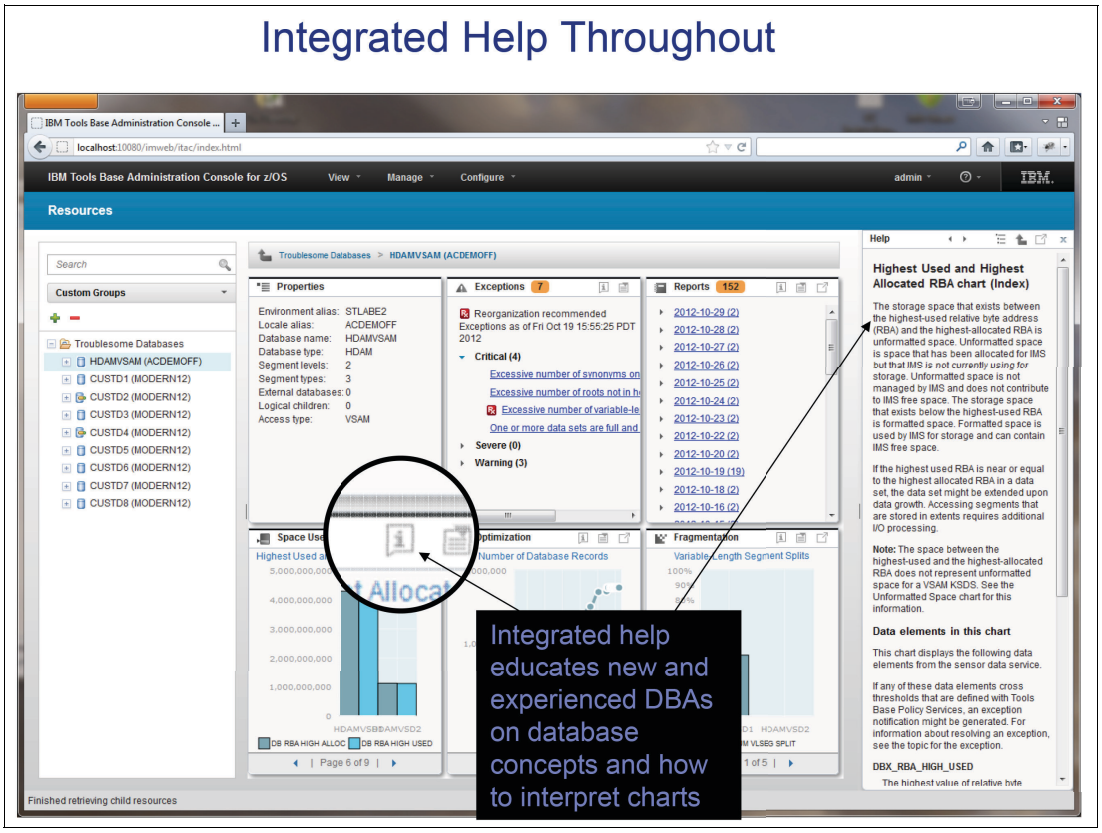

Figure 1-11 Management Console Help

2

Defining a PSB

This chapter describes automated processes to define a program specification block (PSB) in the IMS system in a development environment, utilizing graphical editors and dynamic tools to design the PSB and interact with the IMS.

The chapter contains the following sections:

- PSB creation using IMS Enterprise Suite Explorer for Development
- PSBGEN
- Combined ACBGEN utility and Catalog Populate utility
- Online Change Copy utility and Batch Single Point of Contact utility
- Define a BMP to the IMS system
- Listing IMS Catalog database descriptors and PSBs using SQL Query Builder Function of IMS Suite Enterprise Explorer for Development

2.1 PSB creation using IMS Enterprise Suite Explorer for Development

A PSB is the logical structure to define the program view and authority access to the database. These definitions are coded in one or more program control blocks (PCBs) into the PSB.

The tool that we use to create the PSB is the IMS Enterprise Suite Explorer for Development Version 3.1 (IMS Explorer). This tool provides graphical editors to visualize and edit the definitions of PSBs and PCBs.

In this scenario, we create a new PSB called T1TCUST using the same PSB definition from the existing T1ACUST PSB. T1ACUST already resides in the development environment.

The only difference between T1ACUST and T1TCUST is a segment sensitivity. Segment sensitivity can prevent an application program from accessing all the segments in a particular hierarchy.

We remove the segment sensitivity from CUSTORDN segment for T1TCUST PSB. This way, T1TCUST PSB has no CUSTORDN view and access.

Before you import your PSB and its correspondent DBD from the IMS catalog, you need to set up an IMS catalog connection.

To set up an IMS catalog connection, you need to perform the following steps:

1. In the Data Source Explorer, right-click the Database Connections folder, and click New.
2. Select IMS as the database manager and the IMS Universal JDBC driver as the JDBC driver. Enter the connection properties.

   Figure 2-1 shows the properties used in this scenario.

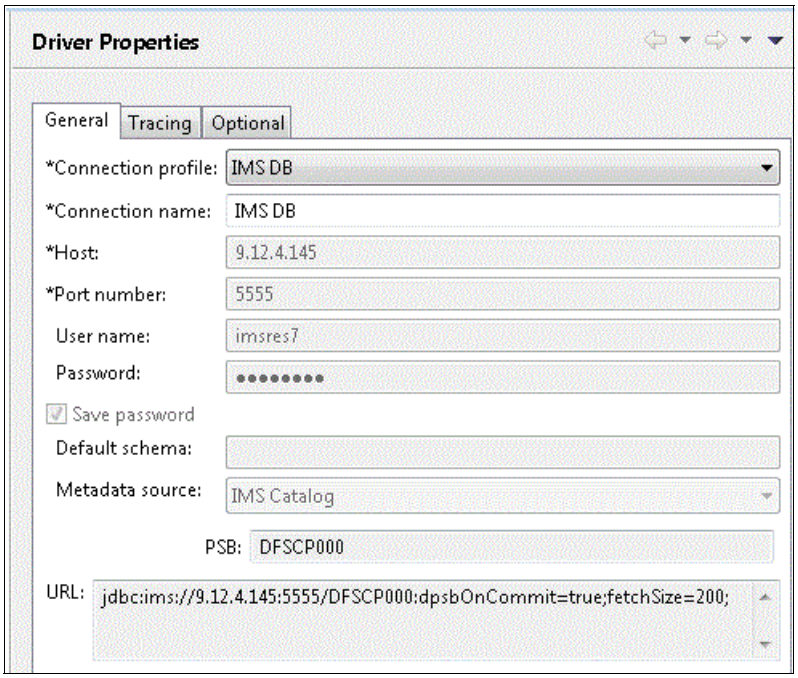

Figure 2-1 IMS catalog connection properties

3. After an IMS catalog connection has been created, create a new IMS Explorer Project. To create an IMS Explorer Project, right-click the Project Explorer window (upper left), and select **New** → **Project** to start the Create a New Project wizard. (Figure 2-2).

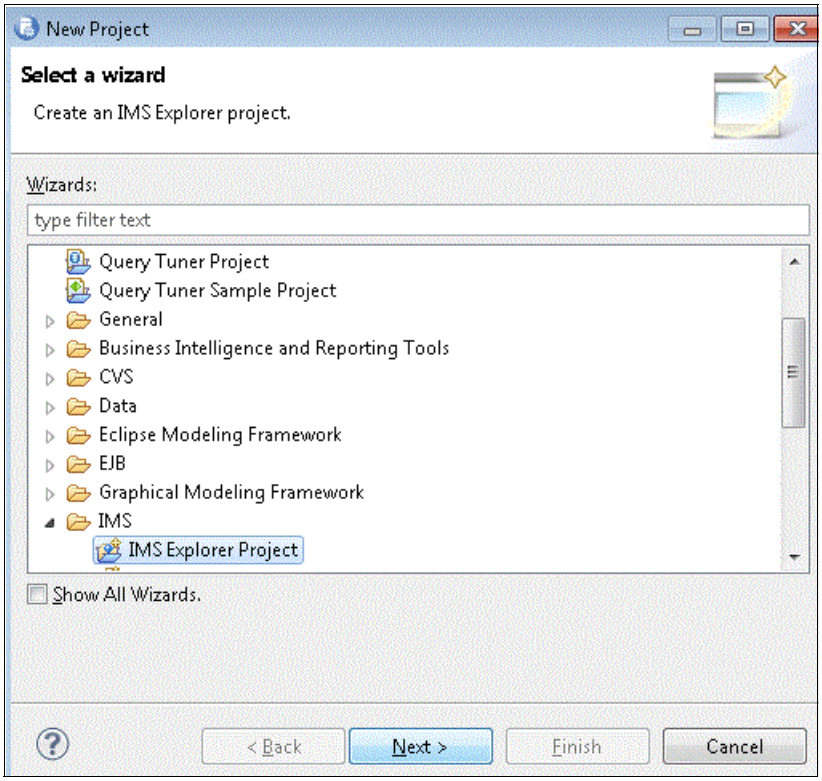

Figure 2-2 Creating New IMS Explorer Project

4. In the next window, see Figure 2-3 on page 16, select **IMS Explorer Project** wizard, and click **Next**.

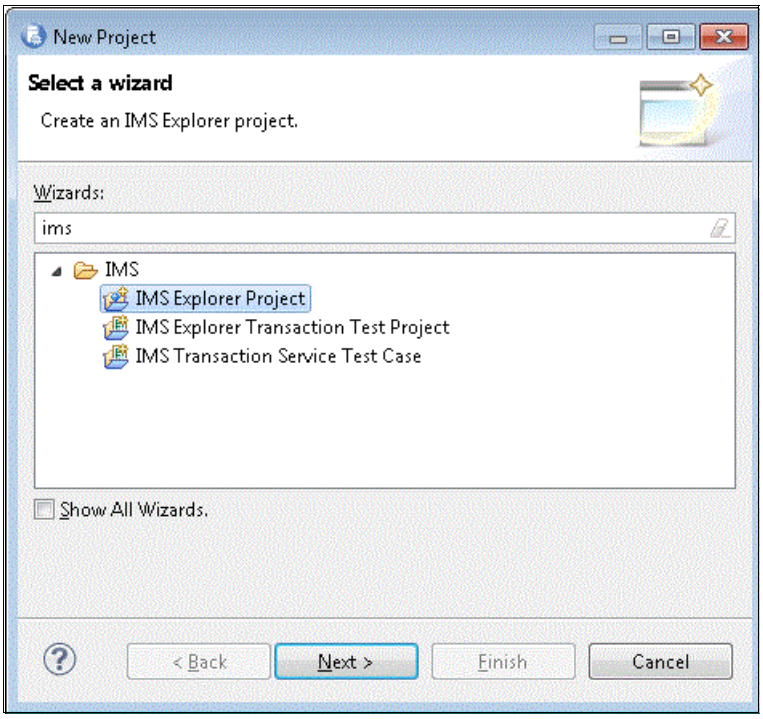

Figure 2-3 IMS Explorer Project

5. Enter a name for your IMS Explorer Project. See Figure 2-4.

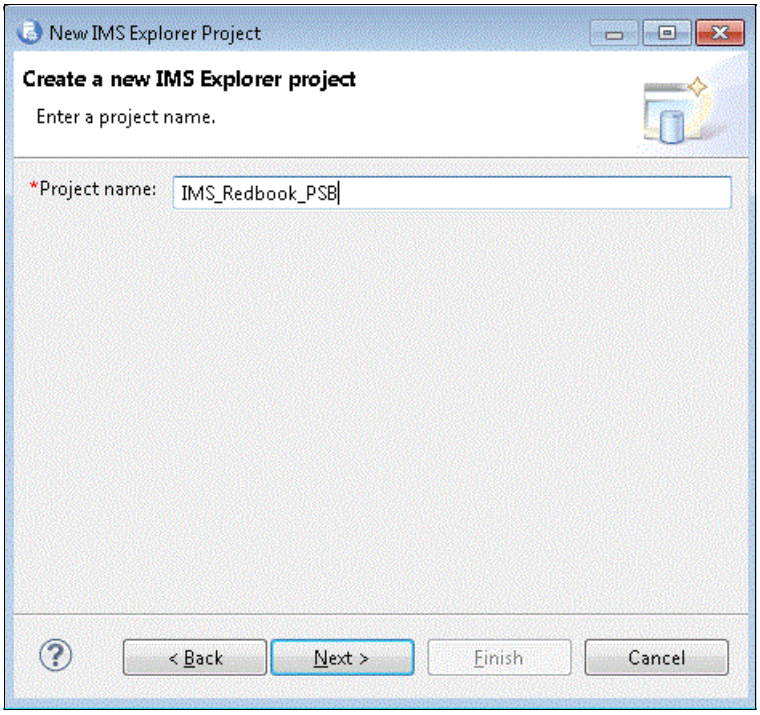

Figure 2-4 IMS Explorer Project name

6. With a right-click over the Project IMS_Redbook_PSB and selecting IMS Resources option, you are able to import a PSB from IMS Catalog to IMS Explorer tool.

The imported PSB is used as a reference to clone a new PSB and when you import a specific PSB from IMS Catalog, automatically the IMS Explorer tool brings the correspondent DBD. In this scenario, the referenced DBD is T1CUST.

Figure 2-5 shows T1ACUST PSB being imported from IMS Catalog to IMS Explorer tool to be cloned and its correspondent T1CUST DBD.

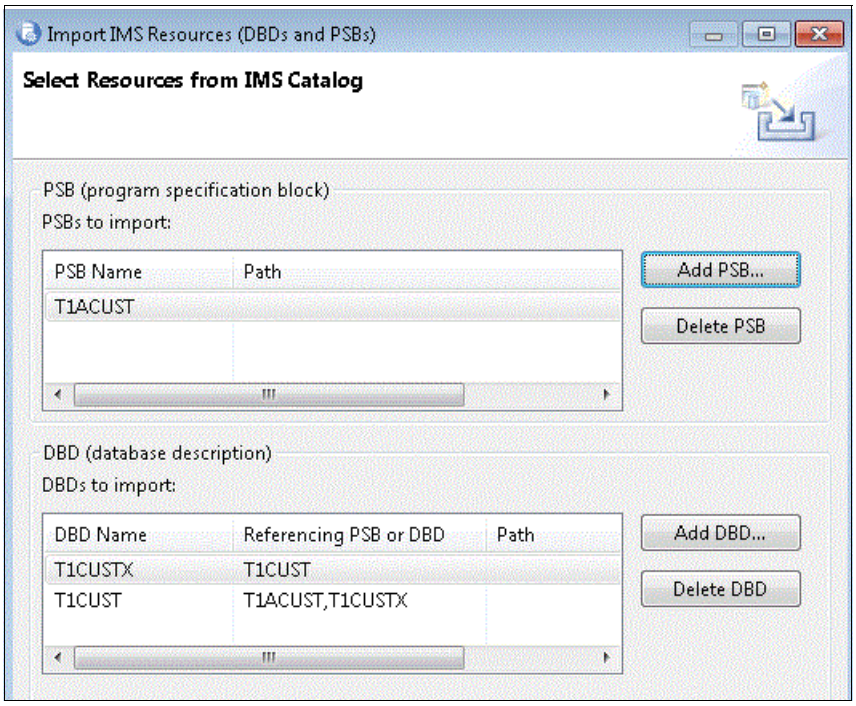

Figure 2-5 Import IMS Resources (DBDs and PSBs)

7. The next step is to create T1TCUST PSB using T1ACUST PSB that was recently imported from CATALOG.

   With a right-click over T1ACUST PSB, we can select the IMS Explorer option and then Create a new PSB. See Figure 2-6 on page 18.

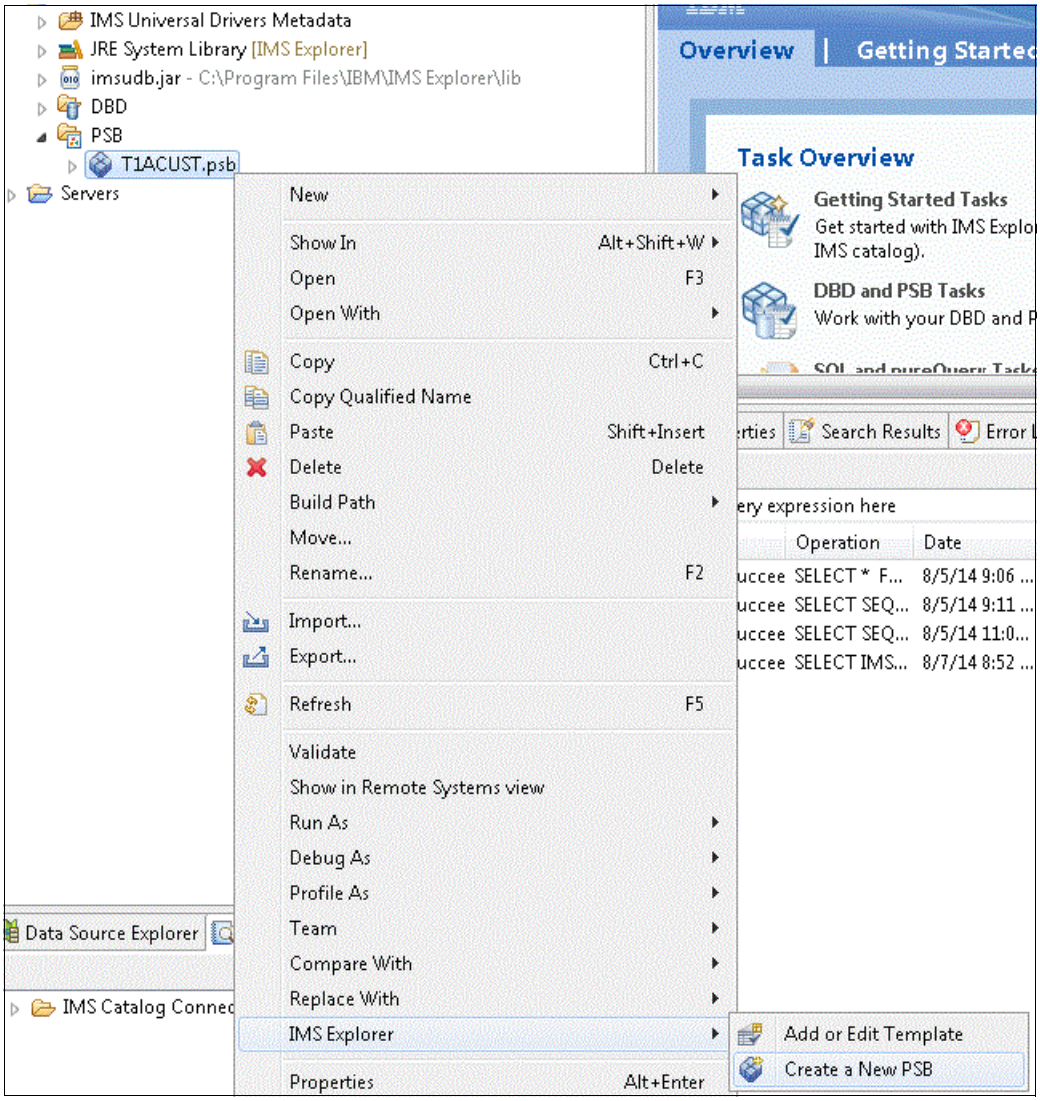

Figure 2-6 Create New PSB

Figure 2-7 on page 19 shows T1TCUST being created using T1ACUST definitions.

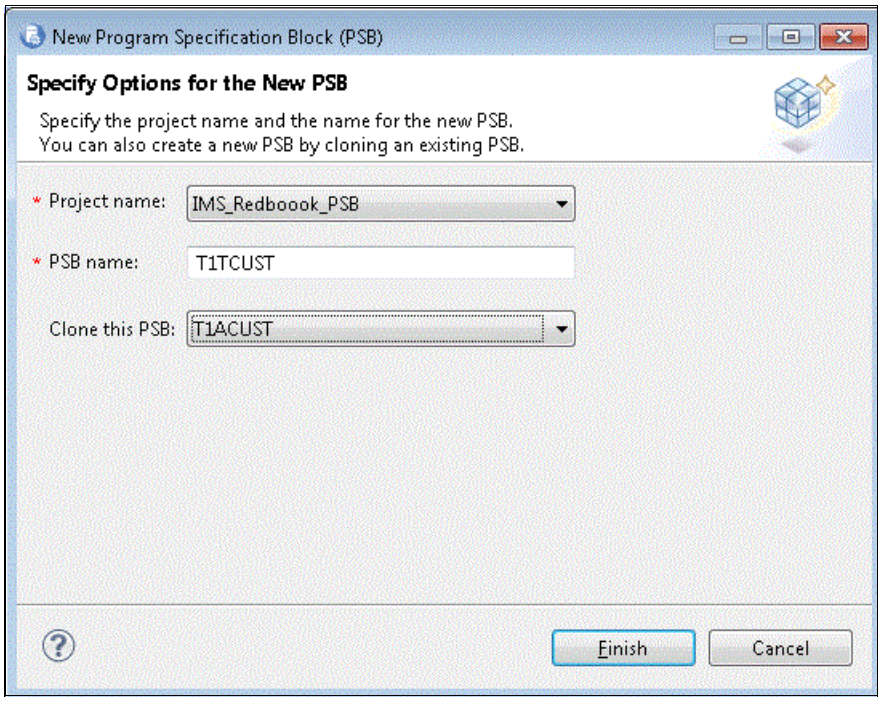

Figure 2-7 New PSB

The PCB Graphical Editor has all PCB information, like hierarchy structure, databases that this PCB accesses, segments hierarchy, field names.

8. In order to specify Segment Sensitivity on the CUSTORDN segment, you need to click the check box that belongs to CUSTORDN. Figure 2-8 on page 20 shows that CUSTORDN is not checked.

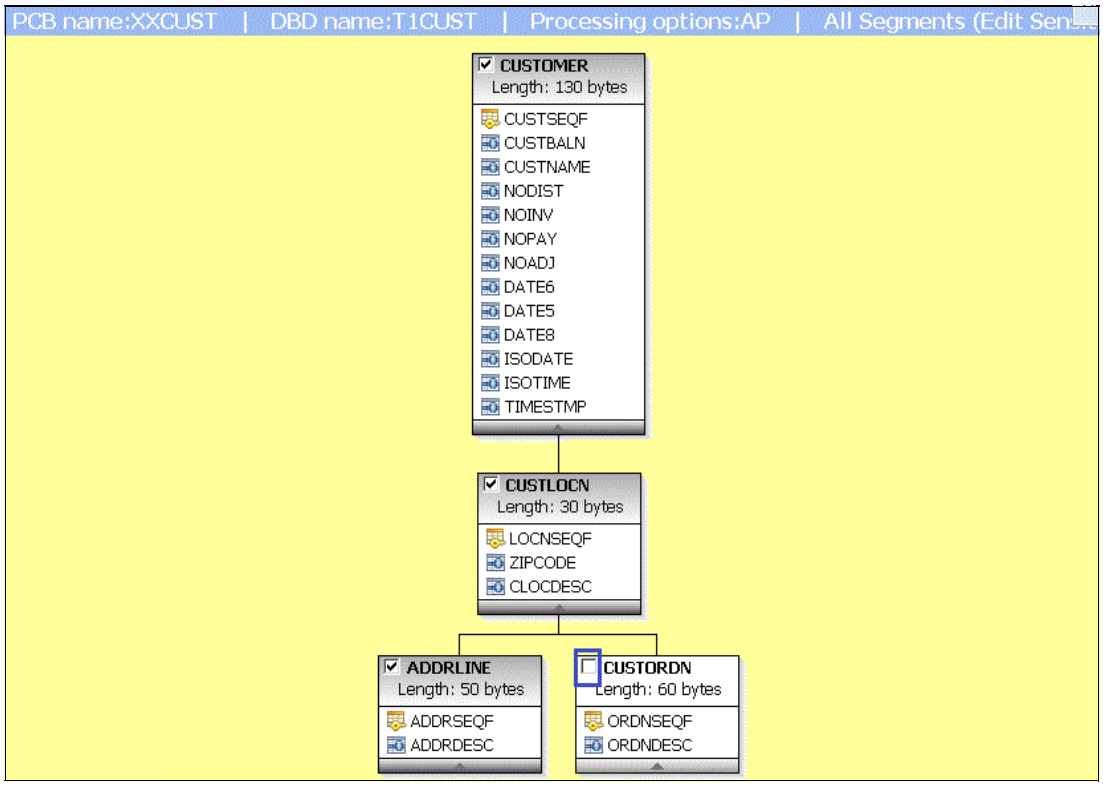

Figure 2-8 PCB Graphical Editor

9. Now you need to save your project before you export it to the z/OS system.
10. To export IMS resources:
    a. From the main menu bar, click **File** → **Export** → **IMS** → **z/OS System**. (You can also export IMS resources by right-clicking an existing project in the Project Explorer view, clicking **Export** → **IMS** → **System z/OS**, and then clicking **Next**.) The Export IMS Resources wizard opens.
    b. In the Project name field, select the name of an IMS Explorer project and click **Next**.
    c. Select the type of IMS resources to export: Generated PSBs or Generated DBDs.
    d. From the list of Available PSBs to export or Available DBDs to export, select the PSB or DBD files that you want to export, and then click **Next**.
    e. Connect to the z/OS system.
    f. Select the high-level qualifier and the PDS file that you want to export to, and then click **Finish**.

Figure 2-9 on page 21 shows a PSB export.

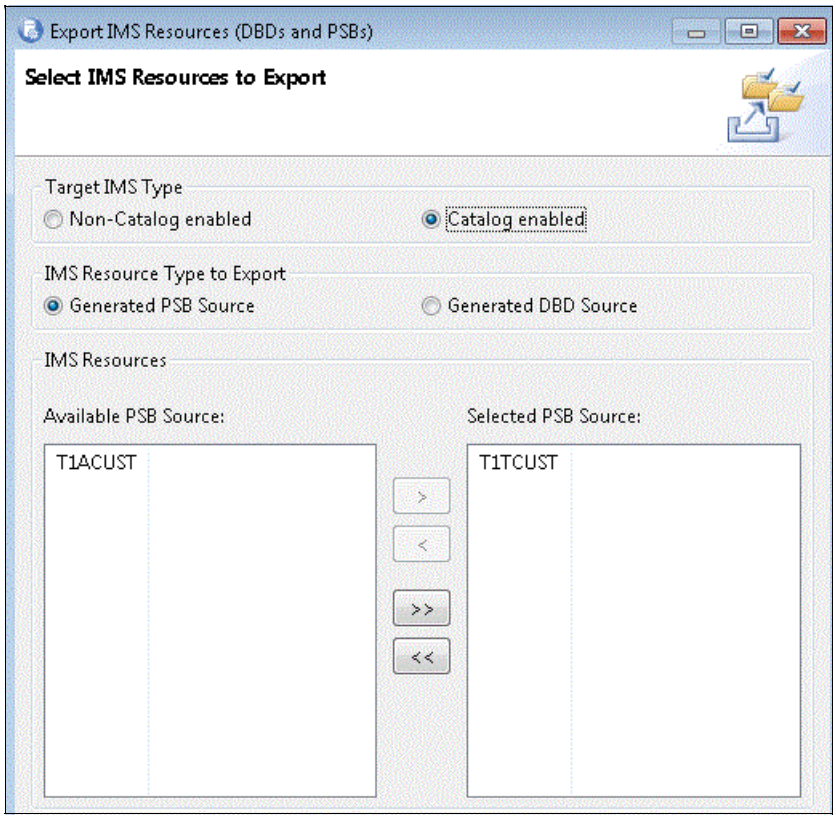

Figure 2-9 PSB export

Figure 2-10 on page 22 shows how to select the destination PDS for the defined object.

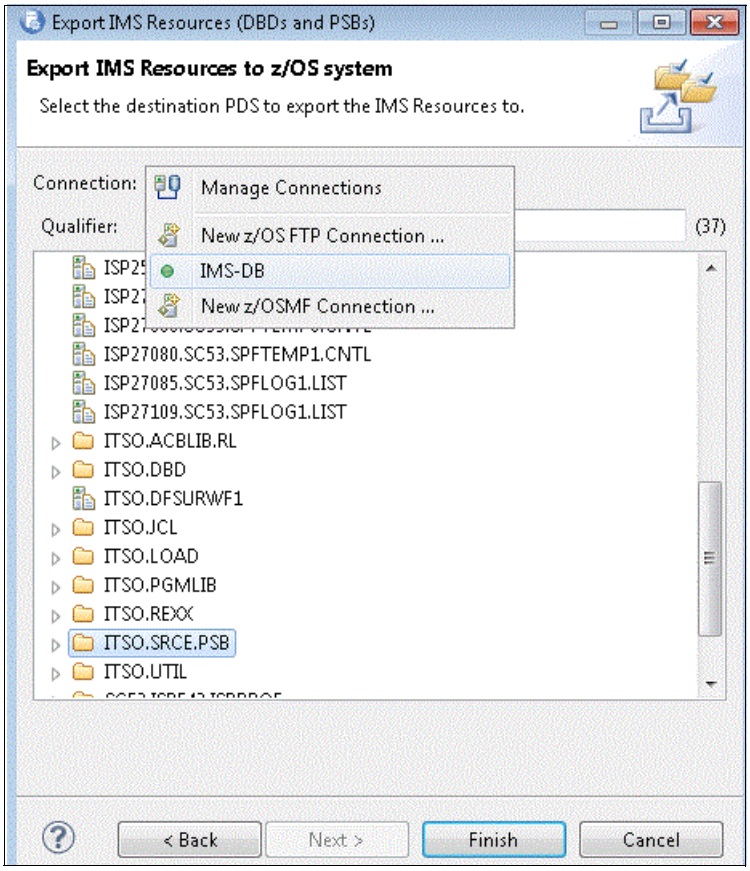

Figure 2-10 Export IMS Resources (DBDs and PSBs)

Now your PSB is coded and resides in your PSB source data set. Example 2-1 refers to the generated T1TCUST PSB source code. Notice that the CUSTORDN segment does not appear in the source code.

Example 2-1 PSB source code

```
PCB TYPE=DB,
      DBDNAME=T1CUST,
      PCBNAME=XXCUST,
      PROCOPT=AP,
      SB=NO,
      KEYLEN=100,
      POS=SINGLE,
      LIST=YES
SENSEG NAME=CUSTOMER,
      PARENT=0
SENSEG NAME=CUSTLOCN,
      PARENT=CUSTOMER
SENSEG NAME=ADDRLINE,
      PARENT=CUSTLOCN
PSBGEN PSBNAME=T1TCUST,
      LANG=PL/I,
      CMPAT=YES,
      IOASIZE=600,
      SSASIZE=840,
      OLIC=NO,
```

```
      GSROLBOK=NO,
      LOCKMAX=0
END
```

For details about how to use IMS Enterprise Suite Explorer for Development tool features, see the IMS Enterprise Suite Explorer for Development 3.1 manual available at this site:

http://www-01.ibm.com/support/knowledgecenter/SS9NWR_3.1.0/com.ibm.ims.explorer31.doc/wb_container_imsexplorer.htm

2.2 PSBGEN

Before you execute an application program, a program specification block generation (PSBGEN) must be executed in order to create the PSB compiled module for the program.

To build the PSBGEN job, you can use a PSBGEN PROC as shown in Example 2-2.

Example 2-2 :PSBGEN procedure

```
//       PROC MBR=TEMPNAME,SOUT=A,RGN=0M,SYS2=
//C      EXEC PGM=ASMA90,REGION=&RGN,
//            PARM=(OBJECT,NODECK,NODBCS,
//            'SIZE(MAX,ABOVE)')
//SYSLIB   DD DSN=IMS.&SYS2.SDFSMAC,DISP=SHR
//SYSLIN   DD UNIT=SYSDA,DISP=(,PASS),
//         SPACE=(80,(100,100),RLSE),
//         DCB=(BLKSIZE=80,RECFM=F,LRECL=80)
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089,
//         SPACE=(121,(300,300),RLSE,,ROUND)
//SYSUT1   DD UNIT=SYSDA,DISP=(,DELETE),
//         SPACE=(CYL,(10,5))
//SYSIN    DD DSN=&SORS(&MBR),DISP=SHR
//L      EXEC PGM=IEWL,PARM='XREF,LIST',
//            COND=(0,LT,C),REGION=4M
//SYSLIN   DD DSN=*.C.SYSLIN,DISP=(OLD,DELETE)
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089,
//         SPACE=(121,(90,90),RLSE)
//SYSLMOD  DD DISP=SHR,
//         DSN=IMS.&SYS2.PSBLIB(&MBR)
//SYSUT1   DD UNIT=(SYSDA,SEP=(SYSLMOD,SYSLIN)),
//         SPACE=(1024,(100,10),RLSE),DISP=(,DELETE)
```

To execute the PSBGEN PROC you can use Example 2-3.

Example 2-3 JCL sample to run PSBGEN procedure

```
//JOBCARD
//MYLIB JCLLIB ORDER=(IMS.PROCLIB)
//*
//STEP01 EXEC PSBGEN,MBR='T1TCUST',SORS='HLQ.SRCE.PSB'
//
```

2.3 Combined ACBGEN utility and Catalog Populate utility

While your T1TCUST PSB resides in your PSBLIB, IMS does not recognize it. This PSB needs to move to the application control block (ACB).

IMS builds the ACB with the ACB Maintenance utility by merging information from the PSB and DBD.

IMS Catalog Populate utility (DFS3PU00) can be used to load or insert records into the IMS catalog database data sets. The DFS3PU00 utility can also be used to estimate the size of the IMS catalog data sets.

To use DFS3PU00, the catalog needs to be started and in UPDATE mode.

Example 2-4 represents an ACBGEN job with the Catalog Populate Utility update step.

Example 2-4 ACBGEN with Catalog Populate Utility update step

```
//ACBCATT EXEC PGM=DFS3UACB,REGION=6M
//STEPLIB  DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//DFSRESLB DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//PROCLIB  DD  DSN=IMS13X.PROCLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSOUT   DD  SYSOUT=*
//SYSABEND DD  SYSOUT=*
//IMS      DD  DSN=IMS13X.PSBLIB,DISP=SHR
//         DD  DSN=IMS13X.DBDLIB,DISP=SHR
//IMSACB   DD  DSN=IMS13X.ACBLIB,DISP=SHR
//SYSUT3   DD  UNIT=SYSDA,SPACE=(80,(100,100))
//SYSUT4   DD  UNIT=SYSDA,SPACE=(256,(100,100)),DCB=KEYLEN=30
//SYSIN    DD  *
  BUILD  PSB=T1TCUST
/*
//ACBCATWK DD  DSN=IMSRES7.IMSX.ACBCATWK,DISP=(NEW,PASS),
//             SPACE=(CYL,(10,10)),
//*            DCB=(BLKSIZE=800,RECFM=FB,LRECL=80),
//             UNIT=3390
//*****************************************************************
//* POPULATE UTILITY DATASETS
//*****************************************************************
//IMSACB01 DD  DSN=*.IMSACB,DISP=SHR      DO NOT REPLACE ASTERISK
//DFSVSAMD DD  DSN=IMSRES7.ITSO.UTIL(VSAMP),DISP=SHR
//*****************************************************************
//* UPDATE INPUT PARMS FOR IMS CATALOG POPULATE UTILITY
//*****************************************************************
//DFS3PPRM DD  *
BMP,DFS3PU00,DFSCP001,,,N00000,,,,1,,,,IVP1,BMP01,,,,'',
/*
//SYSINP DD *
/*
//
```

You can see the output generated by *combined ACBGEN and Catalog Populate Utility* as shown in Example 2-5 on page 25.

Example 2-5 Output: Combined ACBGEN and Catalog Populate Utility

```
DFS3685I  C O M B I N E D   A C B G E N  &  P O P U L A T E   U T I L I T Y

DFS0940I PSB T1TCUST HAS BEEN REPLACED IN LIBRARY.  PSB SIZE = 00003520 BYTES
DFS0941I PSB T1TCUST  IF USING DL/I SEPARATE ADDRESS SPACE, CSA SIZE = 00000576,
SAS SIZE = 00002880.
DFS0589I PROCESS COMPLETE FOR PSB-T1TCUST .  PCB = 0000504, PSB = 00003520,
WORKAREA = 00001984, TOTAL SIZE = 00005504
DFS0593I PSB--T1TCUST  WORKAREA BREAKOUT. NDX = 0000256, XIO = 0000272, IOA =
0000600, SEG = 000008,SSA = 000840


IMS CATALOG POPULATE UTILITY          IMS V13.1
NUMBER OF SEGMENTS INSERTED INTO THE CATALOG
                INSERTED
SC   SEGMENT    SEGMENTS
--   --------   --------
 1   HEADER            1
 2   DBD               0
37   PSB               1
39   PCB               1
41   SS                4
```

For more information about the Catalog Populate Utility, refer to the following site:

http://www-01.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.sur/ims_catalog_pop_utility.htm

2.4 Online Change Copy utility and Batch Single Point of Contact utility

The Online Change Copy utility (DFSUOCU0) is a step while preparing an IMS or an IMSplex for a local or global online change. It copies a source library with your new definitions to a target library. Issuing the Online Change command sequence to prepare and commit an online change causes the inactive library to become the active library.

The batch Online Change Copy utility should run to copy the staging ACBLIB members to the inactive ACBLIB. The next step is to set the IMS system in preparation for the online change implementation. In this case, the standard utility was used.

After the Online Change Copy utility has been run, the Online change can be implemented via IMS commands being issued through the Batch Single Point of Contact (SPOC) utility (CSLUSPOC). Example 2-6 shows the JCL and IMS commands.

For details about Online Change Copy utility, see *IMS Version 13 System Utilities,* SC19-3662.

Example 2-6 SPOC Job to Online Change Copy

```
//SPOC      EXEC PGM=CSLUSPOC,
//  PARM=('IMSPLEX=PLX13,ROUTE=IVP1,WAIT=30')
//STEPLIB   DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
```

```
 /DIS MODIFY ALL
 /MODIFY PREPARE ACBLIB
 /MODIFY COMMIT
 /DIS MODIFY ALL
/*
```

Example 2-7 represents the output of the SPOC job to Online Change Copy utility.

Example 2-7 Output - SPOC Job to Online Change Copy

```
Log for:  /DIS MODIFY ALL

 MbrName  Messages
 -------- ----------------------
 IVP1     YO1 LIBRARY  IMSACBA  (A)  IMS13X.ACBLIBA
 IVP1     YO1 LIBRARY  FORMATA  (A)  IMS13X.FORMATA
 IVP1     YO1 LIBRARY  IMSACBB  (I)  IMS13X.ACBLIBB
 IVP1     YO1 LIBRARY  FORMATB  (I)  IMS13X.FORMATB
 IVP1     YO3 DISPLAY MODIFY COMPLETE *14197/135125*

Log for:  /MODIFY PREPARE ACBLIB

 MbrName  Messages
 -------- ----------------------
 IVP1     DFS3499I ACTIVE DDNAMES:          IMSACBA  FORMATA  MODSTAT ID:    2


Log for:  /MODIFY COMMIT

 MbrName  Messages
 -------- ----------------------
 IVP1     DFS3499I ACTIVE DDNAMES:          IMSACBB  FORMATA  MODSTAT ID:    3


Log for:  /DIS MODIFY ALL

 MbrName  Messages
 -------- ----------------------
 IVP1     YO1 LIBRARY  IMSACBA  (I)  IMS13X.ACBLIBA
 IVP1     YO1 LIBRARY  FORMATA  (A)  IMS13X.FORMATA
 IVP1     YO1 LIBRARY  IMSACBB  (A)  IMS13X.ACBLIBB
 IVP1     YO1 LIBRARY  FORMATB  (I)  IMS13X.FORMATB
 IVP1     YO3 DISPLAY MODIFY COMPLETE *14197/135125*
```

2.5 Define a BMP to the IMS system

A BMP must be defined to the IMS system as the IMS system performs all the database access on behalf of the BMP program. The use of a BMP process allows the batch program to run within the control of the IMS online region. The IMS region controls all database access and enforces program interdependence with existing IMS transactions or other BMP programs.

2.5.1 Taking advantage of dynamic resource definition to define BMP to IMS System

To define the BMP to IMS System, the chosen process was the dynamic resource definition (DRD) and also using the Single Point of Control (SPOC) utility.

We have seen that SPOC allows you to manage operations of all IMS systems within an IMSplex instead of using a master terminal.

You can create, update, or delete certain IMS runtime resource definitions (database, application program, Fast Path routing code, and transaction) and add them to your IMS dynamically, thereby eliminating the need to use the batch system definition or online change processes. This process is called the DRD process.

The advantage of DRD to define a BMP is productivity because DRD avoids IMS MODBLKS SYSGEN. So DRD is an easier and faster way to define a BMP to the IMS System.

Example 2-8 shows a SPOC job sample to define T1TCUST BMP to the IMS system.

Example 2-8 SPOC job to define BMP

```
//SPOC      EXEC PGM=CSLUSPOC,
//  PARM=('IMSPLEX=PLEXID,ROUTE=,WAIT=30')
//STEPLIB   DD DISP=SHR,DSN=IMS.SDFSRESL
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
  CREATE PGM NAME(T1TCUST) SET( BMPTYPE(Y) DOPT(N) RESIDENT(N) -
    SCHDTYPE(PARALLEL))
  QRY PGM NAME(T1TCUST) SHOW(ALL)
//
```

Example 2-9 shows the output of the SPOC job to define a BMP.

Example 2-9 Output - SPOC job to define a BMP

```
Log for:  CREATE PGM NAME(T1TCUST) SET( BMPTYPE(Y) DOPT(N) RESIDENT(N)     SCHDTYPE(PARALLEL))


    Response for: CREATE PGM NAME(T1TCUST) SET( BMPTYPE(Y) DOPT(N) RESIDENT(N)     SCHDTYPE(PARALLEL))
    PgmName  MbrName    CC
    ------------------------------------------------------------------------------------------------------------------------------------
    T1TCUST  IVP1        0

Log for:  QRY PGM NAME(T1TCUST) SHOW(ALL)



    Response for: QRY PGM NAME(T1TCUST) SHOW(ALL)
    PgmName  MbrName    CC LRgnType LBMPType LFP LDOPT LGPSB LRsdnt LTranStat LPgmLang LSchdType LclStat          LModelName
             LModelType LTimeCreate          LTimeUpdate          LTimeAccess          LTimeImport          LDefnType
    ------------------------------------------------------------------------------------------------------------------------------------
    T1TCUST  IVP1        0 BMP      Y        N   N     N     N      N                 PARALLEL  NOTINIT-26-NOPSB DFSDSPG1
             DESC       2014.196 16:44:35.53                                                                 CREATE
```

2.5.2 Starting your BMP using SPOC

As a BMP runs under IMS Control, you need to start your BMP to become usable. Example 2-10 on page 28 shows a SPOC program used to start T1TCUST BMP.

Example 2-10 SPOC Job to Start a BMP

```
//SPOC      EXEC PGM=CSLUSPOC,
//  PARM=('IMSPLEX=PLX13,ROUTE=IVP1,WAIT=30')
//STEPLIB   DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
 START PGM T1TCUST
 QRY PGM NAME(T1TCUST) SHOW(ALL)
/*
```

Example 2-11 shows the output of the SPOC job to start the BMP.

Example 2-11 Output - SPOC job to start a BMP

```
Log for:  START PGM T1TCUST

IVP1     DFS058I 18:18:47 START COMMAND COMPLETED


Log for:  QRY PGM NAME(T1TCUST) SHOW(ALL)

    Response for: QRY PGM NAME(T1TCUST) SHOW(ALL)
    PgmName  MbrName    CC LRgnType LBMPType LFP LDOPT LGPSB LRsdnt LTranStat LPgmLang LSchdType LclStat LModelName LModelType
             LTimeCreate          LTimeUpdate          LTimeAccess          LTimeImport          LDefnType
    ------------------------------------------------------------------------------------------------------------------------
    T1TCUST  IVP1        0 BMP      Y        N   N     N     N      N                 PARALLEL          DFSDSPG1   DESC
             2014.196 16:44:35.53                                          2014.197 13:22:01.94 CREATE
```

2.5.3 Executing your BMP

The BMP is designed to use PSB T1TCUST to read the T1CUST DBD using the primary index T1CUSTX. The program is a REXX exec called CUSTREAD.

Example 2-12 represents a BMP execution job.

Example 2-12 BMP execution

```
//PRODUPDT EXEC PGM=DFSRRC00,REGION=4096K,
// PARM=(BMP,CUSTREAD,T1TCUST,,,C00000,,1,,,,,,IVP1,BMP01,)
//STEPLIB  DD DSN=IMSRES7.ITSO.LOAD,DISP=SHR
//         DD DSN=IMSRES7.ITSO.PGMLIB,DISP=SHR
//         DD DSN=IMS13X.SDFSRESL,DISP=SHR
//DFSRESLB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMS      DD DSN=IMS13X.PSBLIB,DISP=SHR
//         DD DSN=IMS13X.DBDLIB,DISP=SHR
//SYSEXEC  DD DSN=IMSRES4.ITSO.REXX,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD DUMMY
```

Example 2-13 shows an excerpt of BMP output.

Example 2-13 Output -BMP execution

```
DFS3180I INQY ENVIRON Region=BMP      Number=1
DFS3180I INQY ENVIRON Tran=         PGM=CUSTREAD
DFS3180I Starting EXEC Name=CUSTREAD
DFS3160I IMS CMD=MAPDEF CUSTSEG DBMAPDEF
DFS3161I REXXIMS  Command=MAPDEF   RC=0
```

```
DFS3160I IMS CMD=GN DB *CUSTSEG CUST_SSA
DFS3161I REXXTDLI Call=GN   RC=0000 Reason=0000 Status="  "
SEGMENT NAME  OF LAST CALL:  CUSTOMER
CUSTOMER NUMBER :  000200
CUSTOMER BALANCE:  0.00
CUSTOMER NAME   :  CUSTOMER  000200
DFS3160I IMS CMD=GN DB *CUSTSEG CUST_SSA
DFS3161I REXXTDLI Call=GN   RC=0000 Reason=0000 Status="  "
SEGMENT NAME  OF LAST CALL:  CUSTOMER
CUSTOMER NUMBER :  000300
CUSTOMER BALANCE:  0.00
CUSTOMER NAME   :  CUSTOMER  000300
DFS3160I IMS CMD=GN DB *CUSTSEG CUST_SSA
DFS3161I REXXTDLI Call=GN   RC=0900 Reason=0000 Status="GB"
DFS3182I REXX EXEC: CUSTREAD COMPLETED, RC=0
```

2.6 Listing IMS catalog DBDs and PSBs using SQL Query Builder Function of IMS Suite Enterprise Explorer for Development

The IMS Enterprise Suite Explorer for Development (IMS Explorer) is the Eclipse-based graphical tool that simplifies IMS application development tasks. The tool can be used by IMS application developers or database administrators to execute application development tasks including the issue of Structured Query Language (SQL) statements to access IMS data.

To issue SQL statements, you need first of all to create an IMS Catalog Connection. IMS Catalog Connection was previously created in section 2.1, “PSB creation using IMS Enterprise Suite Explorer for Development” on page 14.

When the IMS Connection is set, the next step is to create an SQL statement on SQL Query Builder. The SQL Query Builder provides a graphical interface for creating and running SQL statements. Statements that are generated by the SQL Query Builder are saved in a file with the extension .sql.

The SQL Query Builder supports creating SELECT, INSERT, UPDATE, and DELETE statements.

You can use the New SQL Script wizard to create an SQL statement. The statement contains the template code for the statement type that you select. After you create the SQL statement, you can specify the statement by providing the information for its clauses in the SQL Query Builder.

To create an SQL statement in the SQL Query Builder by using the File menu, follow these steps:

1. Click **File** → **New** → **Other**.
2. In the New SQL Script wizard, **expand Data**, **select SQL** or XQuery Script and then click **Finish**.
3. Complete the New SQL or XQuery Script wizard by clicking **SQL Query Builder** and selecting a statement type.

4. Click **Finish**. The SQL statement is added to the SQL Scripts folder of the data development project that you select in the wizard. The statement opens in the SQL Query Builder.
5. Use the SQL Query Builder to specify the type of statement that you selected in the wizard. In this case, the SELECT statement was chosen.
6. **Save** the statement.

Now it is necessary to add table references to an SQL statement with a right-click the table pane. See Figure 2-11.

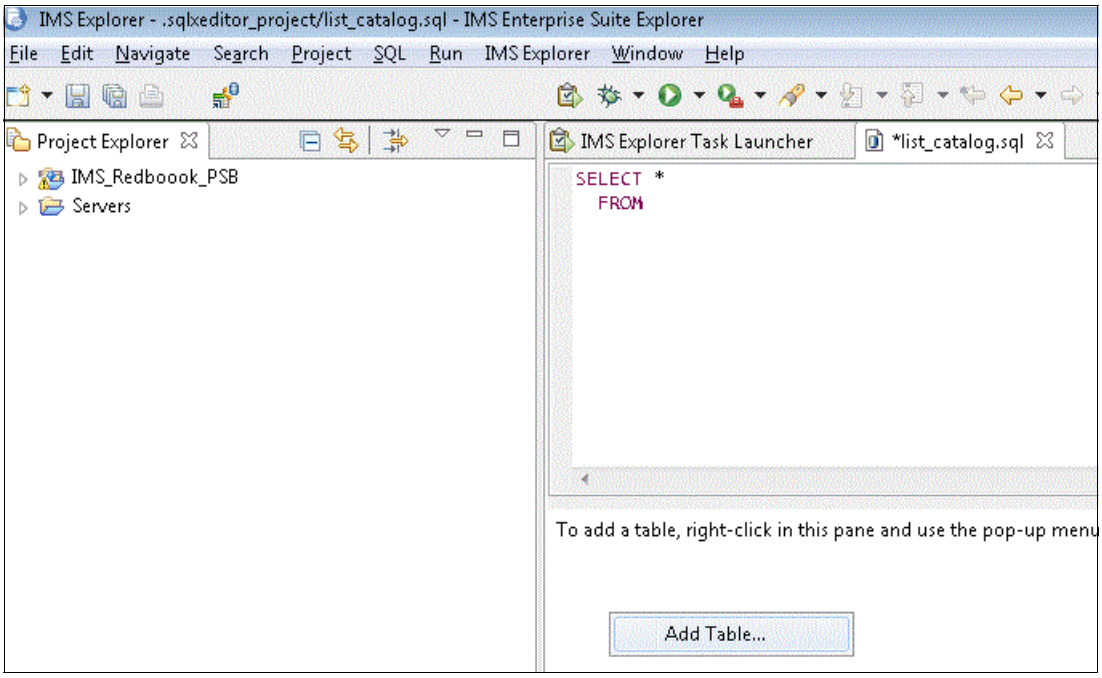

Figure 2-11 Adding table on SQL Query Builder

By clicking **Add Table**, another window appears with catalog PCBs.

In order to list all DBDs and PSBs from the IMS catalog, you need to expand DFSCAT00. DFSCAT00 is the main catalog PCB.

After expanding DFSCAT00, look for the HEADER table. In the IMS Explorer, HEADER has a concept of table, but HEADER is the root segment of IMS catalog. See Figure 2-12 on page 31.

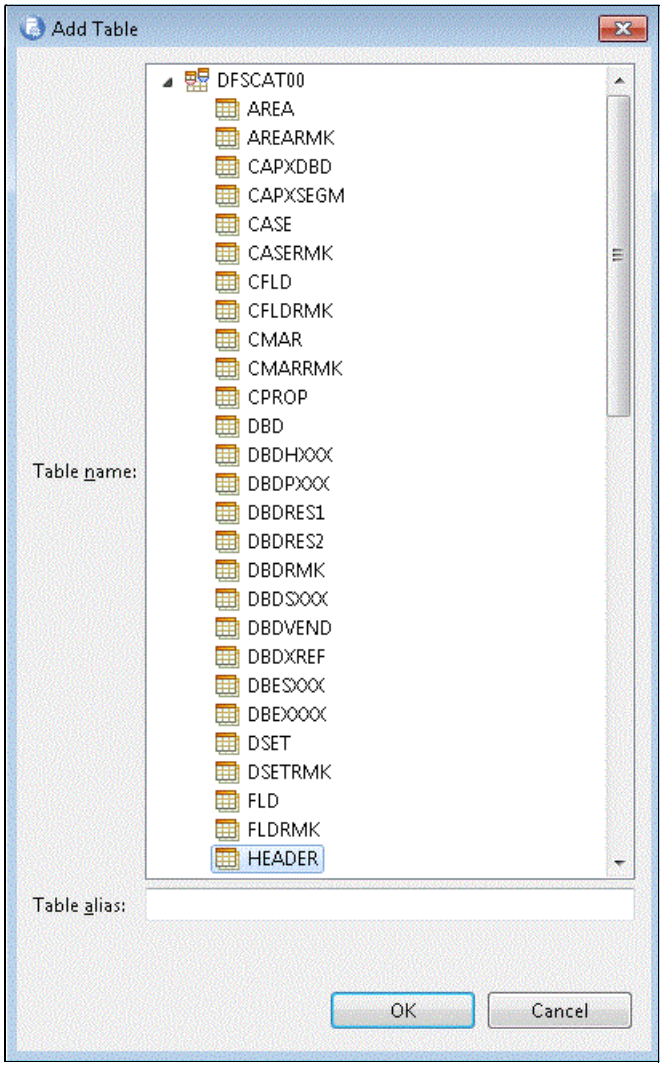

Figure 2-12 Adding table HEADER on SQL Query Builder

Now the HEADER table is on the Table Pane and is possible to choose the columns to use in the SELECT by clicking the check boxes. In this situation, the columns were SEQNUM, RHDRSEQ, TYPE, and IMSNAME. When you click the check box, the SELECT statement is automatically created. See Figure 2-13 on page 32.

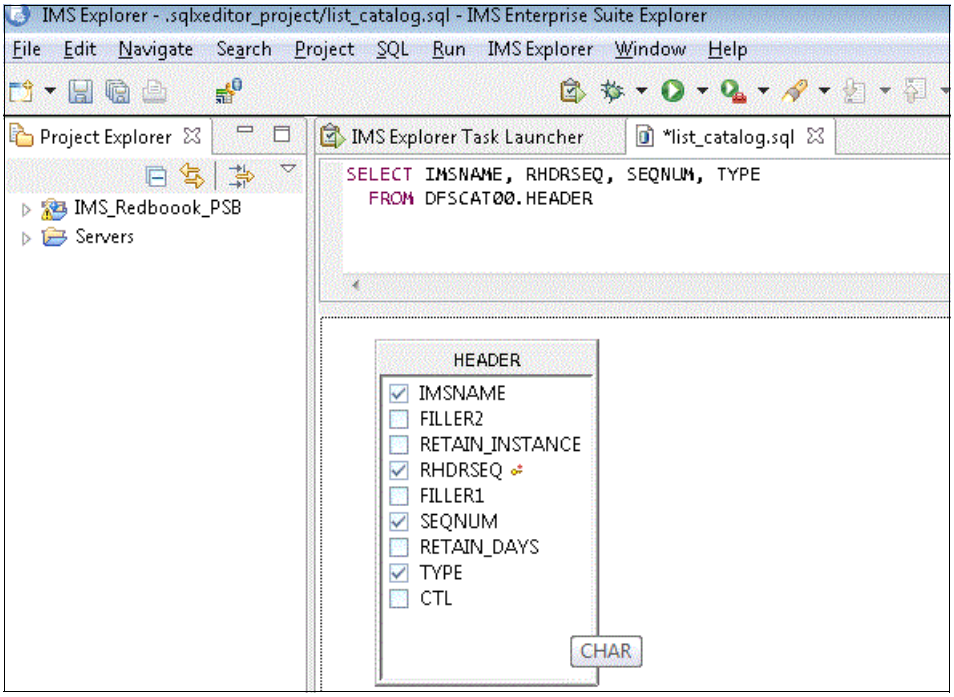

Figure 2-13 Select Statement - SQL Query Builder

To run any SQL statement that is open in the SQL Query Builder, the process is to click SQL in the toolbar and then **Run SQL**. See Figure 2-14.

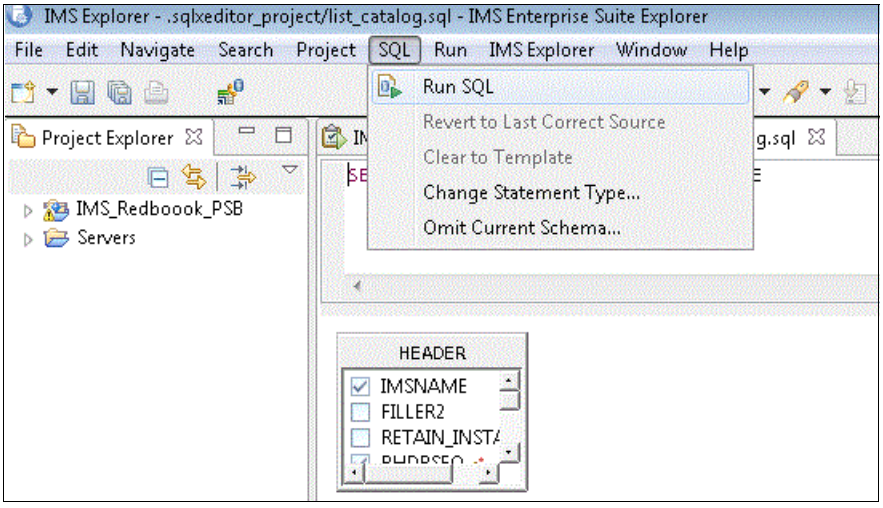

Figure 2-14 Run SQL

Figure 2-15 on page 33 shows the SELECT statement result.

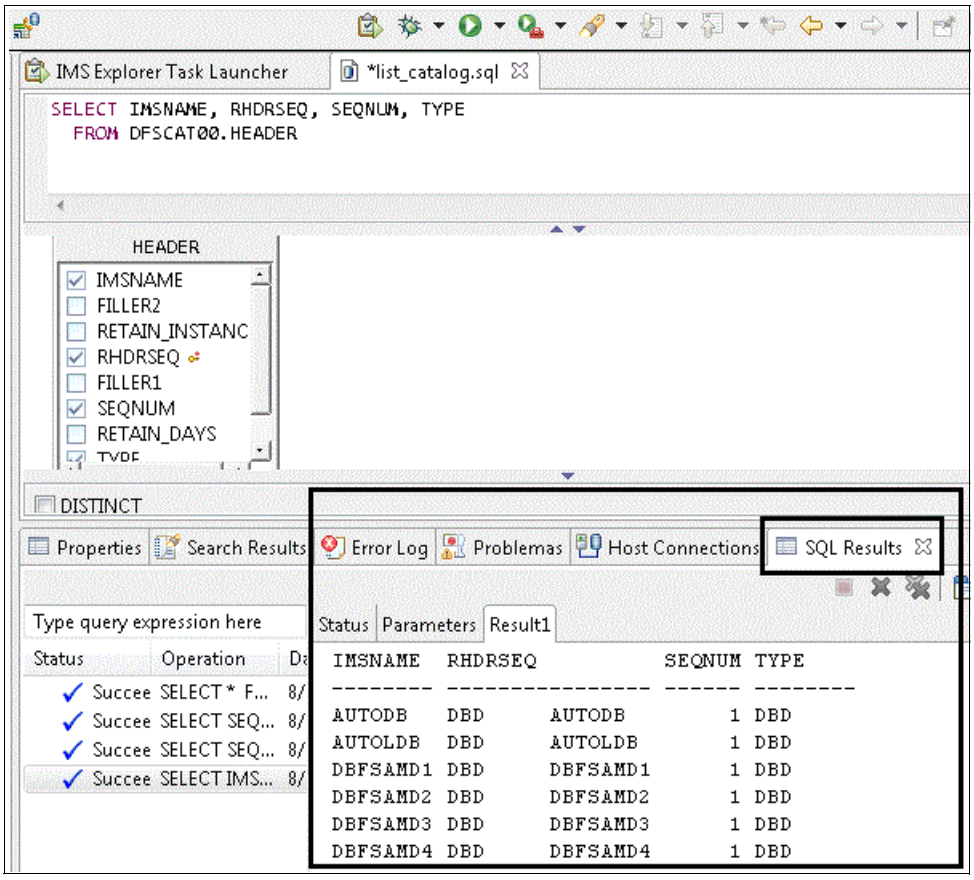

Figure 2-15 SQL result

The example represents the complete result of this SELECT statement against HEADER table. The PSB T1TCUST cloned in this chapter is present in the result. See Example 2-14.

Example 2-14 Select statement result

```
IMSNAME  RHDRSEQ          SEQNUM TYPE
 -------- ---------------- ------ --------
 AUTODB   DBD      AUTODB        1 DBD
 AUTOLDB  DBD      AUTOLDB       1 DBD
 DBFSAMD1 DBD      DBFSAMD1      1 DBD
 DBFSAMD2 DBD      DBFSAMD2      1 DBD
 DBFSAMD3 DBD      DBFSAMD3      1 DBD
 DBFSAMD4 DBD      DBFSAMD4      1 DBD
 DFSCD000 DBD      DFSCD000      1 DBD
 DFSCX000 DBD      DFSCX000      1 DBD
 DI21PART DBD      DI21PART      1 DBD
 EMPDB2   DBD      EMPDB2        1 DBD
 EMPLDB2  DBD      EMPLDB2       1 DBD
 HNUMBER  DBD      HNUMBER       1 DBD
 HORDER   DBD      HORDER        1 DBD
 HPEOPLE  DBD      HPEOPLE       1 DBD
 HPERSN   DBD      HPERSN        1 DBD
 IPODB    DBD      IPODB         1 DBD
 IVPDB1   DBD      IVPDB1        1 DBD
 IVPDB1I  DBD      IVPDB1I       1 DBD
 IVPDB2   DBD      IVPDB2        1 DBD
```

```
IVPDB3   DBD     IVPDB3        1 DBD
IVPDB4   DBD     IVPDB4        1 DBD
IVPDB5   DBD     IVPDB5        1 DBD
IVPDRD1  DBD     IVPDRD1       1 DBD
SINDEX11 DBD     SINDEX11      1 DBD
SINDEX22 DBD     SINDEX22      1 DBD
T1CUST   DBD     T1CUST        1 DBD
T1CUSTX  DBD     T1CUSTX       1 DBD
T2CUST   DBD     T2CUST        1 DBD
T2CUSTX  DBD     T2CUSTX       1 DBD
T3CUST   DBD     T3CUST        1 DBD
T3CUSTX  DBD     T3CUSTX       1 DBD
T4CUST   DBD     T4CUST        1 DBD
T4CUSTX  DBD     T4CUSTX       1 DBD
AUTPSBAL PSB     AUTPSBAL      1 PSB
AUTPSBEL PSB     AUTPSBEL      1 PSB
AUTPSB11 PSB     AUTPSB11      1 PSB
DBFSAMP1 PSB     DBFSAMP1      1 PSB
DBFSAMP2 PSB     DBFSAMP2      1 PSB
DBFSAMP3 PSB     DBFSAMP3      1 PSB
DBFSAMP4 PSB     DBFSAMP4      1 PSB
DBFSAMP5 PSB     DBFSAMP5      1 PSB
DBFSAMP6 PSB     DBFSAMP6      1 PSB
DFHSAM04 PSB     DFHSAM04      1 PSB
DFHSAM05 PSB     DFHSAM05      1 PSB
DFHSAM14 PSB     DFHSAM14      1 PSB
DFHSAM15 PSB     DFHSAM15      1 PSB
DFHSAM24 PSB     DFHSAM24      1 PSB
DFHSAM25 PSB     DFHSAM25      1 PSB
DFSCPL00 PSB     DFSCPL00      1 PSB
DFSCP000 PSB     DFSCP000      1 PSB
DFSCP001 PSB     DFSCP001      1 PSB
DFSCP002 PSB     DFSCP002      1 PSB
DFSCP003 PSB     DFSCP003      1 PSB
DFSIVPA  PSB     DFSIVPA       1 PSB
DFSIVPB  PSB     DFSIVPB       1 PSB
DFSIVPC  PSB     DFSIVPC       1 PSB
DFSIVPDL PSB     DFSIVPDL      1 PSB
DFSIVPD2 PSB     DFSIVPD2      1 PSB
DFSIVPD3 PSB     DFSIVPD3      1 PSB
DFSIVP1  PSB     DFSIVP1       1 PSB
DFSIVP2  PSB     DFSIVP2       1 PSB
DFSIVP3  PSB     DFSIVP3       1 PSB
DFSIVP31 PSB     DFSIVP31      1 PSB
DFSIVP32 PSB     DFSIVP32      1 PSB
DFSIVP34 PSB     DFSIVP34      1 PSB
DFSIVP35 PSB     DFSIVP35      1 PSB
DFSIVP37 PSB     DFSIVP37      1 PSB
DFSIVP4  PSB     DFSIVP4       1 PSB
DFSIVP5  PSB     DFSIVP5       1 PSB
DFSIVP6  PSB     DFSIVP6       1 PSB
DFSIVP61 PSB     DFSIVP61      1 PSB
DFSIVP62 PSB     DFSIVP62      1 PSB
DFSIVP64 PSB     DFSIVP64      1 PSB
DFSIVP65 PSB     DFSIVP65      1 PSB
```

```
DFSIVP67 PSB     DFSIVP67      1 PSB
DFSIVP7  PSB     DFSIVP7       1 PSB
DFSIVP8  PSB     DFSIVP8       1 PSB
DFSIVP9  PSB     DFSIVP9       1 PSB
DFSSAM01 PSB     DFSSAM01      1 PSB
DFSSAM02 PSB     DFSSAM02      1 PSB
DFSSAM03 PSB     DFSSAM03      1 PSB
DFSSAM04 PSB     DFSSAM04      1 PSB
DFSSAM05 PSB     DFSSAM05      1 PSB
DFSSAM06 PSB     DFSSAM06      1 PSB
DFSSAM07 PSB     DFSSAM07      1 PSB
DFSSAM08 PSB     DFSSAM08      1 PSB
DFSSAM09 PSB     DFSSAM09      1 PSB
HAPEOPLA PSB     HAPEOPLA      1 PSB
HAPEOPLP PSB     HAPEOPLP      1 PSB
HAPERSNA PSB     HAPERSNA      1 PSB
HAPERSNP PSB     HAPERSNP      1 PSB
HNBRLOAD PSB     HNBRLOAD      1 PSB
HORDRLD  PSB     HORDRLD       1 PSB
IPOPSB   PSB     IPOPSB        1 PSB
IPOPSBL  PSB     IPOPSBL       1 PSB
T1ACUST  PSB     T1ACUST       1 PSB
T1HACUST PSB     T1HACUST      1 PSB
T1LCUST  PSB     T1LCUST       1 PSB
T1PUTCST PSB     T1PUTCST      1 PSB
T1TCUST  PSB     T1TCUST       1 PSB
T2ACUST  PSB     T2ACUST       1 PSB
T2LCUST  PSB     T2LCUST       1 PSB
T2PUTCST PSB     T2PUTCST      1 PSB
T3ACUST  PSB     T3ACUST       1 PSB
T3LCUST  PSB     T3LCUST       1 PSB
T3PUTCST PSB     T3PUTCST      1 PSB
T4ACUST  PSB     T4ACUST       1 PSB
T4LCUST  PSB     T4LCUST       1 PSB
T4PUTCST PSB     T4PUTCST      1 PSB
```

3

Setting up recovery

If a database is physically lost or damaged, the records in it might become inaccessible, and you need to rebuild the database from the information provided by the IMS system recovery functions such as image copies and logs.

In this chapter, we first introduce some basic recovery concepts and then outline common recovery processes utilizing IMS utilities, and the IMS Recovery Expert tool.

The chapter contains the following sections:

- IMS recovery overview
- Performing an IMS database recovery
- DB recovery to last image copy
- Creating a DBRC recovery point
- Finding a quiet point in a log
- Point in time recovery

3.1 IMS recovery overview

The IMS recovery strategy was designed during the initial stages of IMS development. It was designed to deal with the backup and recovery issues faced at the time. At the time, the systems' both hardware and software were not as resilient as they are now. They were subject to reliability issues to remain active for long periods of times. The DASD and tape devices failed and thus recovery issues were always a concern with both batch and online processing. Backup and recovery had to be considered for all update processing. To understand the recovery processes and some of the new ways to accomplish recoveries, some basic understanding of logging and the IMS Database Recovery Control facility (DBRC[1]) is required. A brief overview is provided to help understand the procedures.

3.1.1 Brief overview of logging

Each IMS subsystem creates its own log files. In a DLIBATCH JOB, there is a single log file defined on the IEFRDER DD statement in the JCL. That log is called a recovery log data set (RLDS). Each IMS online system uses a series of log data sets called online log data sets (OLDS). These data sets are used in a rotating fashion. When one OLDS is filled, it is archived to a system log data set (SLDS) and optionally to an RLDS. If the RLDS is not created during the OLDS archive process, the SLDS will be used a the RLDS for all recovery procedures. The OLDS data sets are not used in the DB recovery processing. The OLDS must be archived before the log records can be used. It is the RLDS (or an SLDS) that is used in the database recovery processing. Before IMS V3, the coding of recovery JCL was done manually. Since IMS V3, DBRC can be used to record and process all recovery-related procedures. An overview of the logging process is depicted in Figure 3-1.

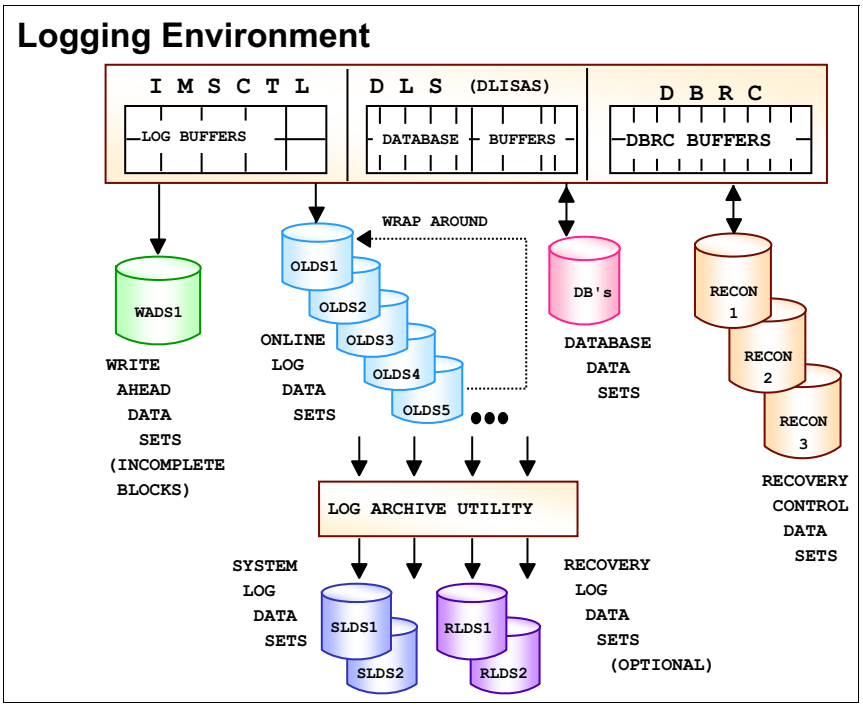

Figure 3-1 Overview of IMS online logging environment

[1] A feature of the IMS Database Manager that facilitates easier recovery of IMS databases, DBRC maintains information that is required for database recoveries, generates recovery control statements, verifies recovery input, maintains a separate change log for database data sets, and supports sharing of IMS databases and areas by multiple IMS subsystems.

3.1.2 DBRC at a glance

DBRC is the function inside of IMS that controls all the recovery-related information.

The log data set information is stored in the RECON data sets in various records. These records are used by DBRC for all recovery-related operations and procedures. As each IMS subsystem starts, it creates a SYSS record and that record remains until that subsystem terminates normally. The log information is retained in a series of records and will be retained until that information is no longer required.

The associated RECON records as shown in Figure 3-2 are:

- PRIOLDS for the OLDS data set information
- PRILOG for the archived RLDS/SLDS data set information
- PRISLDS for the archived SLDS data set information
- SYSS for the currently active IMS subsystem
- LOGALL for all currently authorized databases

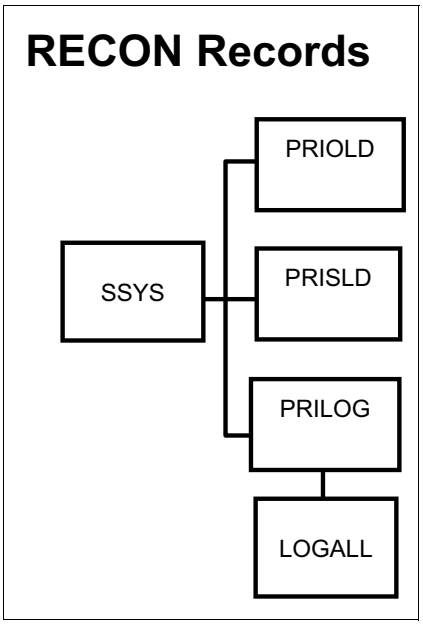

Figure 3-2 Subsystem and log RECON records

Each database for which recovery information is to be recorded is registered the DBRC. Each database with have a combination of DB, DBDS, PART, and AREA records. After registration, all recovery-related events will be recorded against that database. The events tracked are Image Copy (IC), Recovery (RECOV), reorganization reload (REORG), and application update processing by IMS subsystems (ALLOC). When a recovery significant event happens, the appropriate RECON records are created or updated by DBRC. The RECON records are illustrated in Figure 3-3 on page 40.

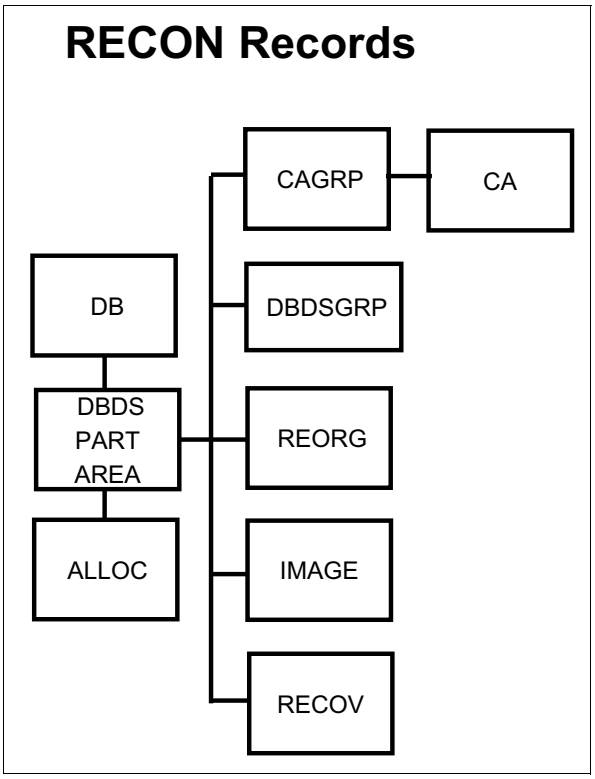

Figure 3-3 Database and event records

The DB, DBDS, PART, and AREA records are created at database registration time and retained unless deleted manually.

The utility event records (IC, REORG, RECOV) are created at the subsystem start time and they are retained until DBRC is no longer required for recovery proposes.

The ALLOC record is the link between a database and the IMS subsystem instance, which has updated this database. For full function (FF) databases, this is written at first update. For fast path (FP) databases, this is done at allocation time.

3.1.3 Application update processing

To understand database recovery, you have to understand how DBRC records application updates in the RECON. ALLOC records are written by IMS subsystems processing application updates in that instance of IMS. The ALLOC reflects the timestamp of the first update for a database data set. The ALLOC records have the SSID and the start time of the RLDS entry in the PRILOG records. Since only one ALLOC record will exist for this database data set for an instance of an IMS subsystem, all of the RLDS entries from that point forward to the end of the PRILOG record would be used for a recovery. If the database is unauthorized from the IMS subsystem before its termination via a DBR command, the DEALLOC timestamp fields of the ALLOC record will be set indicating the time of the deallocation.

An example of ALLOC records in Example 3-1 on page 41 shows an ALLOC with and without a DEALLOC timestamp in the record. The first ALLOC was closed by a DB QUIESCE command, which acts like a DBR command. The second ALLOC is not closed. An IMS subsystem, which terminates normally does not update the ALLOC records with a DEALLOC timestamp, but closes the PRILOG records, thus closing all the ALLOC records by default.

Example 3-1 ALLOC records

```
ALLOC
 ALLOC   =14.218 19:24:53.631527         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.216 22:01:26.256110
 DEALLOC =14.218 19:47:04.158786          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.218 19:47:04.198849         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.216 22:01:26.256110
```

3.1.4 Recovery processing

The recovery process is a process of recovering a database using an Image Copy and applying log records from the various log data sets. The IMS Recovery Utility will recover each database data set individually, so the recovery utility has to be run for each database data sets. It is designed to prevent the loss of any update information. There are three types of recovery available:

- Full recovery
- Timestamp recovery
- Point in time recovery

The full recovery is to apply the IC and all of the available log records. As the database cannot be authorized to an IMS subsystem, all of the logs from the appropriate PRILOG records would be used. If the database data sets had been lost or damaged, a full recovery would be used. Timestamp recoveries are a recovery to a previous time in which the database was not authorized. For example, recovery back to the time of a previous IC. A point in time recovery (PITR) is a recovery to a specific timestamp regardless of database authorizations. This type of recovery is not available in the IMS product and only available with a separately purchased tool. The IBM product is The Database Recovery Facility.

3.2 Performing an IMS database recovery

Performing a full database recovery can be as simple as using the DBRC **GENJCL.RECOV** command and naming the database or database group. The command will locate the most recent IC and all the log files up to the current time. In most cases, this it not the type of recovery that is required. Most of the time some form of timestamp recovery is required. This means that a valid timestamp to recover to must be determined. This can be quite a complex process. The RECON must be integrated to find times when all of the database data sets were not authorized to any IMS subsystem.

The **LIST** command is used to list RECON information. To perform a database recovery, the **LIST.DB** or **LIST.HISTORY** commands will provide information about when a database was updated by an IMS subsystem. The ALLOC records are the link to the PRILOG records, which identify which log data sets are needed for recovery.

3.2.1 ALLOC record timestamps

ALLOC records have three timestamps that are important to understand. These timestamps are used to identify which log data sets contain updates for these database data sets. An example of an ALLOC record is shown in Example 3-2 on page 42.

The first is the ALLOC timestamp. For FF and HALDB databases, this is the time of the first update for this data set for this instance of IMS. It indicates that there is at least one update log record for these data sets. For FP databases, this timestamp is when the area was allocated to this instance of IMS. There may or may not be any update log records actually written.

The second is the START timestamp. It is the start time for the PRILOG records for this instance of IMS. The PRILOG record is written when the subsystem starts. If the subsystem terminates normally, the PRILOG record's STOP time is updated with the timestamp at the end of the last log record in the log. When the subsystem is terminated, only the PRILOG record is closed and the individual ALLOC does not have the DEALLOC timestamp updated. To determine if the ALLOC is closed when there is no DEALLOC timestamp, the STOP time in the PRILOG is used to determine the logs that are required.

The third is the DEALLOC timestamp. This is added to the ALLOC record if the database data set is taken offline from the instance of IMS before that instance terminates normally. This could be the result of a DBR or DB **QUISCE** command.

Example 3-2 ALLOC and PRILOG records

```
ALLOC
 ALLOC   =14.223 18:44:31.698768         *  ALLOC LRID =0000000000000000
 DSSN=0000000003 USID=0000000004 START = 14.220 16:05:53.821139
 DEALLOC =14.223 18:46:07.783133          DEALLOC LRID =0000000000000000


PRILOG                                       RECORD SIZE=     304
 START = 14.220 16:05:53.821139         *    SSID=IVP1     VERSION=13.1
 STOP  = 14.223 18:52:43.798246              #DSN=1
 GSGNAME=**NULL**                                  NORMAL TERM
 FIRST RECORD ID= 0000000000000001       PRILOG TOKEN= 0
 EARLIEST CHECKPOINT = 14.220 16:05:54.399140

 DSN=IMS13X.SLDS.G0347V00                                 UNIT=SYSALLDA
 START = 14.220 16:05:53.821139           FIRST DS LSN= 0000000000000001
 STOP  = 14.223 18:52:43.798246           LAST  DS LSN= 0000000000001051
 FILE SEQ=0001    #VOLUMES=0001
```

3.2.2 Image copy timestamps

The Image Copy Utility (or equivalent) creates an IC record in the RECON for each database data set it creates an IC data set for. It will have the start time of the utility. If the IC was a BATCH IC, no STOP time is recorded. If the IC is a form of concurrent copy, a STOP time will be recorded to identify the concurrent period and which logs may be required. An example of a BATCH IC is shown in Example 3-3.

Example 3-3 IC RECON record

```
IMAGE
 RUN     = 14.220 01:35:33.394827         *  RECORD COUNT =2
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000001

IC1
 DSN=IMSVS.T1HCSTA.T1HCSTAA.IC.IC013532           FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
```

```
VOLSER=TST072
```

3.2.3 GENJCL.RECOV DBRC command

Performing a database recovery uses the DBRC **GENJCL** command to generate the required recovery JCL. The type of recovery is determined by the keywords on the command. A single database can be recovered or a group of databases as defined by DBRC groups. The **RCVTIME** keyword is used to perform a timestamp recovery. A valid DBRC recovery point must be identified by the timestamp used. If the timestamp supplied is not a valid recovery point, the **GENJCL** command will terminate with the appropriate messages. If the **RVCVTIME** keyword is not present, a full recovery will be attempted. The example shown in Example 3-4 is the DBRC command to perform a full recovery of a three-partition HALDB.

Example 3-4 GENJCL.RECOV DBRC command

```
//D        EXEC PGM=DSPURX00,REGION=6M
//STEPLIB  DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSPRINT DD SYSOUT=*
//IMS      DD DSN=IMS13X.DBDLIB
//JCLPDS   DD DISP=SHR,DSN=IMS13X.JCLLIB
//JCLOUT   DD SYSOUT=(*,INTRDR)
//SYSIN  DD *
GENJCL.RECOV DBD(T1HCUST) JOB(RALJOB) LIST ONEJOB
```

The results of the **GENJCL.RECOV** command are shown in Example 3-5.

Example 3-5 Results of previous GENJCL.RECOV command

```
//RCV1 EXEC PGM=DFSRRC00,
//             PARM='UDR,DFSURDB0,T1HCUST,,,,,,,,,,Y,,,,,,,,NONE'
//STEPLIB   DD DISP=SHR,DSN=HPS.SHPSLMD0
//          DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSPRINT  DD SYSOUT=*
//IMS       DD DISP=SHR,DSN=IMS13X.DBDLIB
//T1HCSTAA    DD DSN=IMS13X.IMS13.T1HCUST.T1HCSTA.A00001,
//             DISP=OLD,
//             DCB=BUFNO=10
//DFSUDUMP  DD DSN=IMSVS.T1HCSTA.T1HCSTAA.IC.IC013532,
//             DISP=OLD,DCB=BUFNO=10
//DFSUCUM   DD DUMMY
//DFSULOG   DD DSN=IMS13X.SLDS.G0229V00,
//             DCB=RECFM=VB,
//             DISP=OLD
//          DD DSN=IMS13X.SLDS.G0230V00,
//             DCB=RECFM=VB,
//             DISP=OLD
//DFSVSAMP  DD DISP=SHR,
//             DSN=IMS13X.PROCLIB(DFSVSMDB)
//SYSIN     DD *
S  T1HCUST  T1HCSTAA
/*
//RCV2 EXEC PGM=DFSRRC00,
//             PARM='UDR,DFSURDB0,T1HCUST,,,,,,,,,,Y,,,,,,,,NONE'
//STEPLIB   DD DISP=SHR,DSN=HPS.SHPSLMD0
//          DD DISP=SHR,DSN=IMS13X.SDFSRESL
```

```
//SYSPRINT  DD SYSOUT=*
//IMS       DD DISP=SHR,DSN=IMS13X.DBDLIB
//T1HCSTBA    DD DSN=IMS13X.IMS13.T1HCUST.T1HCSTB.A00002,
//             DISP=OLD,
//             DCB=BUFNO=10
//DFSUDUMP  DD DSN=IMSVS.T1HCSTB.T1HCSTBA.IC.IC013532,
//             DISP=OLD,DCB=BUFNO=10
//DFSUCUM   DD DUMMY
//DFSULOG   DD DSN=IMS13X.SLDS.G0275V00,
//             DCB=RECFM=VB,
//             DISP=OLD
//          DD DSN=IMS13X.SLDS.G0276V00,
//             DCB=RECFM=VB,
//             DISP=OLD
//DFSVSAMP  DD DISP=SHR,
//             DSN=IMS13X.PROCLIB(DFSVSMDB)
//SYSIN     DD *
S  T1HCUST  T1HCSTBA
/*
//RCV3 EXEC PGM=DFSRRC00,
//             PARM='UDR,DFSURDB0,T1HCUST,,,,,,,,,,Y,,,,,,,,NONE'
//STEPLIB   DD DISP=SHR,DSN=HPS.SHPSLMD0
//          DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSPRINT  DD SYSOUT=*
//IMS       DD DISP=SHR,DSN=IMS13X.DBDLIB
//T1HCSTCA    DD DSN=IMS13X.IMS13.T1HCUST.T1HCSTC.A00003,
//             DISP=OLD,
//             DCB=BUFNO=10
//DFSUDUMP  DD DSN=IMSVS.T1HCSTC.T1HCSTCA.IC.IC013532,
//             DISP=OLD,DCB=BUFNO=10
//DFSUCUM   DD DUMMY
//DFSULOG   DD DSN=IMS13X.SLDS.G0320V00,
//             DCB=RECFM=VB,
//             DISP=OLD
//          DD DSN=IMS13X.SLDS.G0321V00,
//             DCB=RECFM=VB,
//             DISP=OLD
//DFSVSAMP  DD DISP=SHR,
//             DSN=IMS13X.PROCLIB(DFSVSMDB)
//SYSIN     DD *
S  T1HCUST  T1HCSTCA
/*
```

3.3 DB recovery to last image copy

Recovery of a database to the last IC would be a common practice. But commonly this would include more than a single database. Additionally, if the database to be recovered is an HALDB or FP database, more than one database data set would be involved, so individual IC times would have to be discovered and used.

For this example, a three-partition HALDB is used. The DBD name is T1HCUST, with T1HCSTA, T1HCSTB, and T1HCSTC the partition names.

3.3.1 DBRC GENJCL.RECOV example

To perform this type of a recovery with DBRC, the process would be:

1. Determine which database needs to be recovered and if there is a DBRC group that covers all but only those databases. If so, use that group name in all the commands.
2. LIST the DBRC information for the DBD or group using the **LIST.DB** DBD(xxx) DBDS or **LIST.HISTORY** command.
3. Read the output of that command and find the latest IC time for all of the data sets. The IC time from the three partitions has been copied into Example 3-6. The latest timestamp was from partition T1HCSTC and that is 14.224 00:37:26.255079.

Example 3-6 LIST.DB for HALDB T1HCUST

```
PARTITION T1HCSTA
IMAGE
 RUN     = 14.224 00:09:55.909194         *  RECORD COUNT =181200
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000007

IC1
 DSN=IMSRES9.IC.T1HCUST.T1HCSTAA.D2240009         FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST074

IMAGE
 RUN     = 14.224 00:32:03.693910         *  RECORD COUNT =181200
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000007

IC1
 DSN=IMSVS.T1HCSTA.T1HCSTAA.IC.IC003202           FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST075

IMAGE
 RUN     = 14.224 00:36:26.415559         *  RECORD COUNT =181200
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000007

IC1
 DSN=IMSVS.T1HCSTA.T1HCSTAA.IC.IC003626           FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST074
PARTITION T1HCSTB
IMAGE
 RUN     = 14.223 23:47:31.436560         *  RECORD COUNT =123240
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000002

IC1
 DSN=IMSRES9.IC.T1HCUST.T1HCSTBA.D2232347         FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST075
IMAGE
 RUN     = 14.224 00:10:03.877881         *  RECORD COUNT =123479
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000002

IC1
 DSN=IMSRES9.IC.T1HCUST.T1HCSTBA.D2240009         FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST07C
IMAGE
```

```
 RUN     = 14.224 00:37:02.606064         *  RECORD COUNT =123479
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000002

IC1
 DSN=IMSVS.T1HCSTB.T1HCSTBA.IC.IC003626           FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0002 VOLS USED=0002
                                     VOLSER=TST07D,TST078
PARTITION T1HCSTC
IMAGE
 RUN     = 14.224 00:10:09.261975         *  RECORD COUNT =17040
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000003

IC1
 DSN=IMSRES9.IC.T1HCUST.T1HCSTCA.D2240009         FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST070
IMAGE
 RUN     = 14.224 00:32:50.303429         *  RECORD COUNT =17040
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000003

IC1
 DSN=IMSVS.T1HCSTC.T1HCSTCA.IC.IC003202           FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST074
IMAGE
 RUN     = 14.224 00:37:26.255079         *  RECORD COUNT =17040
 STOP    = 00.000 00:00:00.000000            BATCH      USID=0000000003

IC1
 DSN=IMSVS.T1HCSTC.T1HCSTCA.IC.IC003626           FILE SEQ=0001
 UNIT=SYSALLDA                       VOLS DEF=0001 VOLS USED=0001
                                     VOLSER=TST070
```

4. Code the recovery time from the previous step and add a second to it, then code it into the **GENJCL.RECOV** command and execute it. The command is shown in Example 3-7.

Example 3-7 GENJCL.RECOV command with RCVTIME

```
//STEP1   EXEC PGM=DSPURX00,REGION=4096K
//STEPLIB  DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//DFSRESLB DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//JCLOUT   DD  SYSOUT=(*,INTRDR)
//JCLPDS   DD  DSN=IMS13X.JCLLIB,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//IMS      DD  DSN=IMS13X.DBDLIB,DISP=SHR
//SYSIN   DD  *
GENJCL.RECOV DBD(T1HCUST)JOB(RALJOB) ONEJOB -
RCVTIME(142240037270000000)
//*
```

3.3.2 IMS Recovery Expert example: recovery to last image copy

Performing the same recovery as the previous example, but this time using IMS Recovery Expert, is a much simpler process:

1. Invoke IMS Recovery Expert CLIST by using the CLIST BSYV21 and select option **3** as shown in Figure 3-4 on page 47.

```
IMS RE   V2R1 -------------------------------- IMS Recovery Expert for z/OS
Option  ===> 3

                                                    User: IMSRES4 - BSY

------------------------------------------------------------------------------
    0. User Settings

    1. System Backup Profiles

    2. System Restore and Offload

    3. Application Profiles

    4. Disaster Recovery Profiles

    5. IMS System Analysis and Configuration

    6. Coordinated Application Profiles

    X. Exit
```

Figure 3-4 Recovery Expert main panel

2. Using an existing application profile group or after creating a new one, select **B** for the profile as shown in Figure 3-5.

```
IMS RE   V2R1   ------- Applications Profile Display ------ 2014/08/13 00:53:4
Option  ===>                                                 Scroll ===> PAGE

Line Commands: D - Delete  U - Update  C - Create  R - Rename  V - View
               B - Build recover job   P - Create Recovery Point
               Q - Quiet Time Analysis
------------------------------------------------------------------------------
 Profile Like  *                                    SSID Like  *
 Creator Like  *                                    Row 1 of 3          >
------------------------------------------------------------------------------

Cmd  Name                           Creator   SSID  Updt
     RLT1H                          RLONG     IVP1   U
     TCUST                          IMSRES4   IVP1   U
 B   T1HCUST                        IMSRES4   IVP1   U
***************************** Bottom of Data ********************************
```

Figure 3-5 Application profile panel

3. On the BUILD JOB panel will appear: Edit the JOB data set, and JOB card information. Then, enter **Y** on the Edit Recovery Options line as shown in Figure 3-6 on page 48.

```
                    Build Job for IMSRES4.T1HCUST

   Recovery Point         1  ( 1 Current, 2 Timestamp, 3 PIT, 4 RPID)
   Recovery Timestamp

   Edit Generated Job     Y           (Yes/No)
   Edit Recovery Options  Y           (Yes/No)

   Build job in Dataset   IMSRES4.JCL.SAVED
                Member    t1hrest

   Job Cards:
==> //OBJREST JOB IMSRES4,CLASS=A,NOTIFY=&SYSUID
==> /*JOBPARM SYSAFF=SC53
==> //*
==> //*

   Press ENTER to process or PF3 to Cancel
```

Figure 3-6 Build job panel

4. Determine which recovery options need to be modified. In this example, the standard IMS Recovery Utility is selected by using an “I” in the Recovery Utility line. To only select the IC as input, use an “I” in the Recovery Resources as shown in Figure 3-7. There are some SBY skeletal members that must be customized and placed in the JCLPDS data sets described in the Datasets for GENJCL.

```
IMS RE   V2R1 -------- Application Recovery Options ------- 2014/08/13 01:04:3
Option   ===>
--------------------------------------------------------------------------------
 Creator: IMSRES4    Name: T1HCUST                          SSID: IVP1
 Share Option: U  (Upd,View,No)    Description: T1HCUST AND INDEX
--------------------------------------------------------------------------------
 Enter the Recovery options to associate with this profile:
                                                                    More:     +
 SLB Processing Only    ==> N (Yes/No)
  Recovery Utility      ==> I (Ims/Drf/User)       Edit Options  N  (Yes/No)
  Index Rebuild Utility ==> N (Iib/User/None)      Edit Options  N  (Yes/No)
  HALDB PIX/ILDS Rbld   ==> I (Ims/User/None)      Edit Options  N  (Yes/No)
  Change Accum Utility  ==> N (Ims/Hpca/User/None) Edit Options  N  (Yes/No)
  Post Recovery IC      ==> N(Ims/Hpic/User/None) Edit Options  N  (Yes/No)
 Recovery Resources     ==> I (All/Slb/Ic)
 From Offload           ==> N (Yes/No)
 Parallel Tasks         ==> 04 (01-99)
 Number of Tape units   ==> 02 (01-99)
 Action on Warnings     ==> W  (Continue/Wtor/Abort)
 Datasets for GENJCL    ==> IMS13X.JCLLIB
                        ==>
```

Figure 3-7 Application recovery option panel

5. After returning to the Build JOB panel, enter a “Y” in the Edit Generated Job line if you want to view the JOB before submitting it. In this example, “N” was used to bypass reviewing the job as shown in Figure 3-8.

```
                    Build Job for IMSRES4.T1HCUST

   Recovery Point         1  ( 1 Current, 2 Timestamp, 3 PIT, 4 RPID)
   Recovery Timestamp

   Edit Generated Job     N (Yes/No)
   Edit Recovery Options  N (Yes/No)

   Build job in Dataset   IMSRES4.JCL.SAVED
                Member    t1hrest

   Job Cards:
==> //OBJREST JOB IMSRES4,CLASS=A,NOTIFY=&SYSUID
==> /*JOBPARM SYSAFF=SC53
==> //*
==> //*

   Press ENTER to process or PF3 to Cancel
```

Figure 3-8 Build job panel to submit recovery

6. Monitor the submitted jobs for completion. The job submitted by Recovery Expert will submit several other jobs to perform the recovery. The controlling job will:
   a. The first job will perform the following functions:
      i. DBR the databases if the IMS online systems are active
      ii. Issue the DBRC command CHANGE.DBDS RECOV to set the DBRC flags for recovery started
   b. The second job performs the following functions:
      i. Recover the HALDB Partition using IMS Recovery Utility

         IMS Recovery Utility JCL for each partition is created only selecting the IC data set as input regardless of the additional Log or change accumulations files available since the last Batch IC. Since the step is created for each partition, only an example of the first partition is shown in Example 3-8.

Example 3-8 Recovery step of partition T1HCSTA

```
//RCV1 EXEC PGM=DFSRRC00,
//             PARM='UDR,DFSURDB0,T1HCUST,,,,,,,,,,Y,,,,,,,,NONE'
//*              JCL FOR RECOVERY.
//STEPLIB   DD DISP=SHR,DSN=HPS.SHPSLMD0
//          DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSPRINT  DD SYSOUT=*
//IMS       DD DISP=SHR,DSN=IMS13X.DBDLIB
//T1HCSTAA    DD DSN=IMS13X.IMS13.T1HCUST.T1HCSTA.A00001,
//             DISP=OLD,
//             DCB=BUFNO=10
//DFSUDUMP  DD DSN=IMSVS.T1HCSTA.T1HCSTAA.IC.IC003626,
//             DISP=OLD,DCB=BUFNO=10
//DFSUCUM   DD DUMMY
```

```
//DFSULOG   DD DUMMY
//DFSVSAMP  DD DISP=SHR,
//             DSN=IMS13X.PROCLIB(DFSVSMDB)
//SYSIN     DD *
//*

DFS391I    D A T A   B A S E   D A T A   S E T   R E C O V E R Y   U T I L I T Y
FABJ0300I HPIC RECOVERY FUNCTION USING THE IMS-COMPATIBLE JCL
      S Y S I N   C O N T R O L   C A R D S
DFS391I    S  T1HCUST  T1HCSTAA
      E N D   O F   S Y S I N   C O N T R O L   C A R D S
DFS391I    **RECOVER DATA BASE T1HCUST  DDNAME T1HCSTAA
DFS323W    FUNCTION RV WAS NOT SUPPLIED A CHANGE ACCUMULATION INPUT
DFS324W    FUNCTION RV WAS NOT SUPPLIED AN INPUT LOG FILE
DFS2803I   RECORD COUNT = 000181200 FOR DDNAME DFSUDUMP
DFS2803I   RECORD COUNT = 000000000 FOR DDNAME DFSUCUM
DFS2803I   RECORD COUNT = 000000000 FOR DDNAME DFSULOG
DSP0021I  RECON DATA SETS SUCCESSFULLY UPDATED
DFS339I    FUNCTION RV HAS COMPLETED NORMALLY RC=00
```

ii. Rebuild the HALDB Primary index using the HALDB Index/ILDS Rebuild utility

The generated JCL for the primary index rebuild for each partition follows the recovery step for that partition. Example 3-9 shows the JCL for partition T1HCSTA.

Example 3-9 DFSPREC0 JCL

```
//UPREC2 EXEC PGM=DFSRRC00,REGION=1300K,COND=(4,LT),
//            PARM='ULU,DFSPREC0,T1HCUST,,,,,,,,,,Y,N'
//*
//STEPLIB   DD DISP=SHR,DSN=IMS13X.SDFSRESL
//*********************************************************************
//*
//* USER JCL FOR REBUILDING EITHER THE INDEX OR ILDS DATA SET, OR
//* BOTH DATA SETS FOR A HALDB PARTITION.
//*
//*********************************************************************
//SYSPRINT DD SYSOUT=*
//IMS      DD DISP=SHR,DSN=IMS13X.DBDLIB
//DFSVSAMP DD DISP=SHR,DSN=IMS13X.PROCLIB(DFSVSMDB)
//SYSIN DD *

PARTITION=T1HCSTA,RECOVTYP=BOTH
Total number of INDEX entries inserted = 00191942
Total number of ILE entries inserted = 00000000
```

iii. Restart the database to the online system using the BSYSTADB utility

The last step in the job is to issue IMS START commands to make the database available to the online system. The JCL and messages are shown in Example 3-10.

Example 3-10 BSYSTADB Utility JCL

```
//** * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
//*                                                                     *
//*  Step:     IMSSTART                                                 *
//*                                                                     *
//*  This step will start the databases that were DBR'd at the         *
```

```
//*  beginning of the recovery process.                              *
//*                                                                  *
//** * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
//*                                                                  *
//IMSSTART EXEC PGM=BSYSTADB,PARM=(03),COND=(4,LT)
//STEPLIB  DD DISP=SHR,DSN=BSY.SBSYLOAD
//BSYREPOS DD DISP=SHR,DSN=BSY.V0210.CONTROL
//BSYPRINT DD SYSOUT=*
//LOGFILE  DD DISP=SHR,DSN=IMSRES4.$$LOG$$.JOB04544
//SYSUDUMP DD SYSOUT=*

BSYI406I - IMS Sub-System IVP1 is ACTIVE on z/OS Image SC53
BSYI414I - PROGRAM BSYSTADB starting to issue IMS STA commands
BSYI923I - Processing Started for Partition T1HCSTA
BSYI923I - Processing Complete for Partition T1HCSTA

BSYI923I - Processing Started for Partition T1HCSTB
BSYI923I - Processing Complete for Partition T1HCSTB

BSYI923I - Processing Started for Partition T1HCSTC
BSYI923I - Processing Complete for Partition T1HCSTC
```

3.4 Creating a DBRC recovery point

The ability to recover databases often depends on where there are valid recovery points. A recovery point is anytime when the databases are not currently authorized to an IMS subsystem where there have been updates. In DBRC terms, that is when the ALLOC records or PRILOG records are closed at that time. For DLIBATCH subsystems, this is when the JOB step completes and closes the PRILOG record. For online subsystems, the PRILOG is opened at the start of the instance of IMS and does not close until IMS terminates normally. The databases are considered updated when the ALLOC record is opened and there is no recovery point until either the ALLOC has a DEALLOC time or the PRILOG is closed. The ALLOC record is updated with a DEALLOC time when a DBR or DB **QUISCE** command is completed for this database.

The DBR command not only closes the ALLOC records but deallocates the data sets from the subsystem. Because of this, a DBR command cannot be completed while there are BMP running, which might be accessing that database, and the DBR command will be rejected by IMS. Since IMS 11, a DB QUIESCE function has been available to perform a QUIESCE and go operation to create a DBRC recovery point where there would not be one otherwise.

The QUIESCE function will try to suspend all updates for a database or set of databases by holding transactions at end of the commit point and all BMP at sync point for a period set by the command. If successful, the OLDS is closed and switched to the next one and that time is used to close all the ALLOC records with a DEALLOC timestamp. This creates a DBRC recovery point. After the QUIESCE is released, new ALLOC records will be written for those databases.

3.4.1 Recovery Expert example: recovery to a point in time

Recovery Expert uses an application profile group that is already defined to process a create recovery point request.

The P option is used in the Application Profile panel to select the request to create a recovery point as shown in Figure 3-9.

```
 IMS RE   V2R1   ------- Applications Profile Display ------ 2014/08/17 23:13:0
 Option  ===>                                                 Scroll ===> PAGE

 Line Commands: D - Delete  U - Update  C - Create  R - Rename  V - View
                B - Build recover job   P - Create Recovery Point
                Q - Quiet Time Analysis

------------------------------------------------------------------------------
  Profile Like  *                                    SSID Like  *
  Creator Like  *                                    Row 1 of 4          >

------------------------------------------------------------------------------

 Cmd  Name                            Creator   SSID  Updt
      RLT1H                           RLONG     IVP1   U
      TCUST                           IMSRES4   IVP1   U
      T1HCUST                         IMSRES4   IVP1   U
 P    T2HCUST                         IMSRES4   IVP1   U
```

Figure 3-9 Create Recovery Point from Application Profile panel

The BUILD JOB panel allows you to edit the JOB before submitting it or to just SUBMIT it as shown in Figure 3-10.

```
                     Build Job for IMSRES4.T2HCUST

   Edit Generated Job     Y           (Yes/No)

   Build job in Dataset   IMSRES4.JCL.SAVED
                Member    JOB444

   Job Cards:
==> //OBJREST JOB IMSRES4,CLASS=A,NOTIFY=&SYSUID
==> /*JOBPARM SYSAFF=SC53
==> //*
==> //*

   Press ENTER to process or PF3 to Cancel
```

Figure 3-10 Build JOB Screen

The job created issues the IMS type 2 UPDATE command to send the command to IMS via the OM task. The messages and responses from IMS are returned to the job as shown in Example 3-11.

Example 3-11 IMS Recovery Expert JOB Messages

```
BSY0001I - IMS Recovery Expert for z/OS Starting. Version 02.01.000
BSY0004I -
BSY0004I - Control card stream processed by BSY..
BSY0004I -
```

```
BSYO004I -
BSYO004I - QUIESCE
BSYO004I - (
BSYO004I - IMS_PROFILE_NAME
BSYO004I - 'T2HCUST'
BSYO004I - IMS_PROFILE_CREATOR
BSYO004I - IMSRES4
BSYO004I - IMS_CQSSID
BSYO004I - IVP1
BSYO004I - )
BSYO004I -
BSYO541I - IMS Quiesce beginning...
BSYO545I - IMS subsystem IVP1 is ACTIVE on z/OS image SC53
BSYO004I - Object explode complete.
BSYO004I -
BSYO004I - DATABASE  AREA/PART DDNAME    TYPE
BSYO004I - T2HCUST   T2HCSTA   T2HCSTAA  HALDB
BSYO004I - T2HCUST   T2HCSTA   T2HCSTAL  HALDB
BSYO004I - T2HCUST   T2HCSTA   T2HCSTAX  HALDB
BSYO004I - T2HCUST   T2HCSTB   T2HCSTBA  HALDB
BSYO004I - T2HCUST   T2HCSTB   T2HCSTBL  HALDB
BSYO004I - T2HCUST   T2HCSTB   T2HCSTBX  HALDB
BSYO004I - T2HCUST   T2HCSTC   T2HCSTCA  HALDB
BSYO004I - T2HCUST   T2HCSTC   T2HCSTCL  HALDB
BSYO004I - T2HCUST   T2HCSTC   T2HCSTCX  HALDB
BSYO541I - Beginning IMS Quiesce...
BSYO541I - BSYI328I - Issuing CSLOMCMD QUIESCE  command to IMSPLEX PLX13,
route=IVP1
BSYO541I - BSYI329I - Command: UPD DB START(QUIESCE) NAME(T2HCUST  )
SET(TIMEOUT(005))
BSYO541I - IMS Quiesce completed successfully...
```

The result of the DB QUIESCE is for IMS to switch OLDS and archive it. The timestamp of the end of this OLDS is used as the DEALLOC time in the ALLOC records for the databases that participated in the QUIESCE. Without the QUIESCE, the ALLOC records would remain open and as the PRILOG is also still open there is no recovery point. A DBR could be issued but that would interrupt normal processing more and may not be available if BMPs are currently running.

To show the results, Example 3-12 has some messages from the IMS control region and the output of a LIST.LOG SSID(IVP1) command.

Example 3-12 Messages from the IMS subsystem and RECON records

Message from the STC for IMS13X

```
21.18.23 STC06198  DFS2484I JOBNAME=IVPGNJCL GENERATED BY LOG AUTOMATIC ARCHIVING IVP1
```

The start of the PRILOG reocord

```
PRILOG                                      RECORD SIZE=    1424
 START = 14.229 20:59:34.589269         *    SSID=IVP1     VERSION=13.1
 STOP  = 00.000 00:00:00.000000 #DSN=8
 GSGNAME=**NULL**                                 NORMAL TERM
 FIRST RECORD ID= 0000000003FAB534       PRILOG TOKEN= 0
 EARLIEST CHECKPOINT = 14.227 23:51:26.889556
```

The specific SLDS entry

```
DSN=IMS13X.SLDS.G0467V00                                UNIT=SYSALLDA
START = 14.229 21:16:14.932003          FIRST DS LSN= 0000000004427539
STOP  = 14.229 21:18:23.842049          LAST  DS LSN= 00000000044E1231
FILE SEQ=0001    #VOLUMES=0001
CHECKPOINT TYPES=80: SIMPLE=Y SNAPQ=N DUMPQ=N PURGE=N FREEZE=N

  VOLSER=TST07B STOPTIME = 14.229 21:18:23.842049
    CKPTCT=1    CHKPT ID = 14.229 21:16:10.856851
    LOCK SEQUENCE#=  CD9ED694E1F2
```

Before the QUIESCE being issued, a listing of the ALLOC records for the partitions shows that the ALLOC are open. A recovery point will be created when the IMS system terminates, the databases taken offline from the subsystem or the QUIESCES being done. The listing of the ALLOC records is shown in Example 3-13.

Example 3-13 Listing of ALLOC records before QUIESCE

```
SN=IMS13X.IMS13.T2HCUST.T2HCSTA.A00001
ALLOC
 ALLOC   =14.229 19:47:21.805919         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.227 23:51:26.270297
 DEALLOC =14.229 20:07:25.509408          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.229 20:21:33.996787         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.227 23:51:26.270297

ALLOC
 ALLOC   =14.229 20:59:38.646365         *  ALLOC LRID =0000000000000000
 DSSN=0000000003 USID=0000000004 START = 14.229 20:59:34.589269

DSN=IMS13X.IMS13.T2HCUST.T2HCSTB.A00002
ALLOC
 ALLOC   =14.229 19:47:38.810767         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.227 23:51:26.270297
 DEALLOC =14.229 20:07:25.509408          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.229 21:14:43.780890         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.229 20:59:34.589269

DSN=IMS13X.IMS13.T2HCUST.T2HCSTC.A00003
ALLOC
 ALLOC   =14.229 19:48:12.915035         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.227 23:51:26.270297
 DEALLOC =14.229 20:07:25.509408          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.229 21:15:26.754277         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.229 20:59:34.589269
```

A LIST.DB after the QUIESCE for the HALDB shows that each partition has a DELLOC timestamp of the STOP time for the OLDS. A listing of all the ALLOC records for the partitions is shown in Example 3-14 on page 55.

Example 3-14 Listing of ALLOC records after QUIESCE

```
DSN=IMS13X.IMS13.T2HCUST.T2HCSTA.A00001
ALLOC
 ALLOC   =14.229 19:47:21.805919         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.227 23:51:26.270297
 DEALLOC =14.229 20:07:25.509408          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.229 20:21:33.996787         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.227 23:51:26.270297

ALLOC
 ALLOC   =14.229 20:59:38.646365         *  ALLOC LRID =0000000000000000
 DSSN=0000000003 USID=0000000004 START = 14.229 20:59:34.589269
 DEALLOC =14.229 21:18:23.826079          DEALLOC LRID =0000000000000000
 QUIESCE


DSN=IMS13X.IMS13.T2HCUST.T2HCSTB.A00002
ALLOC
 ALLOC   =14.229 19:47:38.810767         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.227 23:51:26.270297
 DEALLOC =14.229 20:07:25.509408          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.229 21:14:43.780890         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.229 20:59:34.589269
 DEALLOC =14.229 21:18:23.826079          DEALLOC LRID =0000000000000000
 QUIESCE

DSN=IMS13X.IMS13.T2HCUST.T2HCSTC.A00003
ALLOC
 ALLOC   =14.229 19:48:12.915035         *  ALLOC LRID =0000000000000000
 DSSN=0000000001 USID=0000000002 START = 14.227 23:51:26.270297
 DEALLOC =14.229 20:07:25.509408          DEALLOC LRID =0000000000000000

ALLOC
 ALLOC   =14.229 21:15:26.754277         *  ALLOC LRID =0000000000000000
 DSSN=0000000002 USID=0000000003 START = 14.229 20:59:34.589269
 DEALLOC =14.229 21:18:23.826079          DEALLOC LRID =0000000000000000
 QUIESCE
```

Because the ALLOC records are closed, this becomes a DBRC recovery point should it be needed for any future database recovery.

3.5 Finding a quiet point in a log

The updates on an IMS log reflect the updates processing going on at the time. There is likely to be many concurrent transactions and BMP processing going on at any one time. The databases are physically allocated to the online system when the database is started and remains online until either a DBR command is issued to take it offline or the IMS system itself is stopped. Trying to find a time when a database or a group of databases within that time that

they are not actually being updated by any of the process can provide a time to which the database might be recovered to. Of course, any updates after that time would in fact be lost.

IMS does not allow a recovery to this quiet time. There are tools though which can make use of this quiet time to allow a recovery to be done while protecting the integrity of the databases. This type of recovery is known as a point in time recovery (PITR). The IBM product that can be used to perform a PITR is the IBM IMS Database Recovery Facility for z/OS (DRF).

It should also be noted that using the PITR type of recovery will almost always result in the updates after the selected time to be “undone”, in that the process is to recover to a time when those updates were not performed. It is the responsibility of the DBA or application programmers to understand the ramifications of such a recovery.

DRF can be invoked directly or via IMS Recovery Expert. DRF does not require the use of a quiet time to perform a PITR but the use of one will mean that no updates were in progress at the recovery point.

3.5.1 Finding a quiet time

1. Invoke IMS Recovery Expert CLIST by using the CLIST BSYV21 and select option **3** as shown in Figure 3-11.

```
IMS RE    V2R1 ------- IMS Recovery Expert for z/OS                    -----
Option  ===> 3

                                                        User: IMSRES4 - BSY

-------------------------------------------------------------------------------

     0. User Settings

     1. System Backup Profiles

     2. System Restore and Offload

     3. Application Profiles

     4. Disaster Recovery Profiles

     5. IMS System Analysis and Configuration

     6. Coordinated Application Profiles

     X. Exit
```

Figure 3-11 Recovery Expert main panel

2. Use the Quiet Time Analysis by section Q on the application profile to be used as shown in Figure 3-12 on page 57.

```
IMS RE   V2R1   ------- Applications Profile Display ------ 2014/08/21 01:30:3
Option  ===>                                                 Scroll ===> PAGE

Line Commands: D - Delete  U - Update  C - Create  R - Rename  V - View
               B - Build recover job   P - Create Recovery Point
               Q - Quiet Time Analysis

--------------------------------------------------------------------------------
 Profile Like  *                                    SSID Like  *
 Creator Like  *                                    Row 1 of 4          >

--------------------------------------------------------------------------------

Cmd  Name                           Creator   SSID  Updt
     RLT1H                          RLONG     IVP1   U
     TCUST                          IMSRES4   IVP1   U
 q   T1HCUST                        IMSRES4   IVP1   U
     T2HCUST                        IMSRES4   IVP1   U
****************************** Bottom of Data ********************************
```

Figure 3-12 Applications Profile Display - selecting Q

3. Select **T** and complete the timestamp fields as shown in Figure 3-13.

   The timestamps should create a range defining the period of time required. Select **N** in the DBRC Only field and enter a value in seconds that the quiet period should be. Two seconds should be enough.

```
IMS RE   V2R1 --- Quiet Time Analysis Parameters ----- 2014/08/21  01:33:08
Command ===>
--------------------------------------------------------------------------
Creator: IMSRES4  Name: T1HCUST                                SSID: IVP1
--------------------------------------------------------------------------

Log Range Type               ==> T  (Preceding/Timestamp)

Preceding Options:
  Preceding Type             ==> M  (Hours/Minutes)
  Preceding Value            ==> 30 (00-99)

Timestamp Options:
  Beginning Timestamp        ==> 2014 - 08 - 21 - 21 : 26 : 44
  End Timestamp              ==> 2014 - 08 - 21 - 21 : 28 : 13

DBRC Only                    ==> N  (Yes/No)
Minimum Quiet Time           ==> 00 : 00 : 02  (hh:mm:ss)
```

Figure 3-13 Quiet Time Analysis panel

4. Press Enter when the Build Job panel appears as shown in Figure 3-14 on page 58, and submit the job.

```
 IMS RE   V2R1 ------ Quiet Time Analysis Parameters ----- 2014/08/21  01:44:18
 Command ===>
Esssssssssssssssssss Build Job for IMSRES4.T1HCUST sssssssssssssssssssN ---
e                                                                     e VP1
e    Edit Generated Job     Y           (Yes/No)                      e ---
e                                                                     e
e    Build job in Dataset   IMSRES4.JCL.SAVED                        e
e                  Member    QUIET                                    e
e                                                                     e
e    Job Cards:                                                       e
e ==> //QUIETIME JOB IMSRES4,CLASS=A,NOTIFY=&SYSUID                  e
e ==> /*JOBPARM SYSAFF=SC53                                           e
e ==> //*                                                            e
e ==> //*                                                            e
e                                                                     e
e    Press ENTER to process or PF3 to Cancel                          e
e                                                                     e
e                                                                     e
e                                                                     e
DssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssM
```

Figure 3-14 Build Job Panel

5. Review the Job log output and find the quiet time period as shown in Example 3-15.

   The report shows a quiet time between 2014-08-21-21.26.44.000000 and 2014-08-21-21.28.13.000000. This time can now be used in a PITR using the IMS Recovery Expert Panels or using DRF using JCL.

Example 3-15 Quiet time analysis report output

```
Subsystem ID/Group:          IVP1
Application Profile Creator: IMSRES4
Application Profile Name:    T1HCUST
Log Range Type:              Timestamp
Start timestamp:             2014-08-21 21:26:44
End timestamp:               2014-08-21 21:28:13
Minimum Quiet Time:          00:00:02

Quiet Time Ranges
Start-Timestamp             End-Timestamp
2014-08-21-21.26.44.000000   2014-08-21-21.28.13.000000
21:33:35 BSY0001I - IMS Recovery Expert for z/OS Starting. Version 02.01.000
21:33:35 BSY0003I - Control Cards:
21:33:35 BSY0004I -  LOG-ANALYSIS "IMSRES4"."T1HCUST"
21:33:35 BSY0004I -             QUIET-TIMES
21:33:35 BSY0004I -             LOG-RANGE-TYPE  T
21:33:35 BSY0004I -             SSID            IVP1
21:33:35 BSY0004I -             START-TIME      2014-08-21 21:26:44
21:33:35 BSY0004I -             END-TIME        2014-08-21 21:28:13
21:33:35 BSY0004I -             MIN-TIME        00:00:02
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTA   DDNAME T1HCSTAA
21:33:35 BSY0004I -             DATABASE  T1HCUST   PART T1HCSTA   DDNAME T1HCSTAL
```

```
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTA   DDNAME T1HCSTAX
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTB   DDNAME T1HCSTBA
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTB   DDNAME T1HCSTBL
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTB   DDNAME T1HCSTBX
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTC   DDNAME T1HCSTCA
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTC   DDNAME T1HCSTCL
21:33:35 BSY0004I -            DATABASE  T1HCUST   PART T1HCSTC   DDNAME T1HCSTCX
21:33:35 BSY0004I -
21:33:42 BSYI929I - Processing log dsn: IMS13X.SLDS.G1629V00
21:33:42 BSYI930I - Processing completed for log dsn: IMS13X.SLDS.G1629V00
21:33:42 BSYI328I - Issuing CSLOMCMD SWITCH  command to IMSPLEX PLX13, route=IVP1
21:33:42 BSYI329I - Command: SWITCH OLDS
21:33:42 BSYI428I - SWITCH-OLDS Commands complete for participating IMSsub-systems
21:33:42 BSYI929I - Processing log dsn: IMS13X.SLDS.G1630V00
21:33:42 BSYI930I - Processing completed for log dsn: IMS13X.SLDS.G1630V00
21:33:42 BSY0002I - IMS Recovery Expert for z/OS complete. RC=000.
```

3.6 Point in time recovery

Point in time recovery (PITR) is not provided by IMS and requires the customer to purchase a tool to perform this function. A PITR allows the selection of any valid timestamp as the time to recover to. If this time is in the middle of a period where the database was allocated and processing updates, the PITR will only validate the timestamp to be a valid timestamp in that it is a true timestamp. All the updates completed at that exact time will be included in the recovery, and all updates in flight and incomplete will not be included in the recovery. This means that as far as IMS is concerned, the database has integrity. It is up to the application programmers to determine if the application integrity has been maintained. This type of recovery can be very useful when you have a recovery database from more than just IMS like DB2 or any other form of database.

The IBM product that performs PITR is the IMS Database Recovery Facility. The IMS Recovery Expert Product (RE) can be used to create the JCL required by DRF. DRF can also be invoked directly through JCL without RE.

3.6.1 Using Database Recovery Facility to a quiet time

Invoking DRF with JCL to preform a PITR is done using the standard DRF procedure. The parameters provided define the type of recovery to be processed. In this example, a HALDB is to be recovered to a PITR time provided in the quiet time analysis performed in the previous section.

The timestamp that was identified in the quiet time analysis (2014-08-21-21.28.13.000000) is converted to a Julian date and entered in the **RCVTIME** parameter of the **START** command as shown in Example 3-16.

Example 3-16 Database Recovery Facility JCL

```
//DRFPITR  JOB TIME=5,CLASS=A,MSGCLASS=H,NOTIFY=&SYSUID
//*************************************************************
//*  BRINGS UP A DATABASE RECOVERY FACILITY MASTER REGION      *
//*************************************************************
//STEP1    EXEC PGM=FRXSDR00,
//     PARM=('DRF','BPECFG=FRXBPECF','DRFMBR=JK','GSGNAME=',
```

```
//           'IMSPLEX=','DRFPROC=FRXRSS00',),REGION=0M,TIME=10
//STEPLIB  DD DSN=FRX.SFRXLOAD,DISP=SHR
//         DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMSDALIB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//PROCLIB  DD DSN=IMS13X.PROCLIB,DISP=SHR
//DBDLIB   DD DSN=IMS13X.DBDLIB,DISP=SHR
//PSBLIB   DD DSN=IMS13X.PSBLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//REPORT   DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//*************************M=0*****************************************
//* DRF DD'S FOR IAUS:                                                 *
//*    FRXWTO - ONLY REQUIRED WHEN RPTTYPE=SEP                         *
//*********************************************************************
//FRXWTO   DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//DFSRESLB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMS      DD DSN=IMS13X.DBDLIB,DISP=SHR
//*********************************************************************
//* HPIC DD'S FOR IAUS WHEN RPTTYPE=APP                                *
//*********************************************************************
//ICEPRINT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//ICERPRT  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//DFSPRINT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//*********************************************************************
//* HPPC DD'S FOR IAUS WHEN RPTTYPE=APP                                *
//*********************************************************************
//PRIMAPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//EVALUPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//SUMMARY  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//STATIPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//VALIDPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//SNAPPIT  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//*********************************************************************
//* DEDB PC DD'S FOR IAUS WHEN RPTTYPE=APP (NONE)                      *
//*********************************************************************
//FABARPRT  DD SYSOUT=*
//FABAMSG   DD SYSOUT=*
//FABASNAP  DD SYSOUT=*
//*********************************************************************
//* IB DD'S FOR IAUS WHEN RPTTYPE=APP (NONE)                           *
//*********************************************************************
//IIUSNAP   DD SYSOUT=*
//IIUSOUT   DD SYSOUT=*
//IIUSTAT   DD SYSOUT=*
//IIUPRINT  DD SYSOUT=*
//*********************************************************************
//* DFSPRECO DD'S FOR IAUS WHEN RPTTYPE=APP (NONE)
//*************************************************
//PRPRINT   DD SYSOUT=*
----+----1----+----2----+----3----+----4----+----5
//SYSIN DD *
  OUTPUT(PRO)
  ADD DB(T1HCUST) -
    IB(HALDB(BOTH))
```

```
START RCVTIME('142332128130000',PITR)
```

In Example 3-17, selected reports have been provided from the DRF job. The reports show that all three partitions have been recovered to the requested timestamp. The input was from an IC and then from the log. Because a timestamp from the Quiet Time analysis was used, the PITR Open UOW/UOR Report shows that there were no UOW in flight at the time of the PITR, which is what was expected.

It is important to note here that there were updates on the last log (IMS13X.SLDS.G1630V00), which has updates that were for all practical purposes “backed out of” as they were not processed in the forward recovery.

The last report in Example 3-17 shows that after the recovery of the HALDB partitions, the primary indexes where also recovered.

Example 3-17 DRF PITR to quiet time recovery reports

```
D A T A B A S E   R E C O V E R Y   F A C I L I T Y   C O M M A N D S / C O N T R O L   S T A T E M E N T S

FRD7201I   OUTPUT(PRO)
FRD7201I   ADD DB(T1HCUST) -
FRD7201I     IB(HALDB(BOTH))
FRD7201I   START RCVTIME('1423321281300',PITR)

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   S U M M A R Y   R E P O R T

Database   DD/Area    DSID       --------- Records Read ---------     Records Subord.   STC  Final
Name       Name                        IC          CA         LOG     Written Reg Name   #   Status

T1HCSTA    T1HCSTAA    1                2           0     3075305       11137 AS063201       No errors encountered
T1HCSTB    T1HCSTBA    1                2           0     1462627        5239 AS063202       No errors encountered
T1HCSTC    T1HCSTCA    1                2           0     3330131       11827 AS063203       No errors encountered

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   U T I L I T Y   R E P O R T

Database   DDN        Database Data Set Name                      IC   PC/DP IB   PR   Utility Final Status
-------------------------------------------------------------------------------------------------------------
T1HCSTA    T1HCSTAA   IMS13X.IMS13.T1HCUST.T1HCSTA.A00001         N/A  N/A   N/A  04   PRSSNAME=PR063201
T1HCSTB    T1HCSTBA   IMS13X.IMS13.T1HCUST.T1HCSTB.A00002         N/A  N/A   N/A  04   PRSSNAME=PR063202
T1HCSTC    T1HCSTCA   IMS13X.IMS13.T1HCUST.T1HCSTC.A00003         N/A  N/A   N/A  04   PRSSNAME=PR063203

Final Return (RC) and Reason (RSN) Codes

---IC---    ---PC---    ---DP---    ---IB---    ---PR---    ---LIU--
RC   RSN    RC   RSN    RC   RSN    RC   RSN    RC   RSN    RC   RSN

N/A  N/A    N/A  N/A    N/A  N/A    N/A  N/A    04   N/A    N/A  N/A

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   D A T A   S E T   I / O   R E P O R T

Recover to point: 2014.233 21:28:13.000000

Image Copy Data Set Name                        Volume     IC DS      IC        ---------------- Time Stamp Range -----------------
---------.---------.---------.---------.-----   Serial   Read Count  Type             1st Record                Last Record

IMSVS.T1HCSTB.T1HCSTBA.IC.IC183225              TST07E           2    STD
IMSVS.T1HCSTA.T1HCSTAA.IC.IC183225              TST07C           2    STD
IMSVS.T1HCSTC.T1HCSTCA.IC.IC183225              TST076           2    STD

UDATA From User Image Copy                                                  UIC   ----- UIC Run Time -----
-------------------------------------------------------------------------------  Type

No data available for this type data set

Change Accum Data Set Name                      Volume     CA DS           ---------------- Time Stamp Range -----------------
---------.---------.---------.---------.-----   Serial   Read Count             1st Record                Last Record

No data available for this type data set
No data available for this type data set

Log Data Set Name                               Volume     Log DS     IMS       ---------------- Time Stamp Range -----------------
---------.---------.---------.---------.-----   Serial   Read Count  SYSID        1st Record                Last Record

IMS13X.SLDS.G1620V00                            TST075      771516  IVP1       2014.233 19:05:35.180617 -02014.233 19:06:31.719329
  Prilog: 2014.233 19:05:35.180617
```

```
IMS13X.SLDS.G1625V00                          TST07F      753731  IVP1        2014.233 19:07:41.090293 -02014.233 19:08:07.470116
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1626V00                          TST07E      771322  IVP1        2014.233 19:08:07.470116 -02014.233 19:08:48.871211
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1622V00                          TST075      770797  IVP1        2014.233 19:06:38.657832 -02014.233 19:06:51.037641
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1629V00                          TST07B      771515  IVP1        2014.233 19:09:14.106436 -02014.233 19:09:26.547144
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1623V00                          TST073      771858  IVP1        2014.233 19:06:51.037641 -02014.233 19:07:16.700142
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1624V00                          TST079      770816  IVP1        2014.233 19:07:16.700142 -02014.233 19:07:41.090293
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1627V00                          TST077      771546  IVP1        2014.233 19:08:48.871211 -02014.233 19:09:01.670527
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1628V00                          TST075      771788  IVP1        2014.233 19:09:01.670527 -02014.233 19:09:14.106436
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1621V00                          TST070      758484  IVP1        2014.233 19:06:31.719329 -02014.233 19:06:38.657832
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1630V00                          TST07D      185996  IVP1        2014.233 19:09:26.547144 -02014.233 21:33:39.061380
  Prilog: 2014.233 19:05:35.180617
FRD0000I IMS RECOVERY SOLUTION PACK V1R1 : IMS DATABASE RECOVERY FACILITY           Date: 08/24/2014 Time: 19:36    Page: 4

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   P I T R   O P E N   U O W / U O R   R E P O R T

RCVTIME: 2014.233 21:28:13.000000 -04:00

           ----- Recovery Token-----     Prior     Database                                          Duration of        Log Record
PSB        Subsys   #Sched    #Commits   Chkpid    Name      DDname           Time Opened             Open UOW             Count

No open UOWs encountered for this recovery
1T1HCSTA.T1HCSTAA IBSS=PR06320I  DD=WTOs captured

-----------------------------------------------------
SAS COPY->: DD=PRPRIN@  DSN=IMSRES9.FRXSYSPR.T1HCSTA.T1HCSTAA.T1936381
DFS1982I  -  Reason Code =  60  DFSPRECO control card specified ILE recovery and no ILEs were required for this partition
Total number of INDEX entries inserted = 00020173
Total number of ILE entries inserted = 00000000
T1HCSTB.T1HCSTBA IBSS=PR06320I  DFSPRECOdd=SYSPRINT
-----------------------------------------------------
SAS COPY->: DD=PRPRIN@  DSN=IMSRES9.FRXSYSPR.T1HCSTB.T1HCSTBA.T1936380
DFS1982I  -  Reason Code =  60  DFSPRECO control card specified ILE recovery and no ILEs were required for this partition
Total number of INDEX entries inserted = 00007679
Total number of ILE entries inserted = 00000000
T1HCSTC.T1HCSTCA IBSS=PR06320I  DFSPRECOdd=SYSPRINT
-----------------------------------------------------
SAS COPY->: DD=PRPRIN@  DSN=IMSRES9.FRXSYSPR.T1HCSTC.T1HCSTCA.T1936386
DFS1982I  -  Reason Code =  60  DFSPRECO control card specified ILE recovery and no ILEs were required for this partition
Total number of INDEX entries inserted = 00012901
Total number of ILE entries inserted = 00000000
```

Because this PITR was performed and at least some of the updates were on the last of the log data sets input to the recovery, that log data set is no longer a valid log to be used for a subsequent forward recovery. DBRC has set the IMAGE COPY NEEDED flag in the RECON for these partitions. The reason the IC Needed flag is set, is to create a new valid recovery point. The log used as input to the PITR should not be used again in a forward recovery as there is no way to determine which of those updates have already been recovered out and should not be used again. There is a partial listing of the PART records and the RECOV record (created by DRF) shown in Example 3-18.

Example 3-18 Partial listing of the PART records and the RECOV record

```
DB
 DBD=T1HCSTA   MASTER DB=T1HCUST   IRLMID=*NULL  CHANGE#=1     TYPE=PART
 USID=0000000002  AUTHORIZED USID=0000000002  HARD USID=0000000002
 RECEIVE USID=0000000002  RECEIVE NEEDED USID=0000000000
 DSN PREFIX=IMS13X.IMS13.T1HCUST.T1HCSTA               PARTITION ID=00001
 PREVIOUS PARTITION=**NULL**    NEXT PARTITION=T1HCSTB
 OLRIMSID=**NULL**    ACTIVE DBDS=A-J
 REORG#=00001
 ONLINE REORG STATISTICS:
     OLR BYTES MOVED = 0
     OLR SEGMENTS MOVED = 0
     OLR ROOT SEGMENTS MOVED = 0
```

```
 FREE SPACE:
   FREE BLOCK FREQ FACTOR=0    FREE SPACE PERCENTAGE=0

 PARTITION HIGH KEY/STRING (CHAR):               (LENGTH=6  )
   299999
 PARTITION HIGH KEY/STRING (HEX):
   F2F9F9F9F9F9

 OSAM BLOCK SIZE:
   A = 6144
FLAGS:                              COUNTERS:
  BACKOUT NEEDED        =OFF         RECOVERY NEEDED COUNT   =0
  READ ONLY             =OFF         IMAGE COPY NEEDED COUNT =1
  PROHIBIT AUTHORIZATION=OFF         AUTHORIZED SUBSYSTEMS   =0
                                     HELD AUTHORIZATION STATE=0
                                     EEQE COUNT              =0
  TRACKING SUSPENDED    =NO          RECEIVE REQUIRED COUNT  =0
  OFR REQUIRED          =NO          OLR ACTIVE HARD COUNT   =0
  PARTITION INIT NEEDED =NO          OLR INACTIVE HARD COUNT =0
  OLREORG CURSOR ACTIVE =NO
  PARTITION DISABLED    =NO
  ONLINE REORG CAPABLE  =YES
  REORG INTENT          =NO
  QUIESCE IN PROGRESS   =NO
  QUIESCE HELD          =NO
  ALTER IN PROGRESS     =NO
 PARTITION ALTERED     =NO

RECOV
 RUN     = 14.236 19:36:27.770000         *  RUN USID      = 0000000002
 RECOV TO= 14.233 21:28:13.000000            RECOV TO USID = 0000000002
 POINT-IN-TIME


DB
 DBD=T1HCSTB   MASTER DB=T1HCUST   IRLMID=*NULL  CHANGE#=2     TYPE=PART
 USID=0000000002  AUTHORIZED USID=0000000002  HARD USID=0000000002
 RECEIVE USID=0000000002  RECEIVE NEEDED USID=0000000000
 DSN PREFIX=IMS13X.IMS13.T1HCUST.T1HCSTB               PARTITION ID=00002
 PREVIOUS PARTITION=T1HCSTA     NEXT PARTITION=T1HCSTC
 OLRIMSID=**NULL**    ACTIVE DBDS=A-J
 REORG#=00001
 ONLINE REORG STATISTICS:
     OLR BYTES MOVED = 0
     OLR SEGMENTS MOVED = 0
     OLR ROOT SEGMENTS MOVED = 0

 FREE SPACE:
   FREE BLOCK FREQ FACTOR=0    FREE SPACE PERCENTAGE=0

 PARTITION HIGH KEY/STRING (CHAR):               (LENGTH=6  )
   699999
 PARTITION HIGH KEY/STRING (HEX):
   F6F9F9F9F9F9

 OSAM BLOCK SIZE:
   A = 6144
FLAGS:                              COUNTERS:
   BACKOUT NEEDED        =OFF         RECOVERY NEEDED COUNT   =0
   READ ONLY             =OFF         IMAGE COPY NEEDED COUNT =1
   PROHIBIT AUTHORIZATION=OFF         AUTHORIZED SUBSYSTEMS   =0
                                      HELD AUTHORIZATION STATE=0
                                      EEQE COUNT              =0
   TRACKING SUSPENDED    =NO          RECEIVE REQUIRED COUNT  =0
   OFR REQUIRED          =NO          OLR ACTIVE HARD COUNT   =0
   PARTITION INIT NEEDED =NO          OLR INACTIVE HARD COUNT =0
```

```
   OLREORG CURSOR ACTIVE =NO
   PARTITION DISABLED    =NO
   ONLINE REORG CAPABLE  =YES
   REORG INTENT          =NO
   QUIESCE IN PROGRESS   =NO
   QUIESCE HELD          =NO
   ALTER IN PROGRESS     =NO
   PARTITION ALTERED     =NO

 RECOV
  RUN     = 14.236 19:36:27.770000         *  RUN USID      = 0000000002
  RECOV TO= 14.233 21:28:13.000000            RECOV TO USID = 0000000002
  POINT-IN-TIME


DB
 DBD=T1HCSTC   MASTER DB=T1HCUST   IRLMID=*NULL  CHANGE#=3     TYPE=PART
 USID=0000000002  AUTHORIZED USID=0000000002  HARD USID=0000000002
 RECEIVE USID=0000000002  RECEIVE NEEDED USID=0000000000
 DSN PREFIX=IMS13X.IMS13.T1HCUST.T1HCSTC               PARTITION ID=00003
 PREVIOUS PARTITION=T1HCSTB     NEXT PARTITION=**NULL**
 OLRIMSID=**NULL**    ACTIVE DBDS=A-J
 REORG#=00001
 ONLINE REORG STATISTICS:
     OLR BYTES MOVED = 0
     OLR SEGMENTS MOVED = 0
     OLR ROOT SEGMENTS MOVED = 0

 FREE SPACE:
   FREE BLOCK FREQ FACTOR=0    FREE SPACE PERCENTAGE=0

 PARTITION HIGH KEY/STRING (CHAR):               (LENGTH=6  )
   999999
 PARTITION HIGH KEY/STRING (HEX):
   F9F9F9F9F9F9

 OSAM BLOCK SIZE:
   A = 6144
FLAGS:                              COUNTERS:
  BACKOUT NEEDED        =OFF          RECOVERY NEEDED COUNT   =0
  READ ONLY             =OFF          IMAGE COPY NEEDED COUNT =1
  PROHIBIT AUTHORIZATION=OFF          AUTHORIZED SUBSYSTEMS   =0
                                      HELD AUTHORIZATION STATE=0
                                      EEQE COUNT              =0
  TRACKING SUSPENDED    =NO           RECEIVE REQUIRED COUNT  =0
  OFR REQUIRED          =NO           OLR ACTIVE HARD COUNT   =0
  PARTITION INIT NEEDED =NO           OLR INACTIVE HARD COUNT =0
  OLREORG CURSOR ACTIVE =NO
  PARTITION DISABLED    =NO
  ONLINE REORG CAPABLE  =YES
  REORG INTENT          =NO
  QUIESCE IN PROGRESS   =NO
  QUIESCE HELD          =NO
  ALTER IN PROGRESS     =NO
  PARTITION ALTERED     =NO

RECOV
  RUN     = 14.236 19:36:27.770000         *  RUN USID      = 0000000002
  RECOV TO= 14.233 21:28:13.000000            RECOV TO USID = 0000000002
  POINT-IN-TIME
```

3.6.2 Recovery Expert example: create recovery to quiet time

Recovery Expert can be used to create the same recovery as the previous example. The panels can be used to input the timestamp and request a PITR. The RE CLIST is invoked and the Applications Profile Display panel shown in Figure 3-15 is used to build the JCL with the B option.

```
IMS RE   V2R1   ------- Applications Profile Display ------ 2014/08/24 22:10:1
Option  ===>                                                 Scroll ===> PAGE

Line Commands: D - Delete  U - Update  C - Create  R - Rename  V - View
               B - Build recover job   P - Create Recovery Point
               Q - Quiet Time Analysis
--------------------------------------------------------------------------------
 Profile Like  *                                    SSID Like  *
 Creator Like  *                                    Row 1 of 4          >
--------------------------------------------------------------------------------

Cmd  Name                           Creator   SSID  Updt
     RLT1H                          RLONG     IVP1   U
     TCUST                          IMSRES4   IVP1   U
 b   T1HCUST                        IMSRES4   IVP1   U
     T2HCUST                        IMSRES4   IVP1   U
```

Figure 3-15 Applications Profile Display to Build Recovery JCL

The Build Job panel is now used to select a PITR using option 3 and the timestamp is entered on the panel as shown in Figure 3-16. Select **Y** for the Edit Recovery Options to make sure that DRF is the utility used.

```
ssssssssssssssssssss Build Job for IMSRES4.T1HCUST ssssssssssssssssssss

    Recovery Point         3  ( 1 Current, 2 Timestamp, 3 PIT, 4 RPID)
    Recovery Timestamp     14233212813OO

    Edit Generated Job     Y           (Yes/No)
    Edit Recovery Options  Y           (Yes/No)

    Build job in Dataset   IMSRES4.JCL.SAVED
                 Member    JOBpitr

    Job Cards:
 ==> //OBJREST JOB IMSRES4,CLASS=A,NOTIFY=&SYSUID
 ==> /*JOBPARM SYSAFF=SC53
 ==> //*
 ==> //*

    Press ENTER to process or PF3 to Cancel
```

Figure 3-16 Build JCL Panel for PITR

The Application Recovery Panel shows the available recovery options. Select **D** for the Recovery Utility to select DRF and then **I** for the HALDB PIX/ILDS Build option as shown on Figure 3-17.

```
IMS RE   V2R1 -------- Application Recovery Options ------- 2014/08/24 22:21:2
Option   ===>
------------------------------------------------------------------------------
 Creator: IMSRES4    Name: T1HCUST                          SSID: IVP1
 Share Option: U  (Upd,View,No)    Description: T1HCUST AND INDEX
------------------------------------------------------------------------------
 Enter the Recovery options to associate with this profile:
                                                                  More:     +
 SLB Processing Only    ==> N (Yes/No)
  Recovery Utility      ==> D (Ims/Drf/User)       Edit Options  N  (Yes/No)
  Index Rebuild Utility ==> N (Iib/User/None)      Edit Options  N  (Yes/No)
  HALDB PIX/ILDS Rbld   ==> I (Ims/User/None)      Edit Options  N  (Yes/No)
  Change Accum Utility  ==> N (Ims/Hpca/User/None) Edit Options  N  (Yes/No)
  Post Recovery IC      ==> N (Ims/Hpic/User/None) Edit Options  N  (Yes/No)
 Recovery Resources     ==> I (All/Slb/Ic)
 From Offload           ==> N (Yes/No)
 Parallel Tasks         ==> 04 (01-99)
 Number of Tape units   ==> 02 (01-99)
 Action on Warnings     ==> W  (Continue/Wtor/Abort)
 Datasets for GENJCL    ==> IMS13X.JCLLIB
                        ==>
```

Figure 3-17 Applications Recovery Options Panel to Select DRF

A similar job would be created and the resulting recovery would also have the same result. The use of RE removes the requirement to know the DRF control cards as RE will generate them. The jobs were not shown here but the same DRF procedures were executed.

3.6.3 Example using DRF PITR outside a quiet time

DRF is not limited to using a time when there are no actual updates in progress. There is no requirement to perform the quiet time analysis, just pick a valid timestamp. This might be the case where the application has to recover other non IMS databases to the same time, for example DB2. In this example, DRF is used to recover in the middle of a log where it is not known whether there are any active units of work (UOWs) or not.

The reports in Example 3-19 show that one UOW was processing at the requested recovery time and thus was not included in the recovery. Regardless of whether a UOW was in flight at the selected recovery time, all other UOWs on this log after the time specified are not processed. This means that IMS database integrity has been maintained, but the application must determine whether there are any application-related issues to be dealt with.

Example 3-19 DRV PITR to any timestamp

```
D A T A B A S E   R E C O V E R Y   F A C I L I T Y   C O M M A N D S / C O N T R O L   S T A T E M E N T S

FRD7201I   OUTPUT(PRO)
FRD7201I   ADD DB(T1HCUST) -
FRD7201I     IB(HALDB(BOTH))
FRD7201I START RCVTIME('1423319084350',PITR)

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   S U M M A R Y   R E P O R T

Database   DD/Area    DSID       --------- Records Read ---------     Records Subord.   STC  Final
```

```
Name       Name                         IC          CA         LOG     Written Reg Name   #   Status

T1HCSTA    T1HCSTAA    1                 2           0     3075305       11137 AS068401       No errors encountered
T1HCSTB    T1HCSTBA    1                 2           0     1462627        5239 AS068402       No errors encountered
T1HCSTC    T1HCSTCA    1                 2           0       66557         278 AS068403       No errors encountered
D A T A B A S E   R E C O V E R Y   F A C I L I T Y   U T I L I T Y   R E P O R T

Database   DDN        Database Data Set Name                      IC   PC/DP IB   PR   Utility Final Status
---------------------------------------------------------------------------------------------------------------
T1HCSTA    T1HCSTAA   IMS13X.IMS13.T1HCUST.T1HCSTA.A00001         N/A  N/A   N/A  04   PRSSNAME=PR06320I
T1HCSTB    T1HCSTBA   IMS13X.IMS13.T1HCUST.T1HCSTB.A00002         N/A  N/A   N/A  04   PRSSNAME=PR063202
T1HCSTC    T1HCSTCA   IMS13X.IMS13.T1HCUST.T1HCSTC.A00003         N/A  N/A   N/A  04   PRSSNAME=PR063203

Final Return (RC) and Reason (RSN) Codes

---IC---    ---PC---    ---DP---    ---IB---    ---PR---    ---LIU--
RC   RSN    RC   RSN    RC   RSN    RC   RSN    RC   RSN    RC   RSN

N/A  N/A    N/A  N/A    N/A  N/A    N/A  N/A    04   N/A    N/A  N/A

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   D A T A   S E T   I / O   R E P O R T

Recover to point: 2014.233 21:28:13.000000

Image Copy Data Set Name                       Volume     IC DS      IC       ---------------- Time Stamp Range -----------------
---------.---------.---------.---------.-----  Serial   Read Count  Type            1st Record                Last Record

IMSVS.T1HCSTB.T1HCSTBA.IC.IC183225             TST07E           2    STD
IMSVS.T1HCSTA.T1HCSTAA.IC.IC183225             TST07C           2    STD
IMSVS.T1HCSTC.T1HCSTCA.IC.IC183225             TST076           2    STD

UDATA From User Image Copy                                                 UIC   ----- UIC Run Time -----
-------------------------------------------------------------------------------- Type

No data available for this type data set

Change Accum Data Set Name                     Volume     CA DS              ---------------- Time Stamp Range -----------------
---------.---------.---------.---------.-----  Serial   Read Count               1st Record                Last Record

No data available for this type data set
No data available for this type data set

Log Data Set Name                              Volume     Log DS     IMS     ---------------- Time Stamp Range -----------------
---------.---------.---------.---------.-----  Serial   Read Count  SYSID          1st Record                Last Record

IMS13X.SLDS.G1626V00                           TST07E        8097  IVP1     2014.233 19:08:07.470116 -02014.233 19:08:48.871211
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1625V00                           TST07F      753731  IVP1     2014.233 19:07:41.090293 -02014.233 19:08:07.470116
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1624V00                           TST079      770816  IVP1     2014.233 19:07:16.700142 -02014.233 19:07:41.090293
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1621V00                           TST070      758484  IVP1     2014.233 19:06:31.719329 -02014.233 19:06:38.657832
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1623V00                           TST073      771858  IVP1     2014.233 19:06:51.037641 -02014.233 19:07:16.700142
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1622V00                           TST075      770797  IVP1     2014.233 19:06:38.657832 -02014.233 19:06:51.037641
  Prilog: 2014.233 19:05:35.180617
IMS13X.SLDS.G1620V00                           TST075      771516  IVP1     2014.233 19:05:35.180617 -02014.233 19:06:31.719329
  Prilog: 2014.233 19:05:35.180617

FRD0000I IMS RECOVERY SOLUTION PACK V1R1 : IMS DATABASE RECOVERY FACILITY           Date: 08/24/2014 Time: 19:36    Page: 4

D A T A B A S E   R E C O V E R Y   F A C I L I T Y   P I T R   O P E N   U O W / U O R   R E P O R T

RCVTIME: 2014.233 19:08:43.500000 -04:00

           ----- Recovery Token-----     Prior     Database                                          Duration of        Log Record
PSB        Subsys   #Sched    #Commits   Chkpid    Name      DDname          Time Opened             Open UOW             Count

 T1HACSTLD IVP1     00000001  00000000    N/A     T1HCSTA    T1HCSTAAA       2014.233 19:08:30.4   00:00:20.585240       600
1T1HCSTA.T1HCSTAA IBSS=PR06320I  DD=WTOs captured


-----------------------------------------------------
SAS COPY->: DD=PRPRIN@  DSN=IMSRES9.FRXSYSPR.T1HCSTA.T1HCSTAA.T1936381
DFS1982I  -  Reason Code =  60  DFSPRECO control card specified ILE recovery and no ILEs were required for this partition
Total number of INDEX entries inserted = 00020173
Total number of ILE entries inserted = 00000000
T1HCSTB.T1HCSTBA IBSS=PR06320I  DFSPRECOdd=SYSPRINT
-----------------------------------------------------
SAS COPY->: DD=PRPRIN@  DSN=IMSRES9.FRXSYSPR.T1HCSTB.T1HCSTBA.T1936380
DFS1982I  -  Reason Code =  60  DFSPRECO control card specified ILE recovery and no ILEs were required for this partition
```

```
Total number of INDEX entries inserted = 00007679
Total number of ILE entries inserted = 00000000
T1HCSTC.T1HCSTCA IBSS=PRO63203  DFSPRECOdd=SYSPRINT
-------------------------------------------------
SAS COPY->: DD=PRPRIN@  DSN=IMSRES9.FRXSYSPR.T1HCSTC.T1HCSTCA.T1936386
DFS1982I  -  Reason Code =  60  DFSPREC0 control card specified ILE recovery and no ILEs were required for this partition
Total number of INDEX entries inserted = 00012901
Total number of ILE entries inserted = 00000000
```

4

Configuring IMS

This chapter provides guidance to database administrators (DBAs) who want to use IMS Configuration Manager for z/OS to manage IMS resources such as programs, transactions, and database definitions in test/development systems without the necessity of running an online change (MODBLKS gen) or an IMS sysgen. The IBM IMS Configuration Manager for z/OS is a tool that enables Database Analysts to analyze, modify, and deploy IMS resources and parameters[1].

The following topics are discussed in this chapter:

- Setting up IMS and Plex using IMS Configuration Manager
- Managing IMS resources
- Updating resources groups
- Deleting resource groups
- Promoting application definitions from development to test or test to production

[1] For more information about this tool, see http://www-03.ibm.com/software/products/en/imsconfmanaforzos

4.1 Setting up IMS and Plex using IMS Configuration Manager

Setting up IMS definitions using IMS Configuration Manager for z/OS may become much easier using the DISCOVER function. Anyone with proper IBM RACF® access authorization to the IMS SDFSRESL and RDDS data sets can utilize the DISCOVER function.

Example 4-1 shows how the tool does all the setup for you.

Example 4-1 DISCOVER function example

```
//*********************************************************************
//* IMS CONFIGURATION MANAGER FOR Z/OS - DISCOVER FUNCTION EXAMPLE
//*********************************************************************
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD  DISP=SHR,DSN=GPL.SGPLLINK    -> ICM LOADLIB
//         DD  DISP=SHR,DSN=IMS13X.SDFSRESL -> IMS RESLIB
//SYSIN    DD  *
*
DISCOVER TO(REPOSITORY,GPLREPOS)
/*
//GPLREPOS DD  DISP=SHR,
//             DSN=GPL.GPLREPOS             -> YOUR ICM REPOSITORY
//SYSPRINT DD  SYSOUT=*
```

Figure 4-1 shows the IMSplex discovered by the DISCOVER function defined in IMS Configuration Manager for z/OS (ICM).

```
 File  Help
_____________________________________________________________________________
                                   IMSplex                     Row 1 to 1 of 1
Command ===>                                                  Scroll ===> CSR

Enter NEW to create a new IMSplex

      IMSplex  Description                      Changed              ID
/     *        *                               =*                   *
      PLX13                                     2014-07-10 16.56.16  DISCOVER
****************************** Bottom of data ********************************
```

Figure 4-1 The IMS Plex found by the DISCOVER function

Figure 4-2 on page 71 shows all the IMS registered in the Plex and subordinated started tasks such as operation manager (OM), resource manager (RM), and service common interface (SCI).

```
 File  Help
_____________________________________________________________________________
EDIT                  IMSplex - Member Systems                  Row 1 to 6 of 6
Command ===>                                                   Scroll ===> CSR

IMSplex . . . : PLX13
Description . .

View  . . . . . 1  1. IMS Member Systems
                   2. Change Packages

     Name      Type    VV.R   Description
/    *         *       *      *
     IMSY      IMS     13.1   IMSY13
     IVP1      IMS     13.1   IMSX13
     IVP2      IMS     13.1
     OM1OM     OM      1.6
     RM1RM     RM      1.6
     SCI1SC    SCI     1.6
****************************** Bottom of data ********************************
```

Figure 4-2 All the IMS and subordinated tasks found by the DISCOVER function

Check the *IBM IMS Configuration Manager for z/OS Version 2 Release 1 User's Guide,* SC19-3228 for detailed information about this process.

4.2 Managing IMS resources

In this section, we go through the basic steps to add a new application to a test IMS environment, update the definitions between releases, export the definitions from the test system to be applied into production during application releases, and how to delete or retire an application using IMS Configuration Manager for z/OS.

Example 4-2 shows the STAGE1 source code for an application called ORDER, used in this chapter as an example.

Example 4-2 STAGE1 source code for order application

```
************************************************************************
** TRANSACTION DEFINITIONS
************************************************************************
         APPLCTN PSB=ORD1,PGMTYPE=TP
           TRANSACT CODE=ORD1,MODE=SNGL,                               X
               MSGTYPE=(SNGLSEG,NONRESPONSE,1)
         APPLCTN PSB=ORD2,PGMTYPE=TP
           TRANSACT CODE=ORD2,MODE=SNGL,                               X
               MSGTYPE=(SNGLSEG,NONRESPONSE,1)
         APPLCTN PSB=BMPORD1,SCHDTYP=PARALLEL,PGMTYPE=BATCH
         APPLCTN PSB=BMPORD2,PGMTYPE=BATCH
         APPLCTN PSB=BMPORD3,PGMTYPE=BATCH
************************************************************************
**  DATABASE DEFINITIONS
************************************************************************
```

```
DATABASE DBD=ORD1DB,ACCESS=UP
DATABASE INDEX,DBD=ORD1DBI,ACCESS=UP
DATABASE DBD=ORD2DB,ACCESS=UP
DATABASE DBD=ORD3DB,ACCESS=UP
DATABASE DBD=ORD4DB
```

4.2.1 Creating resource groups

A resource group (RG) provides you with an analogous capability of using PDS members to logically separate groups of resources.

Follow these steps to create a new resource group:

1. Invoke ICM ISPF panel and go to option 3, Resources.
2. Type NEW in the command line; a pop-up menu appears. Complete the required fields highlighted in bold as shown in Figure 4-3.

```
New Resource Group

Press PF3 to create the resource group, PF12 to cancel


Name  . . . . . ORDAPPL
IMSID . . . . .       +
Description . . SHARED ORDER APPL

/  Add resources via Takeup
    Input type . . . . . 1  1. Stage 1 macros
                            2. RDDS
    Input file . . . . . 'IMS13X.JCLLIB(ORDAPP)'
    User macro file(s)




       Create notes from comments (stage 1 only)
```

Figure 4-3 Creating new resource group

Note: It is not required to specify the IMSID if multiple IMS systems share the resource.

3. Press PF3. The JCL using the TAKEUP function is generated as shown on Figure 4-4 on page 73. Submit the job to add the resource in the ICM repository.

```
//*
//* IMS CM V2R1 Takeup JCL
//*
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD  DSN=GPL.SGPLLINK,DISP=SHR
//ASMLIB   DD  DSN=GPL.SGPLSAMP,DISP=SHR
//ASMUT1   DD  UNIT=SYSDA,SPACE=(CYL,(1,1))
//ASMPUNCH DD  UNIT=SYSDA,SPACE=(CYL,(1,1))
//ASMPRINT DD  SYSOUT=*
//OUTREPOS DD  DSN=GPL.GPLREPOS,DISP=SHR
//INPUT1   DD  DSN=IMS13X.STAGE1(ORDAPP),DISP=SHR
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  *
  TAKEUP FROM(STAGE1,INPUT1) +
         TO(REPOSITORY,OUTREPOS) +
         RG('ORDAPPL', +
            'SHARED ORDER APPL') +
         INCLUDE(ALL)
/*
```

Figure 4-4 JCL created by ICM to add resources into ICM repository

PF3 out of the Resources panel and get back in to refresh the resource list. You see that the ORDER application has been added as shown in bold in Figure 4-5.

```
 Resource Group           IMSID   Created     Changed              ID
/    *                       *      =*          =*                   *
     IMSX RESOURCES                 2014-07-14  2014-07-14 19.04.13  IMSRES8
     IMSY RESOURCES                 2014-07-14  2014-07-14 19.03.58  IMSRES8
     ORDAPPL                        2014-07-15  2014-07-15 17.02.09  IMSRES8
```

Figure 4-5 Resource list updated

The resource can be selected as represented in Figure 4-6 on page 74 to browse or change the definitions if needed.

```
Resource Group . : ORDAPPL
IMSID  . . . . . :       Version . . :
Description  . . . SHARED ORDER APPL                          Notes...

     Name      Prompt    Type  D   Created      Changed              ID
/    *                   *     *  =*           =*                   *
     BMPORD1             PGM   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     BMPORD2             PGM   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     BMPORD3             PGM   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD1                PGM   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD1                TRN   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD1DB              DB    N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD1DBI             DB    N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD2                PGM   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD2                TRN   N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD2DB              DB    N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD3DB              DB    N   2014-07-15   2014-07-15 17.02.09  IMSRES8
     ORD4DB              DB    N   2014-07-15   2014-07-15 17.02.09  IMSRES8
```

Figure 4-6 Details about ORDAPPL resource group

4. Now it is time to assign ORDAPPL to IMS. Press PF3 until you are back to the ICM main panel, choose option 2 for Systems, and select the IMS region the resource group to be assigned to. On the next panel, choose option 2 for Resources, type ADD in the command line, and a pop-up menu lets you select one or more resources. In the example represented by Figure 4-7 and Figure 4-8, only the RG ORDAPPL resource was selected and assigned to IMS.

```
Select one or more Resource Groups and then press EXIT.
   Resource Group            IMSID  Changed           ID
S  ORDAPPL                          2014-07-14 19.03  IMSRES8
```

Figure 4-7 All the RG not assigned to any IMS region

```
 Resource Group           Lvl   Created      Changed              ID
/  *                       *    =*           =*                     *
   IMSX RESOURCES          C     2014-07-14   2014-07-14 19.04.13  IMSRES8
   ORDAPPL                 C     2014-07-15   2014-07-15 17.02.09  IMSRES8
```

Figure 4-8 Resources assigned to an IMS region

At this moment, the new resource group is ready to be included in a change package and get installed in IMS.

4.2.2 Creating change packages

When you update resource definitions with IMS Configuration Manager, you are only updating offline definitions: the state of your IMS systems does not change. To update an IMS system with your changes, use IMS Configuration Manager to bundle changes into change packages, and then either install them into a live system or create stage 1 source or a resource definition data set (RDDS) for cold start processing.

Follow the next steps to create a change package:

1. Invoke ICM ISPF panel and choose **option 4, Packages**, to work with installation packages.
2. Type NEW in the command line to create a new change package (CP) and a pop-up menu appears. You must fill all the fields as described in Figure 4-9 and press PF3 to complete the process.

```
 Create System Change Package

Press PF3 to create the change package, PF12 to cancel


Change Package  . . ORDAPPL
Description . . . . ORDAPPL IMS13X
IMSID . . . . . . . IVP1  +
IMSplex . . . . . : PLX13

Change Package type 1  1. COMMAND  (CMD) - Selected resources
                       2. GENERATE (GEN) - Complete system image

Output Type . . . . 1  1. Stage 1 Macros
                       2. Cold Start RDDS
```

Figure 4-9 Creating a change package

3. You are back to the “All Change Packages” panel and it is possible to select the CP to see more information about it. Figure 4-10 illustrates what a CP looks like if selected.

```
Create Date  . . : 2014-08-04 10.26.45  Status . : OPEN    /  NOTSCHED
Change Package . . ORDAPPL
Description  . . . ORDAPPL IMS13X
Type . . . . . . . : CMD
IMSID  . . . . . . : IVP1  Version . . : 13.1
IMSplex  . . . . . : PLX13               Closed Date  . . :
Output Type  . . . : ICMI                Schedule Date  . :
ColdStart Date . . :                     Install Date . . :

     Name      Type  D  Resource Group            Del   Changed
/    *         *     *  *                         *    =*
     BMPORD1   PGM   N  ORDAPPL                        2014-08-04 10.42.59
     BMPORD2   PGM   N  ORDAPPL                        2014-08-04 10.42.59
     BMPORD3   PGM   N  ORDAPPL                        2014-08-04 10.42.59
     ORD1      PGM   N  ORDAPPL                        2014-08-04 10.42.59
     ORD1      TRN   N  ORDAPPL                        2014-08-04 10.42.59
     ORD1DB    DB    N  ORDAPPL                        2014-08-04 10.42.59
     ORD1DBI   DB    N  ORDAPPL                        2014-08-04 10.54.21
     ORD2      PGM   N  ORDAPPL                        2014-08-04 10.54.21
     ORD2      TRN   N  ORDAPPL                        2014-08-04 10.54.21
     ORD2DB    DB    N  ORDAPPL                        2014-08-04 10.54.21
     ORD3DB    DB    N  ORDAPPL                        2014-08-04 10.54.21
     ORD4DB    DB    N  ORDAPPL                        2014-08-04 10.54.21
```

Figure 4-10 Change package details

Note: Make sure the change package is absolutely correct before moving to step 4. A CP cannot be changed when it is closed.

4. Once the new CP has been double checked and there is nothing else to be included, it is time to close the package. Put a “C” in front of the change package to be closed, in this case ORDAPPL as described in Figure 4-11, and press Enter.

```
 All Change Packages              Row 1 of 3 More: <>
Command ===>                                          Scroll ===> CSR

Enter NEW to create a new IMS System Change Package

      Create Date/Time    Change Package Name      IMS  Status   Cond     Type
/    =*                   *                        *    *        *        *
C     2014-08-04 10.26.45 ORDAPPL                  IVP1 OPEN     NOTSCHED CMD
      2014-07-14 18.56.19 IMS13X ALL RESOURCES     IVP1 CLOSED   INSTOK   CMD
****************************** Bottom of data ********************************
```

Figure 4-11 Closing ORDAPPL change package

An alert appears as shown in Figure 4-12 to warn you that the package cannot be changed after the closure. Press Enter again to close the package.

```
Esssssssssssssssssssss Close Confirmation sssssssssssssssssssssN
e                                                               e
e                                                               e
e Create Date . . . : 2014-08-04 10.26.45                       e
e Change Package  . : ORDAPPL                                   e
e Description . . . : ORDAPPL IMS13X                            e
e Type  . . . . . . : CMD                                       e
e                                                               e
e                                                               e
e *WARNING* This action CANNOT be reversed                      e
e                                                               e
e                                                               e
e Press ENTER to confirm close.                                 e
e Press CANCEL or EXIT to cancel close.                         e
e                                                               e
e                                                               e
DsssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssssM
```

Figure 4-12 Close Confirmation panel warns the user that this action cannot be reversed

5. To schedule the package, put an “SCH” in front of the CP as represented in Figure 4-13 on page 77, and press Enter.

```
 All Change Packages              Row 1 of 3 More: <>
Command ===>                                          Scroll ===> CSR

Enter NEW to create a new IMS System Change Package

      Create Date/Time    Change Package Name      IMS  Status   Cond     Type
/    =*                   *                        *    *        *        *
SCH   2014-08-04 10.26.45 ORDAPPL                  IVP1 CLOSED   NOTSCHED CMD
      2014-07-14 18.56.19 IMS13X ALL RESOURCES     IVP1 CLOSED   INSTOK   CMD
```

Figure 4-13 Scheduling a change package

6. On the “Schedule a COMMAND Change Package” panel, you must review the parameters and provide a data set where ICM can store the installation JCL. In the example represented by Figure 4-14, parameter “Submit Immediately” has been changed to NO so you can wait until the IMS maintenance hours to install the CP and parameter “OnFailure” has been changed to RollBack to let the tool undo the work if any problem happens during the installation. Press PF3 to schedule the change package and to create the JCL.

```
 Schedule a COMMAND Change Package

Specify scheduling information and press PF3 or EXIT to process.
Press PF12 or Cancel to cancel the request.

Create Date . . . : 2014-08-04 10.26.45
Change Package  . : ORDAPPL
Description . . . : ORDAPPL IMS13X
Type  . . . . . : CMD
IMSID . . . . . : IVP1  Version . . : 13.1
Output Type . . . : ICMI (Install via DRD Type 2 commands)
Condition . . . . : NOTSCHED

Install or Backout  1  1. Install   2. Backout
Submit Immediately  2  1. Yes       2. No        3. Edit
Force . . . . . 2  1. Yes       2. No
NotReady  . . . . . 1  1. Stop      2. Ignore
OnFailure . . . . . 3  1. Stop      2. Continue  3. RollBack

JCL data set  . . . 'IMS13X.JCLLIB(ORDAPPCP)'
```

Figure 4-14 Change package schedule options

7. Figure 4-15 on page 78 is an example of what the job created in the previous step looks like. Run the job to define all the transactions, programs, and databases from ORDAPPL. The job must complete with return code 0.

```
//IMS13ICM JOB ACTINFO1,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//         NOTIFY=&SYSUID
/*JOBPARM SYSAFF=SC53
//*********************************************************
//* IMS CM V2R1 Schedule JCL
//*********************************************************
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD  DSN=GPL.SGPLLINK,DISP=SHR
//         DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//GPLREPOS DD  DSN=GPL.GPLREPOS,DISP=SHR
//SYSPRINT DD  SYSOUT=*
//REPORT   DD  SYSOUT=*
//SYSIN    DD  *
  INSTALL +
  CPNAME('ORDAPPL') +
  CPDATE(2014.08.04) +
  CPTIME(10.26.45) +
  PLEX(PLX13) +
  SCOPE(IVP1) +
  NOTREADY(STOP) +
  ONFAILURE(ROLLBACK) +
  FROM(REPOSITORY,GPLREPOS)
/*
```

Figure 4-15 JCL to install a scheduled change package

Example 4-3 lists the output of the job generated in the previous step. In front of every transaction, program, and database there is a "*** No prior Install history ***" statement. It means it is the first time that resource was added to this IMS, otherwise the tool shows which job and when those resources were changed for the last time.

Example 4-3 Change package installation job log

```
1V2R1M0                                          IMS Configuration Manager

 FUN1003I Processing started at 2014-08-04 10:39:20
 GPL6000I      SYSIN command input:
 GPL6000I    1   INSTALL +
 GPL6000I    2   CPNAME('ORDAPPL') +
 GPL6000I    3   CPDATE(2014.08.04) +
 GPL6000I    4   CPTIME(10.26.45) +
 GPL6000I    5   PLEX(PLX13) +
 GPL6000I    6   SCOPE(IVP1) +
 GPL6000I    7   NOTREADY(STOP) +
 GPL6000I    8   ONFAILURE(ROLLBACK) +
 GPL6000I    9   FROM(REPOSITORY,GPLREPOS)
 GPL6035I INSTALL started for change packages with timestamp 2014.08.04 10.26.45 within requested scope.
 GPL6227I Resetting Change package element DATABASE 'ORD1DB' for IMS 'IVP1'
 GPL6227I Resetting Change package element DATABASE 'ORD1DBI' for IMS 'IVP1'
 GPL6227I Resetting Change package element DATABASE 'ORD2DB' for IMS 'IVP1'
 GPL6227I Resetting Change package element DATABASE 'ORD3DB' for IMS 'IVP1'
 GPL6227I Resetting Change package element DATABASE 'ORD4DB' for IMS 'IVP1'
 GPL6227I Resetting Change package element PROGRAM 'BMPORD1' for IMS 'IVP1'
 GPL6227I Resetting Change package element PROGRAM 'BMPORD2' for IMS 'IVP1'
 GPL6227I Resetting Change package element PROGRAM 'BMPORD3' for IMS 'IVP1'
 GPL6227I Resetting Change package element PROGRAM 'ORD1' for IMS 'IVP1'
 GPL6227I Resetting Change package element PROGRAM 'ORD2' for IMS 'IVP1'
 GPL6227I Resetting Change package element TRANSACT 'ORD1' for IMS 'IVP1'
 GPL6227I Resetting Change package element TRANSACT 'ORD2' for IMS 'IVP1'
 GPL6003I INSTALL completed RC=00
 FUN1003I Processing ended at 2014-08-04 10:39:21
1V2R1M0                                           IMS Configuration Manager

 Install into IMSplex: PLX13  Change package Timestamp: 2014.08.04 10.26.45                          Run date: 2014.08.04

10.39.21
```

```
 IMSplex member system eligibility report:

 Member   VV.R.M READY Eligible Reason
 -------- ------ ----- -------- --------------------------------
 IVP1     13.1.0 YES   YES


 Installing Change package for IMS 'IVP1'  Prior status: Closed           Name: ORDAPPL

 Sequence Time     Resource Type       Last Changed      Util Job  Jobno   Job TYPE  Last chg in CP     LST CMD Last status
 -------- -------- -------- -------- ------------------- -------- -------- -------- ------------------- -------

--------------------
 00000001 10:39:21 ORD1DB   DATABASE *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  RESIDENT(N) ACCTYPE(UPD)
   CREATE DRD Command:   CREATE DB NAME(ORD1DB) SET( RESIDENT(N) ACCTYPE(UPD) )
          DRD CC=00, CREATE successful

 00000002 10:39:21 ORD1DBI  DATABASE *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  RESIDENT(N) ACCTYPE(UPD)
   CREATE DRD Command:   CREATE DB NAME(ORD1DBI) SET( RESIDENT(N) ACCTYPE(UPD) )
          DRD CC=00, CREATE successful

 00000003 10:39:21 ORD2DB   DATABASE *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  RESIDENT(N) ACCTYPE(UPD)
   CREATE DRD Command:   CREATE DB NAME(ORD2DB) SET( RESIDENT(N) ACCTYPE(UPD) )
          DRD CC=00, CREATE successful

 00000004 10:39:21 ORD3DB   DATABASE *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  RESIDENT(N) ACCTYPE(UPD)
   CREATE DRD Command:   CREATE DB NAME(ORD3DB) SET( RESIDENT(N) ACCTYPE(UPD) )
          DRD CC=00, CREATE successful

 00000005 10:39:21 ORD4DB   DATABASE *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  RESIDENT(N) ACCTYPE(EXCL)
   CREATE DRD Command:   CREATE DB NAME(ORD4DB) SET( RESIDENT(N) ACCTYPE(EXCL) )
          DRD CC=00, CREATE successful

 00000006 10:39:21 BMPORD1  PROGRAM  *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  BMPTYPE(Y) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(PARALLEL) TRANSTAT(N)
   CREATE DRD Command:   CREATE PGM NAME(BMPORD1) SET( BMPTYPE(Y) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(PARALLEL) TRANSTAT(N)

)
          DRD CC=00, CREATE successful

 00000007 10:39:21 BMPORD2  PROGRAM  *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  BMPTYPE(Y) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N)
   CREATE DRD Command:   CREATE PGM NAME(BMPORD2) SET( BMPTYPE(Y) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N) )
          DRD CC=00, CREATE successful

 00000008 10:39:21 BMPORD3  PROGRAM  *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  BMPTYPE(Y) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N)
   CREATE DRD Command:   CREATE PGM NAME(BMPORD3) SET( BMPTYPE(Y) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N) )
          DRD CC=00, CREATE successful

 00000009 10:39:21 ORD1     PROGRAM  *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  BMPTYPE(N) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N)
   CREATE DRD Command:   CREATE PGM NAME(ORD1) SET( BMPTYPE(N) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N) )
          DRD CC=00, CREATE successful

 00000010 10:39:21 ORD2     PROGRAM  *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  BMPTYPE(N) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N)
   CREATE DRD Command:   CREATE PGM NAME(ORD2) SET( BMPTYPE(N) DOPT(N) FP(N) GPSB(N) RESIDENT(N) SCHDTYPE(SERIAL) TRANSTAT(N) )
          DRD CC=00, CREATE successful

 00000011 10:39:21 ORD1     TRANSACT *** No prior Install history ***
          *** No IMS Modblk ***
          ICM Resource:  AOCMD(TRAN) CLASS(1) CMTMODE(SNGL) CONV(N) DCLWA(Y) DIRROUTE(N) EDITUC(Y) EXPRTIME(0) FP(N) INQ(N)
                         LCT(65535) LPRI(1) MAXRGN(0) MSGTYPE(SNGLSEG) NPRI(1) PARLIM(65535) PGM(ORD1) PLCT(65535) PLCTTIME

(6553500)
```

```
                        RECOVER(Y) REMOTE(N) RESP(N) SEGNO(0) SEGSZ(0) SERIAL(N) TRANSTAT(N) WFI(N)
   CREATE DRD Command:  CREATE TRAN NAME(ORD1) SET( AOCMD(TRAN) CLASS(1) CMTMODE(SNGL) CONV(N) DCLWA(Y) DIRROUTE(N) EDITUC(Y)
                        EXPRTIME(0) FP(N) INQ(N) LCT(65535) LPRI(1) MAXRGN(0) MSGTYPE(SNGLSEG) NPRI(1) PARLIM(65535) PGM(ORD1)
                        PLCT(65535) PLCTTIME(6553500) RECOVER(Y) REMOTE(N) RESP(N) SEGNO(0) SEGSZ(0) SERIAL(N) TRANSTAT(N) WFI(N)

)
         DRD CC=00, CREATE successful

 00000012 10:39:21 ORD2     TRANSACT *** No prior Install history ***
         *** No IMS Modblk ***
         ICM Resource:  AOCMD(N) CLASS(1) CMTMODE(SNGL) CONV(N) DCLWA(Y) DIRROUTE(N) EDITUC(Y) EXPRTIME(0) FP(N) INQ(N) LCT(65535)
                        LPRI(1) MAXRGN(0) MSGTYPE(SNGLSEG) NPRI(1) PARLIM(65535) PGM(ORD2) PLCT(65535) PLCTTIME(6553500) RECOVER

(Y)
                        REMOTE(N) RESP(N) SEGNO(0) SEGSZ(0) SERIAL(N) TRANSTAT(N) WFI(N)
   CREATE DRD Command:  CREATE TRAN NAME(ORD2) SET( AOCMD(N) CLASS(1) CMTMODE(SNGL) CONV(N) DCLWA(Y) DIRROUTE(N) EDITUC(Y)
                        EXPRTIME(0) FP(N) INQ(N) LCT(65535) LPRI(1) MAXRGN(0) MSGTYPE(SNGLSEG) NPRI(1) PARLIM(65535) PGM(ORD2)
                        PLCT(65535) PLCTTIME(6553500) RECOVER(Y) REMOTE(N) RESP(N) SEGNO(0) SEGSZ(0) SERIAL(N) TRANSTAT(N) WFI(N)

)
         DRD CC=00, CREATE successful


 INSTALL Totals for IMS: 'IVP1' Current Status: Installed

 Resource     Read    Added  Updated  Deleted  No Chg.    Error
 --------   ------   ------  -------  -------  -------  -------
 DATABASE        5        5        0        0        0        0
 PROGRAM         5        5        0        0        0        0
 TRANSACT        2        2        0        0        0        0
 RTCODE          0        0        0        0        0        0
 DBDESC          0        0        0        0        0        0
 PGMDESC         0        0        0        0        0        0
 TRANDESC        0        0        0        0        0        0
 RTCDESC         0        0        0        0        0        0
 --------   ------   ------  -------  -------  -------  -------
 TOTALS         12       12        0        0        0        0

 INSTALL Job Totals:

 Resource     Read    Added  Updated  Deleted  No Chg.    Error
 --------   ------   ------  -------  -------  -------  -------
 DATABASE        5        5        0        0        0        0
 PROGRAM         5        5        0        0        0        0
 TRANSACT        2        2        0        0        0        0
 RTCODE          0        0        0        0        0        0
 DBDESC          0        0        0        0        0        0
 PGMDESC         0        0        0        0        0        0
 TRANDESC        0        0        0        0        0        0
 RTCDESC         0        0        0        0        0        0
 --------   ------   ------  -------  -------  -------  -------
 Totals         12       12        0        0        0        0
```

All the changes are stored in the Resource Manager and then are written to the RDDS at the next IMS Checkpoint. A DFS3371I message is then generated after a successful AUTOEXPORT. You may issue a simple Checkpoint command to force an AUTOEXPORT.

4.3 Updating resources groups

In the previous sections of this chapter, you learned how to use the **TAKEUP** utility to create resource groups and the **INSTALL** utility to execute change packages to add or remove transactions, programs, and databases. Those two utilities are required to update an existing RG and the following other two are used to complete the process:

- **COPY**: Used to back up or create new resource groups using the same definitions from the original RG.
- **COMPARE**: Used to compare the new RG with the original RG and update the original RG with all the changes.

In this section, we go through the process to update an existing resource group. Say that the ORDER application needs to install a new release on a test system and you (the DBA) are in charge of updating the definitions for that particular application.

To guide you through this process, Example 4-4 has the new version of order application STAGE1 source code used for this scenario to simulate a new version of an application to be installed.

Example 4-4 New STAGE1 source code for order application

```
*********************************************************************
** 08/20/14 - REMOVED - BMP BMPORD1                                 *
**                      DBD ORD4DB                                  *
**            ADDED   - DBD ORDITEM, INDEX ORDITEMI                 *
**                      BMP BMPORD4                                 *
**                      BMP BMPORD5                                 *
**                      BMP BMPORD6                                 *
**                      BMP BMPORD7                                 *
**            CHANGED - BMP BMPORD2 TO PARALLEL                     *
*********************************************************************
** TRANSACTION DEFINITIONS
*********************************************************************
         APPLCTN PSB=ORD1,PGMTYPE=TP
           TRANSACT CODE=ORD1,MODE=SNGL,AOI=TRAN,                    X
               MSGTYPE=(SNGLSEG,NONRESPONSE,4)
         APPLCTN PSB=ORD2,PGMTYPE=TP
           TRANSACT CODE=ORD2,MODE=SNGL,                             X
               MSGTYPE=(SNGLSEG,NONRESPONSE,1)
         APPLCTN PSB=BMPORD2,SCHDTYP=PARALLEL,PGMTYPE=BATCH
         APPLCTN PSB=BMPORD3,PGMTYPE=BATCH
         APPLCTN DOPT,PSB=BMPORD4,SCHDTYP=SERIAL,PGMTYPE=BATCH
         APPLCTN DOPT,PSB=BMPORD5,SCHDTYP=SERIAL,PGMTYPE=BATCH
         APPLCTN PSB=BMPORD6,SCHDTYP=SERIAL,PGMTYPE=BATCH
         APPLCTN PSB=BMPORD7,SCHDTYP=SERIAL,PGMTYPE=BATCH
*********************************************************************
**  DATABASE DEFINITIONS
*********************************************************************
         DATABASE DBD=ORD1DB,ACCESS=UP
         DATABASE INDEX,DBD=ORD1DBI,ACCESS=UP
         DATABASE DBD=ORD2DB,ACCESS=UP
         DATABASE DBD=ORD3DB,ACCESS=UP
         DATABASE DBD=ORDITEM,ACCESS=UP
         DATABASE INDEX,DBD=ORDITEMI,ACCESS=UP
```

Instead of trusting the comments section in the stage1 of the ORDER application to know what has been changed, added, or removed, you can use IBM file compare utility SuperC or any other tool to compare the old stage1 source code from Example 4-2 on page 71 with the new one from Example 4-4. We use ICM to do that.

It is important to have a backup for the existing resource group before moving forward in the update process. The steps below describe the process using ISPF panels and jobs found in sample data set shipped with ICM to use the COPY function.

- Using ISPF panels:

  a. Invoke ICM panels and go to option 3, Resources.

b. In the Resource Groups panels, put a C in front of the resource to be copied, just like Figure 4-16 shows.

```
 Resource Groups                  Row 1 of 6 More: <>
Command ===>                                          Scroll ===> CSR

Enter NEW to create a new Resource Group

     Resource Group           IMSID   Created     Changed             ID
/    *                        *       =*          =*                  *
     IMSX RESOURCES                   2014-07-14  2014-07-14 19.04.13  IMSRES8
     IMSY RESOURCES                   2014-07-14  2014-07-14 19.03.58  IMSRES8
C    ORDAPPL                          2014-07-15  2014-07-15 17.02.09  IMSRES8
     PLX13 RESOURCES                  2014-07-14  2014-07-14 19.03.08  IMSRES8
```

Figure 4-16 Copying resource groups part 1

c. In the Copy Resource Group panel, change the name of the resource group to something that helps you identify this new resource is a backup. In Figure 4-17, RG ORDAPPLBKP is created.

```
 Copy Resource Group

Press PF3 or EXIT to copy the Resource Group. PF12 or Cancel to cancel.

Source
   Name  . . . . : ORDAPPL
   IMSID . . . . :
   Level . . . . : Common

Target
   Name  . . . . . ORDAPPLBKP
   Description . . SHARED ORDER APPL BACKUP
   IMSID . . . . .       +
   Repository  . . 'GPL.GPLREPOS'                              +
```

Figure 4-17 Copying resource groups part 2

d. Do the same process described in step c but this time create a resource group ending with NEW. This new group will be used further in the update process.

- Using JCL:

  Edit sample JCL GPLCOPY that comes with IMS Configuration Manager to create a new member and also a backup for the original resource group just like Example 4-5. The existing RG ORDAPPL is copied to a new one called ORDAPPLNEW and also a backup called ORDAPPLBKP is created.

Example 4-5 JCL to back up or create new resource groups copying from the original one

```
//ICMCOPY  JOB ACTINFO1,CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),
//         NOTIFY=&SYSUID
/*JOBPARM SYSAFF=SC53
//GPLUTIL  EXEC PGM=GPLUTIL
```

```
//STEPLIB  DD  DISP=SHR,DSN=GPL.SGPLLINK
//         DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSIN    DD  *
COPY    MBRTYPE(RG)               +
        MBRNAME(ORDAPPL)          +
        NEWNAME(ORDAPPLNEW)       +
        FROM(REPOSITORY,INREPOS)  +
        TO(REPOSITORY,OUTREPOS)   +
        REPLACE
COPY    MBRTYPE(RG)               +
        MBRNAME(ORDAPPL)          +
        NEWNAME(ORDAPPLBKP)       +
        FROM(REPOSITORY,INREPOS)  +
        TO(REPOSITORY,OUTREPOS)   +
        REPLACE
/*
//INREPOS  DD  DISP=SHR,DSN=GPL.GPLREPOS
//OUTREPOS DD  DISP=SHR,DSN=GPL.GPLREPOS
//SYSPRINT DD  SYSOUT=*
```

Now that you have a backup in case any problem happens during the update, it is time to take the following actions:

1. Run the take up function to load the new stage1 from Example 4-4 on page 81 into ORDAPPLNEW
2. Run the compare function to compare the new resource group (ORDAPPLNEW) to a resource group taken up previously (ORDAPPL). Create a new change package containing the differences between the old and new resource group. Update the old resource group with these changes
3. Install changes found in the compare step into a running IMS system.

All these three steps are done in a single job as shown in Example 4-6.

Example 4-6 Single step job using takeup, compare, and install functions

```
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD  DISP=SHR,DSN=GPL.SGPLLINK
//         DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//ASMLIB   DD  DSN=GPL.SGPLSAMP,DISP=SHR
//ASMUT1   DD  UNIT=SYSDA,SPACE=(CYL,(1,1))
//ASMPUNCH DD  UNIT=SYSDA,SPACE=(CYL,(1,1))
//ASMPRINT DD  SYSOUT=*
//SYSIN    DD  *
TAKEUP  FROM(STAGE1,STAGE1DD) +
        TO(REPOSITORY,GPLREPOS) +
        RG(ORDAPPLNEW) +
        DEFRGLVL(COMMON)      +
        REPLACE
COMPARE INPUT1(RG(ORDAPPLNEW), +
              DDNAME(REPOSITORY,GPLREPOS)), +
        INPUT2(RG(ORDAPPL) +
              DDNAME(REPOSITORY,GPLREPOS)), +
        UPDCP(NAME(ORDAPPL), +
              IMSID(IVP1), +
              UPDREPOS(INPUT2)) +
```

```
        UPDRG(NAME(ORDAPPL), +
              UPDREPOS(INPUT2), +
              REPLACE +
              )
INSTALL CPDATE($LATEST) +
        CPTIME(IGNORED) +
        FROM(REPOSITORY,GPLREPOS) +
        ONFAILURE(ROLLBACK) +
        PLEX(PLX13) +
        SCOPE(IVP1)
/*
//GPLREPOS DD  DISP=SHR,DSN=GPL.GPLREPOS
//STAGE1DD DD  DISP=SHR,DSN=IMS13X.STAGE1(ORDAPP)
//SYSPRINT DD  SYSOUT=*
//REPORT   DD  SYSOUT=*
```

The compare function in Example 4-6 on page 83 compares the new resource group ORDAPPLNEW with the old one, ORDAPPL; copies all the differences into ORDAPPL; and creates a new change package called ORDAPPL using resource group ORDAPPL as input.

The install function on Example 4-6 on page 83 installs the last change package created for IMS IVP1 on IMPLEX PLX13.

Example 4-7 shows the sysprint DD card output for the job in Example 4-6 on page 83.

Example 4-7 Sysprint DD card output

```
FUN1003I Processing started at 2014-08-29 12:18:59
 GPL6000I      SYSIN command input:
 GPL6000I    1 TAKEUP  FROM(STAGE1,STAGE1DD) +
 GPL6000I    2         TO(REPOSITORY,GPLREPOS) +
 GPL6000I    3         RG(ORDAPPLNEW) +
 GPL6000I    4         DEFRGLVL(COMMON)      +
 GPL6000I    5         REPLACE
 GPL6000I    6 COMPARE INPUT1(RG(ORDAPPLNEW), +
 GPL6000I    7               DDNAME(REPOSITORY,GPLREPOS)), +
 GPL6000I    8         INPUT2(RG(ORDAPPL) +
 GPL6000I    9               DDNAME(REPOSITORY,GPLREPOS)), +
 GPL6000I   10         UPDCP(NAME(ORDAPPL), +
 GPL6000I   11               IMSID(IVP1), +
 GPL6000I   12               UPDREPOS(INPUT2)) +
 GPL6000I   13         UPDRG(NAME(ORDAPPL), +
 GPL6000I   14               UPDREPOS(INPUT2), +
 GPL6000I   15               REPLACE +
 GPL6000I   16               )
 GPL6000I   17 INSTALL CPDATE($LATEST) +
 GPL6000I   18         CPTIME(IGNORED) +
 GPL6000I   19         FROM(REPOSITORY,GPLREPOS) +
 GPL6000I   20         ONFAILURE(ROLLBACK) +
 GPL6000I   21         PLEX(PLX13) +
 GPL6000I   22         SCOPE(IVP1)
 GPL6001I TAKEUP started for STAGE1 input DD=STAGE1DD
 GPL6100I Stage 1 assembly started
 GPL6101I Stage 1 assembly ended, RC=00, see ASMPRINT for listing
 GPL6104I TAKEUP has replaced Resource Group 'ORDAPPLNEW' IMSID 'common'
 GPL6105I Counts: DB=      6 PGM=      8 RTC=      0 TRAN=      2 SKIP=      0
 GPL6003I TAKEUP completed RC=00
 GPL6034I COMPARE started
 GPL6502I Created Change Package for IMS 'IVP1' CP timestamp '2014.08.29 12.18.59'
```

```
GPL6503I Updated RG 'ORDAPPL'  ''
GPL6003I COMPARE completed RC=00
GPL6035I INSTALL started for change packages with timestamp $LATEST  within requested scope.
GPL6263I Latest change package '20140829 121859' for IMSID 'IVP1' chosen for processing
GPL6227I Resetting Change package element DATABASE 'ORDITEM' for IMS 'IVP1'
GPL6227I Resetting Change package element DATABASE 'ORDITEMI' for IMS 'IVP1'
GPL6238I Queueing DATABASE 'ORD4DB' for subsequent delete - IMS 'IVP1'
GPL6238I Queueing PROGRAM 'BMPORD1' for subsequent delete - IMS 'IVP1'
GPL6227I Resetting Change package element PROGRAM 'BMPORD2' for IMS 'IVP1'
GPL6227I Resetting Change package element PROGRAM 'BMPORD4' for IMS 'IVP1'
GPL6227I Resetting Change package element PROGRAM 'BMPORD5' for IMS 'IVP1'
GPL6227I Resetting Change package element PROGRAM 'BMPORD6' for IMS 'IVP1'
GPL6227I Resetting Change package element PROGRAM 'BMPORD7' for IMS 'IVP1'
GPL6227I Resetting Change package element TRANSACT 'ORD1' for IMS 'IVP1'
GPL6239I Attempting DELETE of PGM 'BMPORD1' for IMS 'IVP1' after deleting    0 TRAN and    0 RTC
GPL6258I Attempting DELETE of DB 'ORD4DB' for IMS 'IVP1'
GPL6003I INSTALL completed RC=00
FUN1003I Processing ended at 2014-08-29 12:19:01
```

Example 4-8 shows the report DD card output for the job in Example 4-6 on page 83.

Example 4-8 Report DD card output

```
1V2R1M0                                                IMS Configuration Manager

 COMPARE UTILITY
Run date: 2014.08.29 12.18.59



 ++++ Comparing Resource Type: DATABASE ++++

 Resource: ORDITEM  Type: DATABASE IMSID:      RG: ORDAPPLNEW
 Source: INPUT1 Data: RESIDENT(N) ACCTYPE(UPD)
 >>> INPUT1 is unmatched
--------------------------------------------------------------------------------

 Resource: ORDITEMI Type: DATABASE IMSID:      RG: ORDAPPLNEW
 Source: INPUT1 Data: RESIDENT(N) ACCTYPE(UPD)
 >>> INPUT1 is unmatched
--------------------------------------------------------------------------------

 Resource: ORD1DB   Type: DATABASE IMSID:      RG: ORDAPPLNEW
 Source: INPUT1 Data: RESIDENT(N) ACCTYPE(UPD)

 Resource: ORD1DB   Type: DATABASE IMSID:      RG: ORDAPPL
 Source: INPUT2 Data: RESIDENT(N) ACCTYPE(UPD)
 **** All data fields match
 --------------------------------------------------------------------------------

 Resource: ORD1DBI  Type: DATABASE IMSID:      RG: ORDAPPLNEW
 Source: INPUT1 Data: RESIDENT(N) ACCTYPE(UPD)

 Resource: ORD1DBI  Type: DATABASE IMSID:      RG: ORDAPPL
 Source: INPUT2 Data: RESIDENT(N) ACCTYPE(UPD)
 **** All data fields match
 --------------------------------------------------------------------------------
```

```
Resource: ORD2DB   Type: DATABASE IMSID:      RG: ORDAPPLNEW
Source: INPUT1 Data: RESIDENT(N) ACCTYPE(UPD)

Resource: ORD2DB   Type: DATABASE IMSID:      RG: ORDAPPL
Source: INPUT2 Data: RESIDENT(N) ACCTYPE(UPD)
**** All data fields match
--------------------------------------------------------------------------------

Resource: ORD3DB   Type: DATABASE IMSID:      RG: ORDAPPLNEW
Source: INPUT1 Data: RESIDENT(N) ACCTYPE(UPD)

Resource: ORD3DB   Type: DATABASE IMSID:      RG: ORDAPPL
Source: INPUT2 Data: RESIDENT(N) ACCTYPE(UPD)
**** All data fields match
--------------------------------------------------------------------------------

Resource: ORD4DB   Type: DATABASE IMSID:
```

Your IMS system is now updated.

4.4 Deleting resource groups

Before deleting a resource group, it is important to check if the RG in question is used by an IMS system or not. If it is not used by any IMS, just go to the ICM ISPF panel, go to option 3, put a letter D in front of the resource group, and press Enter. However, if that is not the case and it is part of one of your IMS regions, you need to create a delete change package to remove all the definitions from IMS before deleting the resource group itself.

The process to create a delete change package is similar to the process of updating a resource group described in section 4.3, “Updating resources groups” on page 80. Follow these steps to create a delete change package:

1. Invoke the ICM panel and go to option 3, Resources
2. Type NEW in the command line and press Enter
3. Give any name to the resource group name but do not put any information about the other fields. Figure 4-18 on page 87 is an example and the RG created is called RETIREMENT

```
 New Resource Group

Press PF3 to create the resource group, PF12 to cancel


Name  . . . . . RETIREMENT
IMSID . . . . .       +
Description . .

   Add resources via Takeup
    Input type . . . . .    1. Stage 1 macros
                            2. RDDS
    Input file . . . . .
    User macro file(s)




       Create notes from comments (stage 1 only)
```

Figure 4-18 Creating a retirement resource group

4. Create a new member in your jcl library and copy the jcl from Example 4-6 on page 83. Delete the takeup function from the sysin DD statement and also delete all the ASM* (ASMLIB, ASMUT1, ASMPUNCH, and ASMPRINT) and STAGE1dd cards and change the RG used in the INPUT1 statement in the compare function.

   After doing all the changes above, your JCL should be similar to Example 4-9.

Example 4-9 JCL to remove application resources from IMS

```
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD  DISP=SHR,DSN=GPL.SGPLLINK
//         DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSIN    DD  *
COMPARE INPUT1(RG(RETIREMENT), +
              DDNAME(REPOSITORY,GPLREPOS)), +
        INPUT2(RG(ORDAPPL) +
              DDNAME(REPOSITORY,GPLREPOS)), +
        UPDCP(NAME(ORDAPPL), +
              IMSID(IVP1), +
              UPDREPOS(INPUT2)) +
        UPDRG(NAME(ORDAPPL), +
              UPDREPOS(INPUT2), +
              REPLACE +
              )
INSTALL CPDATE($LATEST) +
        CPTIME(IGNORED) +
        FROM(REPOSITORY,GPLREPOS) +
        ONFAILURE(ROLLBACK) +
        PLEX(PLX13) +
        SCOPE(IVP1)
/*
//GPLREPOS DD  DISP=SHR,DSN=GPL.GPLREPOS
```

```
//SYSPRINT DD  SYSOUT=*
//REPORT   DD  SYSOUT=*
```

Submit the job and it must complete with return code 00.

5. Review the job output and look for “Compare Total” and “Install Totals”. The same number of resources (database, program, rtcode, and program) to be deleted must appear on both. Example 4-10 illustrates in bold the totals that need to be checked in the job output.

Example 4-10 Important things to be checked in the output of the retirement job

```
++++ Compare Totals ++++

          Resources   Resources   Resources only   Resources only   Resources in
Resource from INPUT1 from INPUT2    in Input1        in Input2     Not matching
-------- ----------- ----------- ---------------- ---------------- ------------
DATABASE           0           6                0                6            0
PROGRAM            0           8                0                8            0
RTCODE             0           0                0                0            0
TRANSACT           0           2                0                2            0
-------- ----------- ----------- ---------------- ---------------- ------------
Totals             0          16                0               16            0

CP Output Totals:

Resource    Added  Updated  Deleted    Total
-------- -------- -------- -------- --------
DATABASE        0        0        6        6
PROGRAM         0        0        8        8
RTCODE          0        0        0        0
TRANSACT        0        0        2        2
-------- -------- -------- -------- --------
Totals:         0        0       16       16

RG Output totals:

Resource    Added  Updated Deleted     Total
-------- -------- -------- -------- --------
DATABASE        0        0        6        6
PROGRAM         0        0        8        8
RTCODE          0        0        0        0
TRANSACT        0        0        2        2
-------- -------- -------- -------- --------
Totals:         0        0       16       16


INSTALL Totals for IMS: 'IVP1' Current Status: Installed

Resource     Read    Added  Updated  Deleted  No Chg.    Error
--------   ------   ------  -------  -------  -------  -------
DATABASE        6        0        0        6        0        0
PROGRAM         8        0        0        8        0        0
TRANSACT        2        0        0        2        0        0
RTCODE          0        0        0        0        0        0
DBDESC          0        0        0        0        0        0
PGMDESC         0        0        0        0        0        0
TRANDESC        0        0        0        0        0        0
```

```
RTCDESC         0        0        0        0        0        0
--------   ------   ------  -------  -------  -------  -------
TOTALS         16        0        0       16        0        0

INSTALL Job Totals:

Resource     Read    Added  Updated  Deleted  No Chg.    Error
--------   ------   ------  -------  -------  -------  -------
DATABASE        6        0        0        6        0        0
PROGRAM         8        0        0        8        0        0
TRANSACT        2        0        0        2        0        0
RTCODE          0        0        0        0        0        0
DBDESC          0        0        0        0        0        0
PGMDESC         0        0        0        0        0        0
TRANDESC        0        0        0        0        0        0
RTCDESC         0        0        0        0        0        0
--------   ------   ------  -------  -------  -------  -------
Totals         16        0        0       16        0        0
```

Now you are able to delete the resource group in the ICM panel but remember to do the process above for each IMS using the RG you plan to delete.

4.5 Promoting application definitions from development to test or test to production

The **COPY** utility function allows you to migrate resources from one repository to another and to transmit resource definitions from one location to another using a portable XMIT format that is a flat file structure.

In Example 4-11, the resource group ORDAPPL gets copied to IMSX13X.ICM.XMITFILE. If your test or production IMS region runs on a different lpar, the data set created in OUTREPOS dd card can be transmitted by ftp or any other vendor product your shop has.

Example 4-11 JCL to copy resource groups to

```
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD DISP=SHR,DSN=GPL.SGPLLINK
//         DD DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSIN    DD  *
COPY    MBRTYPE(RG)               +
        MBRNAME(ORDAPPL)          +
        FROM(REPOSITORY,INREPOS)  +
        TO(XMITFILE,OUTREPOS)     +
        REPLACE
/*
//INREPOS  DD DISP=SHR,DSN=GPL.GPLREPOS
//OUTREPOS DD DISP=(NEW,CATLG,DELETE),
//         DSN=IMS13X.ICM.XMITFILE,UNIT=SYSDA,SPACE=(CYL,(1,1)),
//         DCB=(LRECL=80,RECFM=FB,BLKSIZE=27920)
//SYSPRINT DD  SYSOUT=*
```

Not only a single resource group but all resources from one IMS can be copied to another one in a remote lpar and the only change required in Example 4-11 on page 89 is to change the control cards in the sysin DD statement.

The control cards in Example 4-12 copy all the resource groups from IMS IVP1 including all the common ones to the xmit file.

Example 4-12 Example of control cards to copy all the resource groups to xmit file

```
COPY    MBRTYPE(RG)               +
        MBRNAME(*)                +
        SYSTEM(IVP1)              +
        COMMON(YES)               +
        FROM(REPOSITORY,INREPOS)  +
        TO(XMITFILE,OUTREPOS)
```

After sending the data set created in Example 4-11 on page 89 to the target system, it is time to run the copy function again to load the content of the xmit file to ICM.

As you can see in Example 4-13, the job is similar to the other one used in Example 4-11 on page 89.

Example 4-13 JCL to copy from xmit file to ICM repository

```
//GPLUTIL  EXEC PGM=GPLUTIL
//STEPLIB  DD DISP=SHR,DSN=GPL.SGPLLINK
//         DD DISP=SHR,DSN=IMS13Z.SDFSRESL
//SYSIN    DD  *
COPY    MBRTYPE(RG)               +
        MBRNAME(ORDAPPL)          +
        NEWNAME(ORDAPPL)         +
        FROM(XMITFILE,INREPOS)    +
        TO(REPOSITORY,OUTREPOS)   +
        REPLACE
/*
//INREPOS  DD DISP=SHR,DSN=IMS13X.ICM.XMITFILE
//OUTREPOS DD DISP=SHR,DSN=GPL.GPLREPOS
//SYSPRINT DD  SYSOUT=*
```

The job was changed to copy from the xmit file (INREPOS) to ICM repository (OUTREPOS), keeping the original name of the resource group (ORDAPPL) but you can give any name you want in the output (NEWNAME).

In case you used the control cards from Example 4-12 to copy all the resources from one IMS and you want to load those definitions on a remote site, use the control card from Example 4-14 to change the IMS name if you copied resource groups that are used exclusively by the old IMS (non-common resource).

Example 4-14 Control cards to load all the resources from another IMS in the target system

```
COPY    MBRTYPE(RG)               +
        MBRNAME(*)                +
        SYSTEM(IVP1)              +
        NEWSYSTEM(IMSZ)           +
        COMMON(YES)               +
        FROM(XMITFILE,INREPOS)    +
        TO(REPOSITORY,OUTREPOS)   +
```

```
REPLACE
```

This way, you are able to upgrade your application to a new release fast and easy and the most important thing is, without impacting the IMS availability because all the updates happened dynamically while the IMS was up. The same process applies to clone a production system in a test system.

5

Cloning IMS databases

Database administrators (DBAs) are often called upon to create copies of databases. There are several reasons for these requests, including:

- Testing application programming changes before the changes going into production.
- Debugging problems without impacting production systems.
- Refreshing a test system with production data.

In this chapter, we describe the steps required to clone databases using traditional techniques. We then describe and demonstrate the steps used when using the IBM IMS Cloning Tool and the IMS Database Recovery Facility. We also describe the use of Recovery Expert for disaster recovery purposes.

Contents:

- Cloning using traditional techniques
- Copying databases to another IMS region with IMS Cloning Tool
- Creating copies of production databases with IMS Cloning Tool
- Using the IMS Database Recovery Facility to clone databases
- Disaster recovery

5.1 Cloning using traditional techniques

The process used to create copies of databases follows the same general steps, and is primarily based on running IMS database recoveries. Not all steps are required for each scenario:

- Image copy from the source system.
- Copy the DBD library from the source system.
- If the target system is in a different site, transmit the following files from the source site to the target site:
  - Image copy files
  - DBD library
  - IDCAMS control card library
- Edit the IDCAMS control cards as appropriate - changing the data set names, SMS storage parameters (or volume serial numbers if you do not use SMS), and space parameters.
- Compare the DBD source and target DBD libraries to determine if the DBD library will need to be updated.
- Set up the recovery job. This will depend on any tools that you may or may not have available.
- If you are refreshing a system (such as a test system), run a set of image copies in the event a fallback is required.
- If necessary, install the source DBD library in the target system.
- Run the recovery jobs.
- If necessary, run image copies on the target system.
- If necessary, perform an ACBGEN on the target system.

5.2 Copying databases to another IMS region with IMS Cloning Tool

The IMS Cloning Tool can assist DBAs when they need to copy a database or group of databases from one system to another in a shared DASD environment. In this case, the source and target systems should have their own RECONs, dynamic allocation libraries, and ACB libraries.

5.2.1 Job control language when copying to another IMS region

Example 5-1 shows the JCL required for moving databases from IMS region IVP1 to IMS region IVP2.

Example 5-1 JCL when copying to another IMS region

```
//S1      EXEC PGM=GCLO0010,REGION=0M
//STEPLIB  DD  DISP=SHR,DSN=GCL.SGCLLOAD
//         DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSUDUMP DD  SYSOUT=*
//ABNLIGNR DD  DUMMY
//GCLPRINT DD  SYSOUT=*
```

```
//GCLINI   DD  DISP=SHR,DSN=GCL.SGCLPARM(GCLINI)
//IVP1ACB  DD  DISP=SHR,DSN=IMS13X.ACBLIB
//IVP1MDA  DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//IVP1REC1 DD  DISP=SHR,DSN=IMS13X.RECON1
//IVP1REC2 DD  DISP=SHR,DSN=IMS13X.RECON2
//IVP1REC3 DD  DISP=SHR,DSN=IMS13X.RECON3
//IVP2ACB  DD  DISP=SHR,DSN=IMS13Y.ACBLIB
//IVP2MDA  DD  DISP=SHR,DSN=IMS13Y.MDALIB
//IVP2REC1 DD  DISP=SHR,DSN=IMS13Y.RECON1
//IVP2REC2 DD  DISP=SHR,DSN=IMS13Y.RECON2
//IVP2REC3 DD  DISP=SHR,DSN=IMS13Y.RECON3
//IMS      DD  DISP=SHR,DSN=IMS13Y.DBDLIB
//SYSLIB   DD  DISP=SHR,DSN=IMS13X.SDFSMAC
//GCLIN    DD  *
```

The Cloning Tool needs to access the libraries for both the source (IVP1) and target (IVP2) IMS regions. The JCL must include DD statements for each system's ACBLIB, dynamic allocation library, and RECON data sets. The Cloning Tool distinguishes these DD statements by using the IMS region name as the first four characters of the DD name. In this example, the source system's DD names all start with the characters IVP1 and the target system's DD names all start with the characters IVP2. In addition, the DBD library of the target system must be included in the IMS DD statement.

The GCLINI DD statement includes the customized parameters for the Cloning Tool when it was installed.

5.2.2 IMS Cloning Tool control cards when copying to another IMS region

Example 5-2 show the control cards needed when copying databases from one IMS region to another IMS region.

Example 5-2 Control cards when copying to another IMS region

```
IMSDBREFRESH                          -
    IMS-SSID(IVP1,IVP2)                 -
    DBD(                                -
      DBDITEMD                          -
      DBDITEMX                          -
      HNUMBER                           -
      HORDER                            -
      T1CUST                            -
      T1CUSTX                           -
      T2CUST                            -
      T2CUSTX                           -
      T3CUST                            -
      T3CUSTX                           -
      T4CUST                            -
      T4CUSTX                           -
    )                                   -
    ALLOW-PARTIAL(Y)                    -
    COPY-IF-NO-IMS-TARGET-DB(Y)         -
    AUTO-START-TARGET-DB(N)             -
     RENAME-MASKS(                       -
       IMS13X.IMS13.** IMS13Y.IMS13.**    -
     )                                   -
```

```
    REGISTER-DBRC(Y)                    -
    INDEXES(Y)                          -
    STOP-COMMAND(DBR)                   -
    WAIT(5,RC(8))
```

The parameters used are:

- IMS-SSID - IVP1 is the source system; IVP2 is the target system.
- DBD - Identifies the DBDs that will be cloned.
- ALLOW-PARTIAL(Y) - Allows the cloning tool to copy some databases even if it encounters errors on others.
- COPY-IF-NO-IMS-TARGET-DB(Y) - Create the cloned copy even if it does not exist on the target system.
- AUTO-START-TARGET-DB(N) - Do not automatically issue an IMS STA DB command on the target system after the databases are copied.
- RENAME-MASKS - This parameter identifies the method in which the cloned database data sets will be renamed.
- REGISTER-DBRC(Y) - The cloned database will not be registered to the target system's (IVP2) RECON data sets. REGISTER-DBRC(Y) is required for HALDB.
- INDEXES(Y) - Indicates that any related indexes will also be cloned.
- STOP-COMMAND(DBR) - Use the DBRECOVER IMS command to stop the source databases. The cloning tool supports DBR, DBD, or QUIESCE commands to stop the databases.
- WAIT(5,RC(8)) - Allow 5 minutes for the DBR command to complete. If the command does not complete within the prescribed time period, terminate the copy and complete with a return code of 8.

5.2.3 Job output when copying to another IMS region

Example 5-3 shows the output of the job.

Example 5-3 Job output when copying to another IMS region

```
1IMS CLONING TOOL                                                    15 AUG 2014 20.25.57
  GCLINI INFORMATION                MODULE INFORMATION               OPERATING SYSTEM
      REL: V1R2M0                       REL: V1R2M0                      z/OS 2.1
     DATE: 22 FEB 2013

 GCLO102OI PROGRAM: GCLO1CIO 20121210 09.01 VERS=1.0 REV=38

    IMSDBREFRESH                        -
      IMS-SSID(IVP1,IVP2)               -
      DBD(                              -
        DBDITEMD                        -
        DBDITEMX                        -
        HNUMBER                         -
        HORDER                          -
        T1CUST                          -
        T1CUSTX                         -
        T2CUST                          -
        T2CUSTX                         -
        T3CUST                          -
        T3CUSTX                         -
        T4CUST                          -
        T4CUSTX                         -
      )                                 -
```

```
     ALLOW-PARTIAL(Y)                    -
     COPY-IF-NO-IMS-TARGET-DB(Y)         -
     AUTO-START-TARGET-DB(N)             -
     RENAME-MASKS(                       -
       IMS13X.IMS13.** IMS13Y.IMS13.**   -
     )                                   -
     REGISTER-DBRC(Y)                    -
     INDEXES(Y)                          -
     STOP-COMMAND(DBR)                   -
     WAIT(5,RC(8))

 GCL30001I 20.25.57 IMS INIT STARTED - PROGRAM REV=6
 GCL30001I 20.25.57 IMS INIT COMPLETED; RETURN CODE=0


 GCL34001I 20:25:57 IMSDBREFRESH Started - Program Rev= 22
 GCL34085I DSNS FOR KEYWORD: RENAME-MASKS                                                    PROCESSING
SEQUENCE
          IMS13X.IMS13.**                          IMS13Y.IMS13.**                                  1



 GCL34901I 20:25:58 CHECKING TARGET DATABASE DEFINITION Started - Program Rev= 2
 GCL34962W 20:25:58 Target IMSPLEX not specified, not able to dynamically add target DB definitions
 GCL34924I SCI IMSPLEX:       NOT ACTIVE
 GCL34963W 20:25:58 Unable to QUERY or CREATE databases on target
 GCL34904I 20:25:58 Checking database DBDITEMD
 GCL34905I 20:25:58 Creating MDA MEMBER for DBDITEMD
 GCL34905I 20:25:58 Creating DBRC DEFINITION for DBDITEMD
 GCL34904I 20:25:58 Checking database DBDITEMX
 GCL34905I 20:25:58 Creating MDA MEMBER for DBDITEMX
 GCL34905I 20:25:58 Creating DBRC DEFINITION for DBDITEMX
 GCL34904I 20:25:58 Checking database HNUMBER
 GCL34905I 20:25:58 Creating DBRC DEFINITION for HNUMBER
 GCL34904I 20:25:59 Checking database HORDER
 GCL34905I 20:25:59 Creating DBRC DEFINITION for HORDER
 GCL34904I 20:25:59 Checking database T1CUST
 GCL34905I 20:25:59 Creating MDA MEMBER for T1CUST
 GCL34905I 20:25:59 Creating DBRC DEFINITION for T1CUST
 GCL34904I 20:25:59 Checking database T1CUSTX
 GCL34905I 20:25:59 Creating MDA MEMBER for T1CUSTX
 GCL34905I 20:25:59 Creating DBRC DEFINITION for T1CUSTX
 GCL34904I 20:26:00 Checking database T2CUST
 GCL34905I 20:26:00 Creating MDA MEMBER for T2CUST
 GCL34905I 20:26:00 Creating DBRC DEFINITION for T2CUST
 GCL34904I 20:26:00 Checking database T2CUSTX
 GCL34905I 20:26:00 Creating MDA MEMBER for T2CUSTX
 GCL34905I 20:26:00 Creating DBRC DEFINITION for T2CUSTX
 GCL34904I 20:26:00 Checking database T3CUST
 GCL34905I 20:26:00 Creating MDA MEMBER for T3CUST
 GCL34905I 20:26:01 Creating DBRC DEFINITION for T3CUST
 GCL34904I 20:26:01 Checking database T3CUSTX
 GCL34905I 20:26:01 Creating MDA MEMBER for T3CUSTX
 GCL34905I 20:26:01 Creating DBRC DEFINITION for T3CUSTX
 GCL34904I 20:26:01 Checking database T4CUST
 GCL34905I 20:26:01 Creating MDA MEMBER for T4CUST
 GCL34905I 20:26:01 Creating DBRC DEFINITION for T4CUST
 GCL34904I 20:26:01 Checking database T4CUSTX
 GCL34905I 20:26:01 Creating MDA MEMBER for T4CUSTX
 GCL34905I 20:26:02 Creating DBRC DEFINITION for T4CUSTX
 GCL34901I 20:26:02 CHECKING TARGET DATABASE DEFINITION Completed; Return Code=0

  12 name(s) entered for keyword: DBD
                                  DBDITEMD
                                  DBDITEMX
                                  HNUMBER
```

```
                                HORDER
                                T1CUST
                                T1CUSTX
                                T2CUST
                                T2CUSTX
                                T3CUST
                                T3CUSTX
                                T4CUST
                                T4CUSTX

GCL34048I OPTIONS IN EFFECT FOR THIS EXECUTION:
          SOURCE IMS-SSID:          IVP1
          TARGET IMS-SSID:          IVP2
          DATA-MOVER:               PGM(ADRDSSU),FASTREP(PREF),FCTOPPRCPRIMARY(PRESMIRNONE)
          ALLOW-PARTIAL:            Y
          AUTO-START-SOURCE-DB:     Y
          AUTO-START-TARGET-DB:     N
          AUTO-STOP-TARGET-DB:      Y
          COPY-IF-NO-IMS-TARGET-DB: Y
            REGISTER-DBRC:          Y
          DATA-MASKING:             N
          DBRC-ACTION:              REDEFINE
          FUZZY-COPY:               N
            LOG-APPLY:              N/A
              MONITOR:              N/A
              SWITCH-OLDS:          N/A
              ARCHIVE-WAIT:         N/A
            VERIFY-NO-UPDATERS      N/A
          GLOBAL:                   N
          INDEXES:                  Y
          LOGICALLY-RELATED:        Y
          NOAUTH-TARGETS:           N
          NOFEOV:                   N
          REPLACE-TARGET-DS:        Y
          SIMULATE:                 N
          STOP-COMMAND:             DBR
          WAIT:                     5,RC(8)


GCL34101I 20:26:02 DB COMPATIBILITY CHECK Started - Program Rev= 9
SOURCE                                              TARGET
DATABASE DATA SET                                   DATABASE DATA SET                                   STATUS
-------- ------------------------------------------ -------- ------------------------------------------ -------
DBDITEMD IMS13X.IMS13.DBDITEM1                      DBDITEMD IMS13Y.IMS13.DBDITEM1                      OK
         IMS13X.IMS13.DBDITEM2                               IMS13Y.IMS13.DBDITEM2
DBDITEMX IMS13X.IMS13.DBDITEMX                      DBDITEMX IMS13Y.IMS13.DBDITEMX                      OK
HNUMBER  IMS13X.IMS13.HNUMBER.NUMBER1.L00001        HNUMBER  IMS13Y.IMS13.HNUMBER.NUMBER1.L00001        OK
         IMS13X.IMS13.HNUMBER.NUMBER1.A00001                 IMS13Y.IMS13.HNUMBER.NUMBER1.A00001
HORDER   IMS13X.IMS13.HORDER.HORDER1.L00001         HORDER   IMS13Y.IMS13.HORDER.HORDER1.L00001         OK
         IMS13X.IMS13.HORDER.HORDER1.A00001                  IMS13Y.IMS13.HORDER.HORDER1.A00001
         IMS13X.IMS13.HORDER.HORDER2.L00002                  IMS13Y.IMS13.HORDER.HORDER2.L00002
         IMS13X.IMS13.HORDER.HORDER2.A00002                  IMS13Y.IMS13.HORDER.HORDER2.A00002
         IMS13X.IMS13.HORDER.HORDER3.L00003                  IMS13Y.IMS13.HORDER.HORDER3.L00003
         IMS13X.IMS13.HORDER.HORDER3.A00003                  IMS13Y.IMS13.HORDER.HORDER3.A00003
T1CUST   IMS13X.IMS13.T1CUST                        T1CUST   IMS13Y.IMS13.T1CUST                        OK
T1CUSTX  IMS13X.IMS13.T1CUSTX                       T1CUSTX  IMS13Y.IMS13.T1CUSTX                       OK
T2CUST   IMS13X.IMS13.T2CUST                        T2CUST   IMS13Y.IMS13.T2CUST                        OK
T2CUSTX  IMS13X.IMS13.T2CUSTX                       T2CUSTX  IMS13Y.IMS13.T2CUSTX                       OK
T3CUST   IMS13X.IMS13.T3CUST                        T3CUST   IMS13Y.IMS13.T3CUST                        OK
T3CUSTX  IMS13X.IMS13.T3CUSTX                       T3CUSTX  IMS13Y.IMS13.T3CUSTX                       OK
T4CUST   IMS13X.IMS13.T4CUST                        T4CUST   IMS13Y.IMS13.T4CUST                        OK
T4CUSTX  IMS13X.IMS13.T4CUSTX                       T4CUSTX  IMS13Y.IMS13.T4CUSTX                       OK
GCL34101I 20:26:02 DB COMPATIBILITY CHECK Completed; Return Code=0


GCL34201I 20:26:02 STOPPING TARGET DBs Started - Program Rev= 14
```

```
GCL34237I 20.26.02 DBDITEMD IS STOPPED
GCL34237I 20.26.02 DBDITEMX IS STOPPED
GCL34237I 20.26.02 HNUMBER  IS STOPPED
GCL34237I 20.26.02 HORDER   IS STOPPED
GCL34237I 20.26.02 T1CUST   IS STOPPED
GCL34237I 20.26.02 T1CUSTX  IS STOPPED
GCL34237I 20.26.02 T2CUST   IS STOPPED
GCL34237I 20.26.02 T2CUSTX  IS STOPPED
GCL34237I 20.26.02 T3CUST   IS STOPPED
GCL34237I 20.26.02 T3CUSTX  IS STOPPED
GCL34237I 20.26.02 T4CUST   IS STOPPED
GCL34237I 20.26.02 T4CUSTX  IS STOPPED
GCL34222I IMS SUBSYSTEM: IVP2 NOT ACTIVE
GCL34238I 20.26.02 WAITING FOR DATABASES TO BE STOPPED
GCL34239I 20.26.02 ALL DATABASES STOPPED

GCL3420lI 20:26:02 STOPPING TARGET DBs Completed; Return Code=0


GCL3420lI 20:26:02 STOPPING SOURCE DBs Started - Program Rev= 14
GCL34237I 20.26.02 DBDITEMD IS STOPPED
GCL34237I 20.26.02 DBDITEMX IS STOPPED
GCL34237I 20.26.02 HNUMBER  IS STOPPED
GCL34237I 20.26.02 HORDER   IS STOPPED
GCL34237I 20.26.02 T1CUST   IS STOPPED
GCL34237I 20.26.02 T1CUSTX  IS STOPPED
GCL34237I 20.26.02 T2CUST   IS STOPPED
GCL34237I 20.26.02 T2CUSTX  IS STOPPED
GCL34237I 20.26.02 T3CUST   IS STOPPED
GCL34237I 20.26.02 T3CUSTX  IS STOPPED
GCL34237I 20.26.02 T4CUST   IS STOPPED
GCL34237I 20.26.02 T4CUSTX  IS STOPPED
GCL34238I 20.26.02 WAITING FOR DATABASES TO BE STOPPED
GCL34239I 20.26.02 ALL DATABASES STOPPED

GCL3420lI 20:26:02 STOPPING SOURCE DBs Completed; Return Code=0


GCL3440lI 20:26:02 DATASET COPY Started - Program Rev= 7
ADR806I (002)-TOMI (03), DATA SET IMS13X.IMS13.DBDITEMX COPIED USING A FAST REPLICATION FUNCTION
ADR806I (002)-TOMI (01), DATA SET IMS13X.IMS13.DBDITEM1 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (002)-TOMI (01), DATA SET IMS13X.IMS13.DBDITEM2 COPIED USING A FAST REPLICATION FUNCTION
ADR454I (002)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.DBDITEMX
                         IMS13X.IMS13.DBDITEM1
                         IMS13X.IMS13.DBDITEM2
ADR806I (003)-TOMI (03), DATA SET IMS13X.IMS13.HNUMBER.NUMBER1.L00001 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (003)-TOMI (03), DATA SET IMS13X.IMS13.HORDER.HORDER1.L00001 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (003)-TOMI (01), DATA SET IMS13X.IMS13.HNUMBER.NUMBER1.A00001 COPIED USING A FAST REPLICATION FUNCTION
ADR454I (003)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.HNUMBER.NUMBER1.L00001
                         IMS13X.IMS13.HORDER.HORDER1.L00001
                         IMS13X.IMS13.HNUMBER.NUMBER1.A00001
ADR806I (004)-TOMI (03), DATA SET IMS13X.IMS13.HORDER.HORDER2.L00002 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (004)-TOMI (01), DATA SET IMS13X.IMS13.HORDER.HORDER1.A00001 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (004)-TOMI (01), DATA SET IMS13X.IMS13.HORDER.HORDER2.A00002 COPIED USING A FAST REPLICATION FUNCTION
ADR454I (004)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.HORDER.HORDER2.L00002
                         IMS13X.IMS13.HORDER.HORDER1.A00001
                         IMS13X.IMS13.HORDER.HORDER2.A00002
ADR806I (005)-TOMI (03), DATA SET IMS13X.IMS13.HORDER.HORDER3.L00003 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (005)-TOMI (01), DATA SET IMS13X.IMS13.HORDER.HORDER3.A00003 COPIED USING A FAST REPLICATION FUNCTION
ADR454I (005)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.HORDER.HORDER3.L00003
                         IMS13X.IMS13.HORDER.HORDER3.A00003
ADR806I (006)-TOMI (03), DATA SET IMS13X.IMS13.T1CUSTX COPIED USING A FAST REPLICATION FUNCTION
```

```
ADR806I (006)-TOMI (01), DATA SET IMS13X.IMS13.T1CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (006)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1CUSTX
                         IMS13X.IMS13.T1CUST
ADR806I (007)-TOMI (03), DATA SET IMS13X.IMS13.T2CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR806I (007)-TOMI (01), DATA SET IMS13X.IMS13.T2CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (007)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T2CUSTX
                         IMS13X.IMS13.T2CUST
ADR806I (008)-TOMI (03), DATA SET IMS13X.IMS13.T3CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR806I (008)-TOMI (01), DATA SET IMS13X.IMS13.T3CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (008)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T3CUSTX
                         IMS13X.IMS13.T3CUST
ADR806I (009)-TOMI (03), DATA SET IMS13X.IMS13.T4CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR806I (009)-TOMI (01), DATA SET IMS13X.IMS13.T4CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (009)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T4CUSTX
                         IMS13X.IMS13.T4CUST
    19 DATA SETS SUCCESSFULLY COPIED
     0 DATA SETS WERE NOT SUCCESSFULLY COPIED
GCL34401I 20:26:06 DATASET COPY Completed; Return Code=0


GCL34301I 20:26:06 STARTING SOURCE DBs Started - Program Rev= 12
GCL34301I 20:26:06 STARTING SOURCE DBs Completed; Return Code=0


GCL34501I 20:26:06 UPDATING TARGET DBs Started - Program Rev= 10
GCL34501I 20:26:07 UPDATING TARGET DBs Completed; Return Code=0

GCL34301I 20:26:07 STARTING TARGET DBs Started - Program Rev= 12
GCL34322I IMS SUBSYSTEM: IVP2 NOT ACTIVE
GCL34301I 20:26:07 STARTING TARGET DBs Completed; Return Code=0

GCL34001I 20:26:07 IMSDBREFRESH Completed; Return Code=0


GCL30001I 20.26.07 IMS TERM STARTED - PROGRAM REV=6
GCL30001I 20.26.07 IMS TERM COMPLETED; RETURN CODE=0

GCL01009I IMS CLONING TOOL EXECUTION COMPLETE. HIGHEST RETURN CODE WAS 0
```

Upon completion of the job, all of the databases were copied to the new IMS region, the databases were all registered to IMS Database Recovery Control (DBRC), the IVP2 dynamic allocation library was populated, and the ACBLIB DMB members were copied from the IVP1 ACBLIB to the IVP2 ACBLIB.

5.3 Creating copies of production databases with IMS Cloning Tool

Often, a DBA is asked to create copies of production databases to allow offline testing of programs or for debugging purposes. The IMS Cloning Tool can assist in this. The steps to follow are:

1. Create “private” RECON data sets. This is required if you are cloning HALDB databases.
2. Define a “private” dynamic allocation library. Only the library is required. The IMS Cloning Tool will populate this library if requested.
3. Create and execute the IMS Cloning Tool job.

5.3.1 JCL to create a production copy

The first step to create a clone is to create the IMS Cloning Tool JCL.

Example 5-4 shows the JCL needed to run the cloning tool.

Example 5-4 JCL for creating production copies

```
//S1      EXEC PGM=GCLOOO1O,REGION=OM
//STEPLIB  DD  DISP=SHR,DSN=GCL.SGCLLOAD
//         DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//SYSUDUMP DD  SYSOUT=*
//ABNLIGNR DD  DUMMY
//GCLPRINT DD  SYSOUT=*
//GCLINI   DD  DISP=SHR,DSN=GCL.SGCLPARM(GCLINI)
//IVP1ACB  DD  DISP=SHR,DSN=IMS13X.ACBLIB
//IVP1MDA  DD  DISP=SHR,DSN=IMS13X.SDFSRESL
//IVP1REC1 DD  DISP=SHR,DSN=IMS13X.RECON1
//IVP1REC2 DD  DISP=SHR,DSN=IMS13X.RECON2
//IVP1REC3 DD  DISP=SHR,DSN=IMS13X.RECON3
//IRESACB  DD  DISP=SHR,DSN=IMS13X.ACBLIB
//IRESMDA  DD  DISP=SHR,DSN=IMSRES9.GCL.MDALIB
//IRESREC1 DD  DISP=SHR,DSN=IMSRES9.GCL.RECON1
//IRESREC2 DD  DISP=SHR,DSN=IMSRES9.GCL.RECON2
//IRESREC3 DD  DISP=SHR,DSN=IMSRES9.GCL.RECON3
//IMS      DD  DISP=SHR,DSN=IMS13X.DBDLIB
//SYSLIB   DD  DISP=SHR,DSN=IMS13X.SDFSMAC
//GCLIN    DD  *
```

This JCL is similar to the JCL found in Example 5-1 on page 94. In this example, the source system in IVP1, and it is denoted in the IVP1* DD statements. When creating a cloned copy of a database, you select a 1 - 4 byte character string that does not conflict with any existing IMS subsystem ID. For this example IRES is used. The IRES* DD statements should point to the dynamic allocation library and RECON data sets you previously created. The source and target ACBLIBs should be the same.

5.3.2 Cloning a single HIDAM database

To clone a single database, you must create the control cards.

Example 5-5 shows the control cards required to clone a HIDAM database using the **IMSDBREFRESH** command.

Example 5-5 Control cards for cloning a HIDAM database

```
IMSDBREFRESH                          -
     IMS-SSID(IVP1,IRES)                 -
     DBD(                                -
       T1CUST                            -
     )                                   -
     COPY-IF-NO-IMS-TARGET-DB(Y)         -
     RENAME-MASKS(                       -
       IMS13X.IMS13.** IMSRES9.IMS13.**  -
     )                                   -
     REGISTER-DBRC(N)                    -
     INDEXES(Y)                          -
```

```
    STOP-COMMAND(DBR)                    -
    WAIT(5,RC(8))
```

The parameters used are similar to the control cards shown in Example 5-2 on page 95. The differences are noted here:

- IMS-SSID - IVP1 is the source system; IRES is the target system.
- DBD - The database T1CUST is a HIDAM database whose primary index is named T1CUSTX.
- REGISTER-DBRC(N) - The cloned database will not be registered to the previously created RECON data sets. REGISTER-DBRC(Y) is required for HALDB.
- INDEXES(Y) - Indicates that any related indexes will also be cloned. In this case, the HIDAM primary index T1CUST will be cloned.

The output of the job is shown in Example 5-6.

Example 5-6 Output for cloning a single HIDAM database

```
1IMS CLONING TOOL                                                          11 AUG 2014 19.29.50
  GCLINI INFORMATION                  MODULE INFORMATION                   OPERATING SYSTEM
      REL: V1R2M0                         REL: V1R2M0                         z/OS 2.1
     DATE: 22 FEB 2013

 GCL01020I PROGRAM: GCL01CI0 20121210 09.01 VERS=1.0 REV=38

    IMSDBREFRESH                          -
      IMS-SSID(IVP1,IRES)                 -
      DBD(                                -
        T1CUST                            -
      )                                   -
      COPY-IF-NO-IMS-TARGET-DB(Y)         -
      RENAME-MASKS(                       -
        IMS13X.IMS13.** IMSRES9.IMS13.**  -
      )                                   -
      REGISTER-DBRC(N)                    -
      INDEXES(Y)                          -
      STOP-COMMAND(DBR)                   -
      WAIT(5,RC(8))

 GCL30001I 19.29.50 IMS INIT STARTED - PROGRAM REV=6
 GCL30001I 19.29.51 IMS INIT COMPLETED; RETURN CODE=0


 GCL34001I 19:29:51 IMSDBREFRESH Started - Program Rev= 22

 GCL34085I DSNS FOR KEYWORD: RENAME-MASKS                                                    PROCESSING
SEQUENCE
           IMS13X.IMS13.**                          IMSRES9.IMS13.**                                  1



 GCL34901I 19:29:51 CHECKING TARGET DATABASE DEFINITION Started - Program Rev= 2
 GCL34963W 19:29:51 Register DBRC(N) specified, new target databases will not be registered to DBRC
 GCL34962W 19:29:51 Target IMSPLEX not specified, not able to dynamically add target DB definitions
 GCL34924I SCI IMSPLEX:       NOT ACTIVE
 GCL34963W 19:29:51 Unable to QUERY or CREATE databases on target
 GCL34904I 19:29:51 Checking database T1CUST
 GCL34905I 19:29:51 Creating MDA MEMBER for T1CUST
 GCL34904I 19:29:51 Checking database T1CUSTX
 GCL34905I 19:29:51 Creating MDA MEMBER for T1CUSTX
 GCL34901I 19:29:51 CHECKING TARGET DATABASE DEFINITION Completed; Return Code=0

  1 name(s) entered for keyword: DBD
```

```
                                  T1CUST

GCL34048I OPTIONS IN EFFECT FOR THIS EXECUTION:
          SOURCE IMS-SSID:          IVP1
          TARGET IMS-SSID:          IRES
          DATA-MOVER:               PGM(ADRDSSU),FASTREP(PREF),FCTOPPRCPRIMARY(PRESMIRNONE)
          ALLOW-PARTIAL:            N
          AUTO-START-SOURCE-DB:     Y
          AUTO-START-TARGET-DB:     Y
          AUTO-STOP-TARGET-DB:      Y
          COPY-IF-NO-IMS-TARGET-DB: Y
            REGISTER-DBRC:          N
          DATA-MASKING:             N
          DBRC-ACTION:              REDEFINE
          FUZZY-COPY:               N
            LOG-APPLY:              N/A
              MONITOR:              N/A
              SWITCH-OLDS:          N/A
              ARCHIVE-WAIT:         N/A
            VERIFY-NO-UPDATERS      N/A
          GLOBAL:                   N
          INDEXES:                  Y
          LOGICALLY-RELATED:        Y
          NOAUTH-TARGETS:           N
          NOFEOV:                   N
          REPLACE-TARGET-DS:        Y
          SIMULATE:                 N
          STOP-COMMAND:             DBR
          WAIT:                     5,RC(8)


GCL34101I 19:29:51 DB COMPATIBILITY CHECK Started - Program Rev= 9
SOURCE                                              TARGET
DATABASE DATA SET                                   DATABASE DATA SET                                   STATUS
-------- ------------------------------------------ -------- ------------------------------------------ -------
T1CUST   IMS13X.IMS13.T1CUST                        T1CUST   IMSRES9.IMS13.T1CUST                       OK
T1CUSTX  IMS13X.IMS13.T1CUSTX                       T1CUSTX  IMSRES9.IMS13.T1CUSTX                      OK
GCL34101I 19:29:51 DB COMPATIBILITY CHECK Completed; Return Code=0


GCL34201I 19:29:51 STOPPING TARGET DBs Started - Program Rev= 14
GCL34237I 19.29.51 T1CUST   IS STOPPED
GCL34237I 19.29.51 T1CUSTX  IS STOPPED
GCL34222I IMS SUBSYSTEM: IRES NOT ACTIVE
GCL34238I 19.29.51 WAITING FOR DATABASES TO BE STOPPED
GCL34239I 19.29.51 ALL DATABASES STOPPED

GCL34201I 19:29:51 STOPPING TARGET DBs Completed; Return Code=0


GCL34201I 19:29:51 STOPPING SOURCE DBs Started - Program Rev= 14
GCL34237I 19.29.51 T1CUST   IS STOPPED
GCL34237I 19.29.51 T1CUSTX  IS STOPPED
GCL34238I 19.29.51 WAITING FOR DATABASES TO BE STOPPED
GCL34239I 19.29.51 ALL DATABASES STOPPED

GCL34201I 19:29:51 STOPPING SOURCE DBs Completed; Return Code=0


GCL34401I 19:29:51 DATASET COPY Started - Program Rev= 7
ADR806I (002)-TOMI (01), DATA SET IMS13X.IMS13.T1CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (002)-DDDS (02), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1CUST
ADR806I (003)-TOMI (03), DATA SET IMS13X.IMS13.T1CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR454I (003)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1CUSTX
```

```
     2 DATA SETS SUCCESSFULLY COPIED
     0 DATA SETS WERE NOT SUCCESSFULLY COPIED
GCL34401I 19:29:52 DATASET COPY Completed; Return Code=0


GCL34301I 19:29:52 STARTING SOURCE DBs Started - Program Rev= 12
GCL34301I 19:29:52 STARTING SOURCE DBs Completed; Return Code=0


GCL34501I 19:29:52 UPDATING TARGET DBs Started - Program Rev= 10
GCL34501I 19:29:52 UPDATING TARGET DBs Completed; Return Code=0

GCL34301I 19:29:52 STARTING TARGET DBs Started - Program Rev= 12
GCL34322I IMS SUBSYSTEM: IRES NOT ACTIVE
GCL34301I 19:29:52 STARTING TARGET DBs Completed; Return Code=0

GCL34001I 19:29:52 IMSDBREFRESH Completed; Return Code=0


GCL30001I 19.29.52 IMS TERM STARTED - PROGRAM REV=6
GCL30001I 19.29.52 IMS TERM COMPLETED; RETURN CODE=0

GCL01009I IMS CLONING TOOL EXECUTION COMPLETE. HIGHEST RETURN CODE WAS 0
```

5.3.3 Cloning multiple databases in a single step

The IMS Cloning Tool can clone multiple databases in a single job step. Using the same JCL shown in Example 5-4 on page 101, you can specify the DBDs to clone using wildcard characters.

Example 5-7 shows the control cards for cloning similarly named databases.

Example 5-7 Control cards to clone multiple databases

```
IMSDBREFRESH                              -
     IMS-SSID(IVP1,IRES)                     -
     DBD(                                    -
       T*CUST                                -
     )                                       -
     COPY-IF-NO-IMS-TARGET-DB(Y)             -
     RENAME-MASKS(                           -
       IMS13X.IMS13.** IMSRES9.IMS13.**      -
     )                                       -
     REGISTER-DBRC(Y)                        -
     INDEXES(Y)                              -
     STOP-COMMAND(DBR)                       -
     WAIT(5,RC(8))
```

In Example 5-7, the DBD parameter uses T*CUST. The Cloning Tool will select all of the members in the source ACB library that match. This example selects T1CUST, T2CUST, T3CUST, T4CUST, and T1HCUST. T1HCUST is a PHIDAM database, so REGISTER-DBRC(Y) must be used. INDEXES(Y) is used, so all related indexes are also selected.

The output of the job can be seen in Example 5-8.

Example 5-8 Output of job to clone multiple databases

```
1IMS CLONING TOOL                                                11 AUG 2014 20.33.04
```

```
 GCLINI INFORMATION                    MODULE INFORMATION                       OPERATING SYSTEM
     REL: V1R2M0                           REL: V1R2M0                             z/OS 2.1
    DATE: 22 FEB 2013

GCL0102I PROGRAM: GCL01CIO 20121210 09.01 VERS=1.0 REV=38

   IMSDBREFRESH                          -
     IMS-SSID(IVP1,IRES)                 -
     DBD(                                -
       T*CUST                            -
     )                                   -
     COPY-IF-NO-IMS-TARGET-DB(Y)         -
     RENAME-MASKS(                       -
       IMS13X.IMS13.** IMSRES9.IMS13.**  -
     )                                   -
     REGISTER-DBRC(Y)                    -
     INDEXES(Y)                          -
     STOP-COMMAND(DBR)                   -
     WAIT(5,RC(8))

GCL3O001I 2O.33.O4 IMS INIT STARTED - PROGRAM REV=6
GCL3O001I 2O.33.O4 IMS INIT COMPLETED; RETURN CODE=O


GCL34O01I 2O:33:O4 IMSDBREFRESH Started - Program Rev= 22
GCL34O85I DSNS FOR KEYWORD: RENAME-MASKS                                                    PROCESSING
SEQUENCE
          IMS13X.IMS13.**                          IMSRES9.IMS13.**                                 1

GCL34O49I 2O:33:O4 Expanding DB mask: T*CUST
                                      T1CUST   ADDED
                                      T1HCUST  ADDED
                                      T2CUST   ADDED
                                      T3CUST   ADDED
                                      T4CUST   ADDED


GCL349O1I 2O:33:O4 CHECKING TARGET DATABASE DEFINITION Started - Program Rev= 2
GCL34962W 2O:33:O4 Target IMSPLEX not specified, not able to dynamically add target DB definitions
GCL34924I SCI IMSPLEX:       NOT ACTIVE
GCL34963W 2O:33:O4 Unable to QUERY or CREATE databases on target
GCL3494I 2O:33:O4 Checking database T1CUST
GCL3495I 2O:33:O4 Creating DBRC DEFINITION for T1CUST
GCL3494I 2O:33:O5 Checking database T1HCUST
GCL3495I 2O:33:O5 Creating DBRC DEFINITION for T1HCUST
GCL3494I 2O:33:O5 Checking database T2CUST
GCL3495I 2O:33:O5 Creating DBRC DEFINITION for T2CUST
GCL3494I 2O:33:O5 Checking database T3CUST
GCL3495I 2O:33:O5 Creating DBRC DEFINITION for T3CUST
GCL3494I 2O:33:O5 Checking database T4CUST
GCL3495I 2O:33:O5 Creating DBRC DEFINITION for T4CUST
GCL3494I 2O:33:O5 Checking database T1CUSTX
GCL3495I 2O:33:O5 Creating DBRC DEFINITION for T1CUSTX
GCL3494I 2O:33:O5 Checking database T1HNAMY
GCL3495I 2O:33:O5 Creating DBRC DEFINITION for T1HNAMY
GCL3494I 2O:33:O6 Checking database T2CUSTX
GCL3495I 2O:33:O6 Creating DBRC DEFINITION for T2CUSTX
GCL3494I 2O:33:O6 Checking database T3CUSTX
GCL3495I 2O:33:O6 Creating DBRC DEFINITION for T3CUSTX
GCL3494I 2O:33:O6 Checking database T4CUSTX
GCL3495I 2O:33:O6 Creating DBRC DEFINITION for T4CUSTX
GCL3491I 2O:33:O6 CHECKING TARGET DATABASE DEFINITION Completed; Return Code=O

 5 name(s) entered for keyword: DBD
                                  T1CUST
                                  T1HCUST
```

```
                                T2CUST
                                T3CUST
                                T4CUST

GCL34048I OPTIONS IN EFFECT FOR THIS EXECUTION:
          SOURCE IMS-SSID:          IVP1
          TARGET IMS-SSID:          IRES
          DATA-MOVER:               PGM(ADRDSSU),FASTREP(PREF),FCTOPPRCPRIMARY(PRESMIRNONE)
          ALLOW-PARTIAL:            N
          AUTO-START-SOURCE-DB:     Y
          AUTO-START-TARGET-DB:     Y
          AUTO-STOP-TARGET-DB:      Y
          COPY-IF-NO-IMS-TARGET-DB: Y
            REGISTER-DBRC:          Y
          DATA-MASKING:             N
          DBRC-ACTION:              REDEFINE
          FUZZY-COPY:               N
            LOG-APPLY:              N/A
              MONITOR:              N/A
              SWITCH-OLDS:          N/A
              ARCHIVE-WAIT:         N/A
            VERIFY-NO-UPDATERS      N/A
          GLOBAL:                   N
          INDEXES:                  Y
          LOGICALLY-RELATED:        Y
          NOAUTH-TARGETS:           N
          NOFEOV:                   N
          REPLACE-TARGET-DS:        Y
          SIMULATE:                 N
          STOP-COMMAND:             DBR
          WAIT:                     5,RC(8)


GCL34101I 20:33:06 DB COMPATIBILITY CHECK Started - Program Rev= 9
SOURCE                                                TARGET
DATABASE DATA SET                                     DATABASE DATA SET                                     STATUS
-------- -------------------------------------------- -------- ---------------------------------------------- -------
T1CUST   IMS13X.IMS13.T1CUST                          T1CUST   IMSRES9.IMS13.T1CUST                          OK
T1HCUST  IMS13X.IMS13.T1HCUST.T1HCSTA.L00001          T1HCUST  IMSRES9.IMS13.T1HCUST.T1HCSTA.L00001          OK
         IMS13X.IMS13.T1HCUST.T1HCSTA.X00001                   IMSRES9.IMS13.T1HCUST.T1HCSTA.X00001
         IMS13X.IMS13.T1HCUST.T1HCSTA.A00001                   IMSRES9.IMS13.T1HCUST.T1HCSTA.A00001
         IMS13X.IMS13.T1HCUST.T1HCSTB.L00002                   IMSRES9.IMS13.T1HCUST.T1HCSTB.L00002
         IMS13X.IMS13.T1HCUST.T1HCSTB.X00002                   IMSRES9.IMS13.T1HCUST.T1HCSTB.X00002
         IMS13X.IMS13.T1HCUST.T1HCSTB.A00002                   IMSRES9.IMS13.T1HCUST.T1HCSTB.A00002
         IMS13X.IMS13.T1HCUST.T1HCSTC.L00003                   IMSRES9.IMS13.T1HCUST.T1HCSTC.L00003
         IMS13X.IMS13.T1HCUST.T1HCSTC.X00003                   IMSRES9.IMS13.T1HCUST.T1HCSTC.X00003
         IMS13X.IMS13.T1HCUST.T1HCSTC.A00003                   IMSRES9.IMS13.T1HCUST.T1HCSTC.A00003
T2CUST   IMS13X.IMS13.T2CUST                          T2CUST   IMSRES9.IMS13.T2CUST                          OK
T3CUST   IMS13X.IMS13.T3CUST                          T3CUST   IMSRES9.IMS13.T3CUST                          OK
T4CUST   IMS13X.IMS13.T4CUST                          T4CUST   IMSRES9.IMS13.T4CUST                          OK
T1CUSTX  IMS13X.IMS13.T1CUSTX                         T1CUSTX  IMSRES9.IMS13.T1CUSTX                         OK
T1HNAMY  IMS13X.IMS13.T1HNAMY.T1HNAMD.A00001          T1HNAMY  IMSRES9.IMS13.T1HNAMY.T1HNAMD.A00001          OK
         IMS13X.IMS13.T1HNAMY.T1HNAME.A00002                   IMSRES9.IMS13.T1HNAMY.T1HNAME.A00002
T2CUSTX  IMS13X.IMS13.T2CUSTX                         T2CUSTX  IMSRES9.IMS13.T2CUSTX                         OK
T3CUSTX  IMS13X.IMS13.T3CUSTX                         T3CUSTX  IMSRES9.IMS13.T3CUSTX                         OK
T4CUSTX  IMS13X.IMS13.T4CUSTX                         T4CUSTX  IMSRES9.IMS13.T4CUSTX                         OK
GCL34101I 20:33:06 DB COMPATIBILITY CHECK Completed; Return Code=0


GCL34201I 20:33:06 STOPPING TARGET DBs Started - Program Rev= 14
GCL34237I 20.33.06 T1CUST   IS STOPPED
GCL34237I 20.33.06 T1HCUST  IS STOPPED
GCL34237I 20.33.06 T2CUST   IS STOPPED
GCL34237I 20.33.06 T3CUST   IS STOPPED
GCL34237I 20.33.06 T4CUST   IS STOPPED
GCL34237I 20.33.06 T1CUSTX  IS STOPPED
```

```
GCL34237I 20.33.06 T1HNAMY  IS STOPPED
GCL34237I 20.33.06 T2CUSTX  IS STOPPED
GCL34237I 20.33.06 T3CUSTX  IS STOPPED
GCL34237I 20.33.06 T4CUSTX  IS STOPPED
GCL34222I IMS SUBSYSTEM: IRES NOT ACTIVE
GCL34238I 20.33.06 WAITING FOR DATABASES TO BE STOPPED
GCL34239I 20.33.06 ALL DATABASES STOPPED

GCL34201I 20:33:06 STOPPING TARGET DBs Completed; Return Code=0


GCL34201I 20:33:06 STOPPING SOURCE DBs Started - Program Rev= 14
GCL34237I 20.33.06 T1CUST   IS STOPPED
GCL34237I 20.33.06 T1HCUST  IS STOPPED
GCL34237I 20.33.06 T2CUST   IS STOPPED
GCL34237I 20.33.06 T3CUST   IS STOPPED
GCL34237I 20.33.06 T4CUST   IS STOPPED
GCL34237I 20.33.06 T1CUSTX  IS STOPPED
GCL34237I 20.33.06 T1HNAMY  IS STOPPED
GCL34237I 20.33.06 T2CUSTX  IS STOPPED
GCL34237I 20.33.06 T3CUSTX  IS STOPPED
GCL34237I 20.33.06 T4CUSTX  IS STOPPED
GCL34238I 20.33.06 WAITING FOR DATABASES TO BE STOPPED
GCL34239I 20.33.06 ALL DATABASES STOPPED

GCL34201I 20:33:06 STOPPING SOURCE DBs Completed; Return Code=0


GCL34401I 20:33:06 DATASET COPY Started - Program Rev= 7
GCLDSS02W 20:33:10 DFSMSdss COPY Completed; Return Code=4
ADR806I (002)-TOMI (03), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTA.L00001 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (002)-TOMI (03), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTA.X00001 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (002)-TOMI (01), DATA SET IMS13X.IMS13.T1CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (002)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1HCUST.T1HCSTA.L00001
                         IMS13X.IMS13.T1HCUST.T1HCSTA.X00001
                         IMS13X.IMS13.T1CUST
ADR806I (003)-TOMI (03), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTB.L00002 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (003)-TOMI (03), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTB.X00002 COPIED USING A FAST REPLICATION FUNCTION
ADR383W (003)-DDDS (01), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTA.A00001 NOT SELECTED
ADR455W (003)-DDDS (03), THE FOLLOWING DATA SETS WERE NOT SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1HCUST.T1HCSTA.A00001
ADR454I (003)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1HCUST.T1HCSTB.L00002
                         IMS13X.IMS13.T1HCUST.T1HCSTB.X00002
ADR806I (004)-TOMI (03), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTC.L00003 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (004)-TOMI (03), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTC.X00003 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (004)-TOMI (01), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTB.A00002 COPIED USING A FAST REPLICATION FUNCTION
ADR454I (004)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1HCUST.T1HCSTC.L00003
                         IMS13X.IMS13.T1HCUST.T1HCSTC.X00003
                         IMS13X.IMS13.T1HCUST.T1HCSTB.A00002
ADR806I (005)-TOMI (01), DATA SET IMS13X.IMS13.T2CUST COPIED USING A FAST REPLICATION FUNCTION
ADR383W (005)-DDDS (01), DATA SET IMS13X.IMS13.T1HCUST.T1HCSTC.A00003 NOT SELECTED
ADR455W (005)-DDDS (03), THE FOLLOWING DATA SETS WERE NOT SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T1HCUST.T1HCSTC.A00003
ADR454I (005)-DDDS (02), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T2CUST
ADR806I (006)-TOMI (01), DATA SET IMS13X.IMS13.T4CUST COPIED USING A FAST REPLICATION FUNCTION
ADR806I (006)-TOMI (01), DATA SET IMS13X.IMS13.T3CUST COPIED USING A FAST REPLICATION FUNCTION
ADR454I (006)-DDDS (02), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                         IMS13X.IMS13.T4CUST
                         IMS13X.IMS13.T3CUST
ADR806I (007)-TOMI (03), DATA SET IMS13X.IMS13.T1CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR806I (007)-TOMI (03), DATA SET IMS13X.IMS13.T1HNAMY.T1HNAMD.A00001 COPIED USING A FAST REPLICATION FUNCTION
ADR454I (007)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
```

```
                        IMS13X.IMS13.T1CUSTX
                        IMS13X.IMS13.T1HNAMY.T1HNAMD.A00001
ADR806I (008)-TOMI (03), DATA SET IMS13X.IMS13.T1HNAMY.T1HNAME.A00002 COPIED USING A FAST REPLICATION FUNCTION
ADR806I (008)-TOMI (03), DATA SET IMS13X.IMS13.T2CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR454I (008)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                        IMS13X.IMS13.T1HNAMY.T1HNAME.A00002
                        IMS13X.IMS13.T2CUSTX
ADR806I (009)-TOMI (03), DATA SET IMS13X.IMS13.T3CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR806I (009)-TOMI (03), DATA SET IMS13X.IMS13.T4CUSTX COPIED USING A FAST REPLICATION FUNCTION
ADR454I (009)-DDDS (01), THE FOLLOWING DATA SETS WERE SUCCESSFULLY PROCESSED
                        IMS13X.IMS13.T3CUSTX
                        IMS13X.IMS13.T4CUSTX
    17 DATA SETS SUCCESSFULLY COPIED
     0 DATA SETS WERE NOT SUCCESSFULLY COPIED
GCL34401I 20:33:10 DATASET COPY Completed; Return Code=0


GCL34301I 20:33:10 STARTING SOURCE DBs Started - Program Rev= 12
GCL34301I 20:33:10 STARTING SOURCE DBs Completed; Return Code=0


GCL34501I 20:33:10 UPDATING TARGET DBs Started - Program Rev= 10
GCL34501I 20:33:11 UPDATING TARGET DBs Completed; Return Code=0

GCL34301I 20:33:11 STARTING TARGET DBs Started - Program Rev= 12
GCL34322I IMS SUBSYSTEM: IRES NOT ACTIVE
GCL34301I 20:33:11 STARTING TARGET DBs Completed; Return Code=0

GCL34001I 20:33:11 IMSDBREFRESH Completed; Return Code=0


GCL30001I 20.33.11 IMS TERM STARTED - PROGRAM REV=6
GCL30001I 20.33.11 IMS TERM COMPLETED; RETURN CODE=0

GCL01009I IMS CLONING TOOL EXECUTION COMPLETE. HIGHEST RETURN CODE WAS 0
```

5.4 Using the IMS Database Recovery Facility to clone databases

In addition to the IMS Cloning Tool, the IMS Database Recovery Facility (DRF) can be used to create duplicate copies of databases. This technique uses image copy data sets that are recorded in the RECON data sets. This may be desirable if the production data sets must be kept available, and no DBR, DBD, or QUIESCE is possible.

5.4.1 JCL to clone multiple databases using the Database Recovery Facility

DRF allows you to clone multiple databases easily with its support of DBRC DBDS groups, CA groups, and Recovery groups. In Example 5-9, the DBDS group CUSTGRP is selected for processing. This group contains the HIDAM databases T1CUST, T2CUST, T3CUST, and T4CUST.

Example 5-9 DRF JCL to clone group DBDS

```
//*************************************************************
//*  BRINGS UP A DATABASE RECOVERY FACILITY MASTER REGION      *
//*************************************************************
//STEP1    EXEC PGM=FRXSDR00,
//     PARM=('DRF','BPECFG=FRXBPECF','DRFMBR=JK','GSGNAME=',
```

```
//           'IMSPLEX=','DRFPROC=FRXRSS00',),REGION=0M,TIME=10
//STEPLIB  DD DSN=FRX.SFRXLOAD,DISP=SHR
//         DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMSDALIB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//PROCLIB  DD DSN=IMS13X.PROCLIB,DISP=SHR
//DBDLIB   DD DSN=IMS13X.DBDLIB,DISP=SHR
//PSBLIB   DD DSN=IMS13X.PSBLIB,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//REPORT   DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//*************************M=0*************************************
//* DRF DD'S FOR IAUS:                                            *
//*    FRXWTO - ONLY REQUIRED WHEN RPTTYPE=SEP                    *
//*****************************************************************
//FRXWTO   DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//DFSRESLB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMS      DD DSN=IMS13X.DBDLIB,DISP=SHR
//*****************************************************************
//* HPIC DD'S FOR IAUS WHEN RPTTYPE=APP                           *
//*****************************************************************
//ICEPRINT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//ICERPRT  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//DFSPRINT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//*****************************************************************
//* HPPC DD'S FOR IAUS WHEN RPTTYPE=APP                           *
//*****************************************************************
//PRIMAPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//EVALUPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//SUMMARY  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//STATIPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//VALIDPRT DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//SNAPPIT  DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0
//*****************************************************************
//* DEDB PC DD'S FOR IAUS WHEN RPTTYPE=APP (NONE)                 *
//*****************************************************************
//FABARPRT  DD SYSOUT=*
//FABAMSG   DD SYSOUT=*
//FABASNAP  DD SYSOUT=*
//*****************************************************************
//* IB DD'S FOR IAUS WHEN RPTTYPE=APP (NONE)                      *
//*****************************************************************
//IIUSNAP   DD SYSOUT=*
//IIUSOUT   DD SYSOUT=*
//IIUSTAT   DD SYSOUT=*
//IIUPRINT  DD SYSOUT=*
//*****************************************************************
//* DFSPRECO DD'S FOR IAUS WHEN RPTTYPE=APP (NONE)                *
//*****************************************************************
//PRPRINT   DD SYSOUT=*
//SYSIN DD *
  OUTPUT(DUP)
  DBDSN001('IMSRES9')
  DBDSL001(DISP(NEW))
  ADD DBDSGRP(CUSTGRP) DBATRB(DBDSL(001) DBDSN(001))
```

```
START RCVTYPE(LASTIC)
```

The previous example will duplicate the databases included in the DBDS group CUSTGRP, creating new database data sets using the high-level qualifier of IMSRES9. The recoveries will use the latest image copy data sets available for each database. This is specified in the RCFTYPE(LASTIC) parameter.

The HIDAM primary indexes are not included in the DBDS group since they are registered to DBRC as unrecoverable. This will require a post processing job to rebuild all of the indexes created in this execution. The Index Builder job is not included in this example.

While DRF does support the execution of other utilities such as Index Builder, High Performance Image Copy and High Performance Pointer Checker. It restricts the use of these utilities when the OUTPUT(DUP) statement is used.

5.4.2 Output from DRF cloning job

Example 5-10 has the output of the DRF cloning job.

Example 5-10 DRF output cloning a DBDS group

```
1FRD0000I IMS RECOVERY SOLUTION PACK V1R1 : IMS DATABASE RECOVERY FACILITY          Date: 08/25/2014 Time: 19:33    Page: 1


 D A T A B A S E   R E C O V E R Y   F A C I L I T Y   C O M M A N D S / C O N T R O L   S T A T E M E N T S

 FRD7201I   OUTPUT(DUP)
 FRD7201I   DBDSN001('IMSRES9')
 FRD7201I   DBDSL001(DISP(NEW))
 FRD7201I   ADD DBDSGRP(CUSTGRP) DBATRB(DBDSL(001) DBDSN(001))
 FRD7201I   START RCVTYPE(LASTIC)


 D A T A B A S E   R E C O V E R Y   F A C I L I T Y   R E C O V E R Y   P A R A M E T E R S

 PROCESS : RCVCOPY            RECOVERY OPTIONS
 SOURCE  : PRI                  RCVTYPE : Recover to Last IC
 READNUM : 03,10                TYPE    : TSR                LOGNUM  : 03,10              ICNUM   : 03,10
 ERROR   : STOP                 CHECK   : No                 OUTPUT  : Dup                TAPECHK : No
 RCVTOKEN: DRFCLONE             TIME FMT: LCL                CATDS   : Default
 DRFPROC : FRXRSS00             LBI     : No                 SPSIZE  :    1024            CACHE   : No

 ----------  Sort-Related Parameters  ----------

 NUM     :       99             MAINSIZE:      32            AVGRLEN :    16383
 FILSZ   :      N/A             HIPRMAX : OPTIMAL            ASPREF  :     AS             ASGNAME :      N/A
 DYNALLOC:      N/A , N/A


 D A T A B A S E   R E C O V E R Y   F A C I L I T Y   S U M M A R Y   R E P O R T

 Database   DD/Area    DSID        --------- Records Read ---------     Records Subord.   STC  Final
 Name       Name                         IC          CA         LOG     Written Reg Name   #   Status

 T1CUST     T1CUST      1            20520           0           0           0 AS111601       No errors encountered
 T2CUST     T2CUST      1            94320           0           0           0 AS111602       No errors encountered
 T3CUST     T3CUST      1            54240           0           0           0 AS111603       No errors encountered
 T4CUST     T4CUST      1                3           0           0           0 AS111604       No errors encountered


 D A T A B A S E   R E C O V E R Y   F A C I L I T Y   R C V C O P Y   R E P O R T

 Database   DD/Area     New Data Set Name                                                Records     Volume
 Name       Name        --------.--------.--------.--------.--------     Copied     Serial

 T1CUST     T1CUST      IMSRES9.IMS13.T1CUST                              20520    TST077
 T2CUST     T2CUST      IMSRES9.IMS13.T2CUST                              94320    TST073
 T3CUST     T3CUST      IMSRES9.IMS13.T3CUST                              54240    TST07D
 T4CUST     T4CUST      IMSRES9.IMS13.T4CUST                                  3    TST073
1FRD0000I IMS RECOVERY SOLUTION PACK V1R1 : IMS DATABASE RECOVERY FACILITY          Date: 08/25/2014 Time: 19:33    Page: 2
```

```
 D A T A B A S E   R E C O V E R Y   F A C I L I T Y   U T I L I T Y   R E P O R T

 Database   DDN        Database Data Set Name                        IC   PC/DP IB   PR   Utility Final Status
-------------------------------------------------------------------------------------------------------------------
 T1CUST     T1CUST     IMS13X.IMS13.T1CUST                           N/A  N/A   N/A  N/A
 T2CUST     T2CUST     IMS13X.IMS13.T2CUST                           N/A  N/A   N/A  N/A
 T3CUST     T3CUST     IMS13X.IMS13.T3CUST                           N/A  N/A   N/A  N/A
 T4CUST     T4CUST     IMS13X.IMS13.T4CUST                           N/A  N/A   N/A  N/A

 Final Return (RC) and Reason (RSN) Codes

 ---IC---    ---PC---    ---DP---    ---IB---    ---PR---    ---LIU--
 RC   RSN    RC   RSN    RC   RSN    RC   RSN    RC   RSN    RC   RSN

 N/A  N/A    N/A  N/A    N/A  N/A    N/A  N/A    N/A  N/A    N/A  N/A
1FRD0000I IMS RECOVERY SOLUTION PACK V1R1 : IMS DATABASE RECOVERY FACILITY           Date: 08/25/2014 Time: 19:33    Page: 3


 D A T A B A S E   R E C O V E R Y   F A C I L I T Y   D A T A   S E T   I / O   R E P O R T

 Recover to point: Not Specified

 Image Copy Data Set Name                      Volume     IC DS      IC        ---------------- Time Stamp Range ------------------
 ---------.---------.---------.---------.-----  Serial   Read Count  Type             1st Record                 Last Record

 IMSRES9.IC.T4CUST.T4CUST.D2362240             TSTO76           3   IC EXT.
 IMSRES9.IC.T1CUST.T1CUST.D2362240             TSTO78       20520   IC EXT.
 IMSRES9.IC.T3CUST.T3CUST.D2362240             TSTO7B       54240   IC EXT.
 IMSRES9.IC.T2CUST.T2CUST.D2362240             TSTO74       94320   IC EXT.

 UDATA From User Image Copy                                                 UIC   ----- UIC Run Time -----
 ---------------------------------------------------------------------------  Type

 No data available for this type data set

 Change Accum Data Set Name                    Volume     CA DS              ---------------- Time Stamp Range ------------------
 ---------.---------.---------.---------.-----  Serial   Read Count               1st Record                 Last Record

 No data available for this type data set

 Log Data Set Name                             Volume     Log DS     IMS     ---------------- Time Stamp Range ------------------
 ---------.---------.---------.---------.-----  Serial   Read Count  SYSID          1st Record                 Last Record

 No data available for this type data set
```

Because this was a recovery to the last image copy, no change accumulation or log data is included. After this job completed, the Index Builder job to rebuild the four HIDAM primary indexes was run.

5.5 Disaster recovery

The restore of an entire IMS system at a remote site when a disaster causes a system to be unusable can be viewed as an extreme case of database cloning. IMS Recovery Expert can help in this restore. IMS Recovery Expert uses a repository to save information needed to restore a system.

IMS Recovery Expert has two methods in which it can operate:

- First, using the storage-based fast replication DASD hardware, IMS Recovery Expert can perform a System Level Backup (SLB) of an entire system. This technique can provide a quicker backup with less downtime of traditional techniques.
- The second technique uses traditional image copy backups for its remote restore. Regardless of the technique selected, IMS Recovery Expert will use GENJCL skeletons to generate the recovery JCL. You can customize these GENJCL skeletons to match your organization's requirements.

The process for preparing IMS Recovery Expert for using in a disaster recovery exercise is well documented in the *IBM IMS Recovery Expert User's Guide*, SC19-2473. In general, the preparation is divided between the local and remote sites.

On the local site, you first must create a disaster recovery profile. One decision you must make is whether you will be using a System Level Backup or image copies to recover your data. This profile identifies the recovery assets required (image copy data sets, archive logs, change accumulation data sets), which will be required at the remote/recovery site.

After the profile is built, you must generate the disaster recovery preparation job. This job will create the JCL and control cards needed at the remote/recovery site.

The next step is to execute the generated preparation job. The output of the job is placed in a partitioned data set. The output includes all of the jobs necessary to recover the system at the remote site. This job should be run regularly.

The last local preparation step is to make sure all of the resources needed to recover the system have been sent to the remote site. This includes the PDS containing the output of the generated preparation job, any System Level Backups (if used), and any other recovery assets that may be required at the remote site such as RECON data sets, archive logs, image copy data sets, and change accumulation data sets.

As you would expect, there are also a few steps that must be performed at the remote site after z/OS has been restored and brought up. First, IMS Recovery Expert needs to be installed and the disaster recovery PDS containing the jobs generated by IMS Recovery Expert needs to be restored. After the PDS is restored, you can start running the jobs it contains. A high-level summary of the jobs that need to be run at the remote site follows:

1. Restore the IMS Recovery Expert repository.
2. If you are using System Level Backups, run the job to restore them.
3. If you are using image copies, run the jobs to restore the necessary recovery assets and the jobs to recover the databases.
4. Restart IMS.

As noted above, the *IBM IMS Recovery Expert User's Guide*, SC19-2473, has a very good explanation of the process.

6

Managing a database

Keeping IMS databases reorganized helps ensure that your IMS applications perform at their optimal levels. Monitoring and managing a database is simplified by using tools. The IBM IMS Database Solution Pack simplifies decision-making tasks for managing your IMS databases.

In this chapter, we describe common scenarios in database administration and show the use of IMS Database Solution Pack or Fast Path Solution Pack.

This chapter contains the following:

- Autonomics for database reorganization
- Managing fragmentation

6.1 Autonomics for database reorganization

One of the most common tasks for maintaining IMS databases and maintaining the health of an IMS system is the reorganization process. There are a number of reasons reorganizations are required, not limited to:

- Reclaiming and consolidating free space that has become fragmented during processing
- Optimizing the physical storage of the database segments to improve performance
- Reducing the size of the physical database data sets, or reallocating them to reduce the number of data set extents

In this section, we compare reorganization scenarios without using tools and when using tools such as Database Solution Pack or Fast Path Solution Pack.

6.1.1 Reorganizing databases using traditional methods

The traditional method of reorganizing a database is made up of a number of steps. In general, the tasks followed are:

1. Unload the database
2. Reallocate the database data sets
3. Reload the database
4. If necessary, rebuild any secondary indexes
5. Back up the newly reorganized database

In a traditional reorganization, these tasks are performed sequentially and can be performed with the utilities provided with IMS, or with IMS Tools. The steps in a traditional reorg are processed sequentially and the database data is read and written several times while the reorganization runs - reading the database for the unload and writing a sequential output file, reading the sequential file and using it to reload the database.

6.1.2 Reorganizing databases using IMS Database Reorganization Expert

IMS Database Reorganization Expert[1] can simplify the reorganization process. It can process these tasks in parallel, reducing the elapsed time for the reorganization. IMS Database Reorganization Expert performs this by unloading the database and reloading it into a shadow copy of the database. It provides the following:

- Runs the unload and reload tasks in parallel. In addition, the optional tasks of the index rebuild, image copy, HASH pointer checking, and prefix resolution/prefix update (for logical relationships) also run concurrently.
- Passes the unload records directly to the reload task, eliminating IO processing of writing a sequential unload file and reading the file in the reload task.
- Dynamically allocates all data sets: The input database data sets, the output shadow copy database data sets, and the output secondary indexes.
- Provides a way to take the database offline for the execution of the reorganization and restarting the database when the reorganization completes.
- Provides full IMS Database Recovery Control (DBRC) support.

[1] IMS Database Reorganization Expert is part of the IBM IMS Database Solution Pack for z/OS described at Appendix A.7, “IMS Database Solution Pack” on page 170.

IMS Database Reorganization Expert uses IMS HP Unload, IMS HP Load, IMS Index Builder, IMS HP Image Copy, IMS HP Pointer Checker, and IMS HP Prefix Resolution.

A sample reorg of a HIDAM database with no secondary indexes is shown in Example 6-1. This example does not include an image copy, so the image copy must be taken after the completion of the reorganization.

Example 6-1 IMS Reorg Expert JCL- HIDAM database

```
//REXPERT  JOB TIME=5,CLASS=A,MSGCLASS=H,NOTIFY=&SYSUID,REGION=0M
//REORG    EXEC PGM=HPSGMAIN,PARM='DBD=T1CUST,DBRC=Y,IMSID=IVP1'
//STEPLIB  DD DISP=SHR,DSN=HPS.SHPSLMDO       * RE EXPERT/HPIC LIB
//         DD DISP=SHR,DSN=IIU.SIIULMOD       * INDEX BUILDER LIB
//         DD DISP=SHR,DSN=AII.SHKTLOAD       * ITKB LOAD LIB
//         DD DISP=SHR,DSN=IMS13X.SDFSRESL
//IMS      DD DISP=SHR,DSN=IMS13X.DBDLIB
//HPSIN DD *
(REORG)
CONDREORG=NO
DBRCAUTHCMD=YES
IC=NO
IMSCMD=NO
INDEXBLD=YES,NEW
ITKBSRVR=IMSTOOL
NAMESWAP=YES
SPACEALLOC=YES
/*
```

In this example, we allocate the shadow data sets (SPACEALLOC=YES) and rename the input and shadow data sets if the reorganization is successful (NAMESWAP=YES). The output of this job is shown in Example 6-2.

Example 6-2 IMS Reorg Expert Output - HIDAM database

```
1IMS DB REORG EXPERT                                              PAGE:       1
 5655-S35                                                    10/09/2014  21.20.50

                                "ENVIRONMENT"

 EXEC PARAMETERS

   DATABASE TO REORGANIZE.............. T1CUST
    PRIMARY INDEX...................... T1CUSTX
0  IMS ID............................. IVP1
   GLOBAL SERVICE GROUP NAME.......... (SYSTEM DEFAULT)
   ACTIVATE DBRC...................... YES
   ACTIVATE IRLM FOR NATIVE DL/I CALLS... (SYSTEM DEFAULT)
   MAKE ADDRESS SPACE SWAPPABLE.......... NO


 SYSTEM ENVIRONMENT

   OPERATING SYSTEM..................... z/OS 02.01.00
   STORAGE MANAGEMENT................... DFSMS/zOS 02.01.00
   IMS.................................. IMS 13.1.0
   RECON DATA SET....................... IMS V13R1    (MINIMUM VERSION = 11.1)
     ACCESS=SERIAL
   PRODUCT VERSION...................... IMS DB REORG EXPERT V4.1.0
1IMS DB REORG EXPERT                                              PAGE:       1
```

```
 5655-S35                                                    10/09/2014  21.20.50

                          "DEFAULT OPTION TABLES"

      SYSTEM DEFAULT: HPSCOPTS IN HPS.SHPSLMDO
 INSTALLATION DEFAULT: HPSCOPTI NOT FOUND

 KEYWORD        SYSTEM DEFAULT
 ------------   ----------------
 CONDREORG      NO
 DECODEDBD      (NO,NO)
 DECODESXD      (NO,NO)
 DISPOLDDS      TEMPNAME
 HPIO           N/A
 ILDSBLD        (YES,DSPR)
 ITKBLOAD       *NO
 ITKBSRVR       *NO
 SINDEXSUF      NO
 STATRL         NO
1IMS DB REORG EXPERT                                           PAGE:       1
 5655-S35                                                    10/09/2014  21.20.50

                         "HPSIN CONTROL STATEMENTS"

 0........1.........2.........3.........4.........5.........6.........7.........8
 12345678901234567890123456789012345678901234567890123456789012345678901234567890
 (REORG)
 CONDREORG=NO
 DBRCAUTHCMD=YES
 IC=NO
 IMSCMD=NO
 INDEXBLD=YES,NEW
 ITKBSRVR=IMSTOOL
 NAMESWAP=YES
 SPACEALLOC=YES
1IMS DB REORG EXPERT                                           PAGE:       2
 5655-S35                                                    10/09/2014  21.20.50

                         "HPSIN CONTROL STATEMENTS"

 "RUN TIME OPTIONS FOR THIS EXECUTION"

 OPTIONS FOR REORG FUNCTION:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 ADDBGRP        N/A (NOTE: THIS OPTION IS IGNORED WHEN ADXCFGRP=*NO)
 ADXCFGRP       *NO
 AUTHFAIL       ABORT
 CONDREORG      NO
 DALUNIT        SYSALLDA
 DBRCAPI        YES
 DBRCAUTHCMD    YES
 DBSHARE        NO
 DDNMAP         (T1CUST  ,TMPUST  )
 DDNMAP         (T1CUSTX ,TMPUSTX )
 DECODEDBD      (NO,NO)
 DECODESXD      (NO,NO)
 DELOLDDS       NO
 DISPOLDDS      TEMPNAME
```

```
 DYNALLOC       (YES,YES,YES),Z
 HPIO           N/A (NOTE: THIS OPTION IS NOT SPECIFIED FOR DRIVER)
 IC             NO
 ICNEEDED       DEFAULT: 'ON' FOR RECOVABL DB AND 'OFF' FOR NONRECOV DB
 ICTYPE         N/A (NOTE: THIS OPTION IS IGNORED UNLESS IC=YES)
 ILDSBLD        N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO NON-HALDB)
 IMSCMD         NO
 IMSCMDOPT      N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 INDEXBLD       N/A (NOTE: THE DATABASE HAS NO SECONDARY INDEX)
 ITKBSRVR       IMSTOOL
 ITKBLOAD       *NO
 LASTAUTHFLAG   OFF
 NAMESWAP       YES
 NAMESWAPFAIL   ABORT
 NEWDBD         N/A (NOTE: THIS OPTION IS NOT SPECIFIED)
 PARTITION      N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO NON-HALDB)
 PREFIXRES      N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO THIS DATABASE)
 PSINDEXBLD     N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO NON-HALDB)
 RC_CHANGE      NONE
 REORGINPUT     DBDS
 SINDEXSUF      N/A (NOTE: THIS OPTION IS IGNORED UNLESS INDEXBLD=YES,NEW)
 SPACEALLOC     YES
 STARTDB        N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 STATRL         NO
 STATUL         NO
 TOSITASK       N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 TOSIWAIT       N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 TOSIXCFGRP     N/A (NOTE: THIS OPTION IS NOT SPECIFIED)

1IMS DB REORG EXPERT                                              PAGE:       3
 5655-S35                                                  10/09/2014  21.20.50

                          "HPSIN CONTROL STATEMENTS"

 "RUN TIME OPTIONS FOR THIS EXECUTION"

 OPTIONS FOR PIPE (ID=1) BETWEEN UNLOAD AND RELOAD:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 PIPEBLKSZ      32768
 PIPEDEPTH      62
 PIPEWAIT       15,RDWR
 PIPEWAIT       0.5,OPEN

 OPTIONS FOR PIPE (ID=2) BETWEEN RELOAD AND INDEX BUILDER:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 PIPEBLKSZ      32768
 PIPEDEPTH      62
 PIPEWAIT       15,RDWR
 PIPEWAIT       0.5,OPEN

  * PIPE (ID=2) IS NOT ALLOCATED BECAUSE INDEXBLD=NO AND PSINDEXBLD=NO.
1IMS HIGH PERFORMANCE UNLOAD                                      PAGE:       1
 5655-E06                                                  10/09/2014  21.20.50

                           "DEFAULT OPTION TABLES"
```

```
      SYSTEM DEFAULT: HPSCOPTS IN HPS.SHPSLMDO
 INSTALLATION DEFAULT: HPSCOPTI NOT FOUND

 KEYWORD        SYSTEM DEFAULT
 ------------   ----------------
 BLDLPCK        NO
1IMS HIGH PERFORMANCE UNLOAD                                      PAGE:       1
 5655-E06                                                      10/09/2014  21.20.50

                          "HPSIN CONTROL STATEMENTS"

 0........1.........2.........3.........4.........5.........6.........7.........8
 12345678901234567890123456789012345678901234567890123456789012345678901234567890
  *** NO CONTROL STATEMENT IS SPECIFIED ***


 "RUN TIME OPTIONS FOR THIS EXECUTION"

 DBD : T1CUST    DBORG : HIDAM

 OPTIONS FOR UNLOAD FUNCTION:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 CHECKREC       NO
 DECODEDBD      NO
 DECOMPRESS     NO
 OUTPUT         SYSUT2,*HD
 PARTITION      N/A (THIS IS NOT A PARTITIONED DATABASE.)
 PROGMON        0
 USERHDR        N/A (*UH IS NOT SPECIFIED ON OUTPUT CONTROL STATEMENT)


 OPTIONS FOR HSSR ENGINE:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 BLDLPCK        NO
 BUFFERS        *ALL,,8,,100,YES,YES
 BUFSTAT        NO
 BYINDEX        NO
 DATXEXIT       NO
 DBSTATS        NO
 KEYCHECK       NO
 LOUT           NO
 PARTINFO       NO
 PARTSTAT       NO
 RTEXIT         HPSURTEX
 SKIPERROR      0


 OPTIONS FOR DIAGNOSIS:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 COMPAREDLI     NO
 DIAGG          NO
 RAPCHECK       NO
 TRACE          (NONE)
1IMS HIGH PERFORMANCE LOAD                                        PAGE:       1
```

```
 5655-M26                                                    10/09/2014  21.20.55

                           "DEFAULT OPTION TABLES"

      SYSTEM DEFAULT: HPSCOPTS IN HPS.SHPSLMDO
 INSTALLATION DEFAULT: HPSCOPTI NOT FOUND

 KEYWORD        SYSTEM DEFAULT
 ------------   ----------------
 ILEDATAC       N/A
 ILESTORC       N/A
 OADSPR         NO
 PAD            X'00'
 PARTINIT       NO
 REPAIRILK      NO
 SORT           NO
 TWINSTAT       NO
 WF1REC         YES
1IMS HIGH PERFORMANCE LOAD                                       PAGE:       1
 5655-M26                                                    10/09/2014  21.20.55

                           "HPSIN CONTROL STATEMENTS"

 0........1.........2.........3.........4.........5.........6.........7.........8
 12345678901234567890123456789012345678901234567890123456789012345678901234567890
  *** NO CONTROL STATEMENT IS SPECIFIED ***
0
 "RUN TIME OPTIONS FOR THIS EXECUTION"

 DBD : T1CUST    DBORG : HIDAM

 OPTIONS FOR PROCESS CONTROL:

 KEYWORD      VALUE
 ----------   ------------------------------------------------------------------
 INPUT        DFSUINPT                          (FORMAT: *HD/*PHD)
 DBRLBUF      45
 BUFFERNO     N/A
 DBIOBUF      15
 RECNUM       N/A
 HPIO         YES
 OADSPR       N/A
 GDGBASE      NO
 GDGLIMIT     N/A

 COMPRESS     YES
 FRSPC        YES
 PAD          X'00'
 SEARCH       N/A
 RAAFORMAT    N/A
 SEQERROR     ABEND
 DATXEXIT     NO
 PROGMON      0
 EXTENT       52
 SORT         N/A
 SORTHIDAM    NO
 CHKUPDT      N/A
 CHKTRAIL     N/A
 CHKEMPTYUL   N/A
 BMSETDSG     *
```

```
 WF1REC       N/A
 WF1DSN       N/A
 WF1UNIT      N/A
 WF1VOL       N/A
 WF1SPACE     N/A
 WFPHLQ       N/A
 WFPUNIT      N/A
 WFPVOL       N/A
 WFPVOLCNT    N/A
 WFPSPACE     N/A
 DECODEDBD    NO
1IMS HIGH PERFORMANCE LOAD                                          PAGE:       2
 5655-M26                                                      10/09/2014  21.20.55

                          "HPSIN CONTROL STATEMENTS"

 0........1.........2.........3.........4.........5.........6.........7.........8
 12345678901234567890123456789012345678901234567890123456789012345678901234567890

 ILDSBLD      N/A
 ILEDATAC     N/A
 ILESTORC     N/A
 LPART        N/A
 PARTSTAT     N/A
 PARTINIT     N/A
 REPAIRILK    N/A
 RMBSEGSZ     N/A
0
 LAPIPCBNO    N/A
 LAPIPCB      N/A
 LAPIPDBD     N/A

 PIPEOWAIT    N/A
0
 OPTIONS FOR DIAGNOSIS:

 KEYWORD      VALUE
 ----------   ----------------------------------------------------------------
 DBDSNAP      NO
 TWINSTAT     NO
 TRACE        NO
1IMS HIGH PERFORMANCE UNLOAD                                        PAGE:       1
 5655-E06                                                      10/09/2014  21.20.50

                       "BUFFERING AND I/O STATISTICS"

                            --- PCB#=0001 ---

 DBNAME = T1CUST     DS GROUPS = 1    ORG = HIDAM        ACCESS METHOD = OSAM

 *** BUFFER POOL ***

  BUFFER HANDLER: CAB

  BUFFER HANDLER PARAMETERS IN EFFECT:

   DDNAME    SIZE OF  SEQBUF  SEQBUF  DIRBUF  THRESHOLD  ALLOCATE  PAGE   NUM OF
             A BUF  AMOUNT  NUMBER  NUMBER    PERCENT  OVFLWBUF   FIX  BUFFERS
   -------- -------- ------- ------- ------- ---------- --------- ----- --------
   T1CUST      6,144       8       8      16        100        NO   YES       88
```

```
  ---------------------------------------------------------------------------

 TOTAL NUMBER OF BYTES IN THIS BUFFER POOL:     540,672


*** I/O STATISTICS ***

  DDNAME            IO         IO        RBA     PCT     PCT
                  DIRECT       SEQU   REQUESTS  IO/REQ  IO/BLK
  --------  ---------- ---------- ---------- ------- -------
  T1CUST             8      2,555     20,447   12.53   12.53
  --------  ---------- ---------- ---------- ------- -------
  TOTAL              8      2,555     20,447   12.53
1IMS HIGH PERFORMANCE UNLOAD                                        PAGE:       1
 5655-E06                                                  10/09/2014  21.20.50

                           "SEGMENT COUNT SUMMARY"

 DBNAME = T1CUST     DS GROUPS = 1    ORG = HIDAM        ACCESS METHOD = OSAM
 OUTPUT = SYSUT2

 *** SEGMENT COUNT IN WHOLE DB ***
                                                          DELETED BY
   SEGNAME  LVL DSG PARENT   RETRIEVED     UNLOADED      USER EXIT
   -------- --- --- -------- ------------ ------------ ------------
   CUSTOMER  01  01                13,420       13,420          N/A
   DISTRICT  02  01 CUSTOMER      199,404      199,404          N/A
   CUSTLOCN  02  01 CUSTOMER            0            0          N/A
   ADDRLINE  03  01 CUSTLOCN            0            0          N/A
   CUSTORDN  03  01 CUSTLOCN            0            0          N/A
   CUSTINVN  02  01 CUSTOMER    1,594,991    1,594,991          N/A
   PAYMENTS  02  01 CUSTOMER       69,573       69,573          N/A
   ADJUSTMT  02  01 CUSTOMER      131,597      131,597          N/A
   -------- --- --- -------- ------------ ------------ ------------
   TOTAL                       2,008,985    2,008,985          N/A
   TOTAL ERRORS                        0
1IMS HIGH PERFORMANCE LOAD                                          PAGE:       1
 5655-M26                                                  10/09/2014  21.20.55

                           "SEGMENT COUNT SUMMARY"

 DBNAME = T1CUST     DS GROUPS = 1    ORG = HIDAM        ACCESS METHOD = OSAM

 *** SEGMENT COUNT IN WHOLE DB ***
                                                     DELETED BY  DELETED BY
   SEGNAME  LVL DSG PARENT   READ         RELOADED    RANDOMIZER  USER EXIT
   -------- --- --- -------- ------------ ----------- ----------- -----------
   CUSTOMER  01  01                13,420      13,420         N/A         N/A
   DISTRICT  02  01 CUSTOMER      199,404     199,404         N/A         N/A
   CUSTLOCN  02  01 CUSTOMER            0           0         N/A         N/A
   ADDRLINE  03  01 CUSTLOCN            0           0         N/A         N/A
   CUSTORDN  03  01 CUSTLOCN            0           0         N/A         N/A
   CUSTINVN  02  01 CUSTOMER    1,594,991   1,594,991         N/A         N/A
   PAYMENTS  02  01 CUSTOMER       69,573      69,573         N/A         N/A
   ADJUSTMT  02  01 CUSTOMER      131,597     131,597         N/A         N/A
   -------- --- --- -------- ------------ ----------- ----------- -----------
   TOTAL                       2,008,985   2,008,985         N/A         N/A

1IMS DB REORG EXPERT              "DBRC AUTHORIZATION PROCESSING FOR REORGANIZATION"
PAGE:       1
```

```
 5655-S35
10/09/2014  21.20.50

0 CHANGE.DB    DBD(T1CUST  ) NOAUTH
0DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
0DSP0220I  COMMAND COMPLETION TIME 14.282 21:20:50.878743
0DSP0211I  COMMAND PROCESSING COMPLETE
0DSP0211I  HIGHEST CONDITION CODE = 00
0 CHANGE.DB    DBD(T1CUSTX ) NOAUTH
0DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
0DSP0220I  COMMAND COMPLETION TIME 14.282 21:20:50.888191
0DSP0211I  COMMAND PROCESSING COMPLETE
0DSP0211I  HIGHEST CONDITION CODE = 00
1IMS DB REORG EXPERT                          "DATA SET INFORMATION"
PAGE:       1
 5655-S35
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 RECON DATA SETS

     DD NAME  STATUS      DATA SET NAME
     -------- ----------- ---------------------------------------------
     RECON1   COPY1       IMS13X.RECON1
     RECON2   COPY2       IMS13X.RECON2
     RECON3   SPARE       IMS13X.RECON3


 DATABASE DEFINITION

     DBD................................. T1CUST
      PRIMARY INDEX...................... T1CUSTX
     DB ORGANIZATION..................... HIDAM
     ACCESS METHOD....................... OSAM


 DATA SETS USED BY EACH TASK

  DBDNAME  USAGE  ALLOC BY DD NAME  DATA SET NAME(S)
  -------- ------ -------- -------- ---------------------------------------------
  T1CUST   (DSG-1)
           DBRC            T1CUST   IMS13X.IMS13.T1CUST
           UNLOAD JCL      T1CUST   IMS13X.IMS13.T1CUST
           RELOAD DYNALLOC TMPUST   IMS13X.IMS13.T1CUST.Z

  T1CUSTX  (PINDEX)
           DBRC            T1CUSTX  IMS13X.IMS13.T1CUSTX
           UNLOAD JCL      T1CUSTX  IMS13X.IMS13.T1CUSTX
                                (D) IMS13X.IMS13.T1CUSTX.DATA
                                (I) IMS13X.IMS13.T1CUSTX.INDEX
           RELOAD DYNALLOC TMPUSTX  IMS13X.IMS13.T1CUSTX.Z
                                (D) IMS13X.IMS13.T1CUSTX.DATA.Z
                                (I) IMS13X.IMS13.T1CUSTX.INDEX.Z

1IMS DB REORG EXPERT                         "RESULT OF NAME SWAPPING"
PAGE:       1
 5655-S35
10/09/2014  21.21.00

0
```

```
  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.T1CUST                          -
      NEWNAME(IMS13X.IMS13.T1CUST.T                       )
0IDC0531I ENTRY IMS13X.IMS13.T1CUST ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.T1CUSTX                         -
      NEWNAME(IMS13X.IMS13.T1CUSTX.T                      )
0IDC0531I ENTRY IMS13X.IMS13.T1CUSTX ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.T1CUSTX.DATA                    -
      NEWNAME(IMS13X.IMS13.T1CUSTX.DATA.T                 )
0IDC0531I ENTRY IMS13X.IMS13.T1CUSTX.DATA ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.T1CUSTX.INDEX                   -
      NEWNAME(IMS13X.IMS13.T1CUSTX.INDEX.T                )
0IDC0531I ENTRY IMS13X.IMS13.T1CUSTX.INDEX ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.T1CUST.Z                        -
      NEWNAME(IMS13X.IMS13.T1CUST                         )
0IDC0531I ENTRY IMS13X.IMS13.T1CUST.Z ALTERED
1IMS DB REORG EXPERT                          "RESULT OF NAME SWAPPING"
PAGE:       1
 5655-S35
10/09/2014  21.21.00

0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.T1CUSTX.Z                       -
      NEWNAME(IMS13X.IMS13.T1CUSTX                        )
0IDC0531I ENTRY IMS13X.IMS13.T1CUSTX.Z ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.T1CUSTX.DATA.Z                  -
      NEWNAME(IMS13X.IMS13.T1CUSTX.DATA                   )
0IDC0531I ENTRY IMS13X.IMS13.T1CUSTX.DATA.Z ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.T1CUSTX.INDEX.Z                 -
      NEWNAME(IMS13X.IMS13.T1CUSTX.INDEX                  )
```

```
0IDC0531I ENTRY IMS13X.IMS13.T1CUSTX.INDEX.Z ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

0IDC0002I IDCAMS PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0
1IMS DB REORG EXPERT                        "DBRC NOTIFICATION PROCESSING"
PAGE:       1
 5655-S35
10/09/2014  21.21.00

0 NOTIFY.REORG DBD(T1CUST  ) DDN(T1CUST  ) USID(0000000002)             -
0               RUNTIME('2014.282 21:20:57.322246 -04:00')
0DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
0DSP0220I  COMMAND COMPLETION TIME 14.282 21:21:00.806214
1IMS DB REORG EXPERT                        "DBRC NOTIFICATION PROCESSING"
PAGE:       2
 5655-S35
10/09/2014  21.21.00

0 NOTIFY.REORG DBD(T1CUSTX ) DDN(T1CUSTX ) USID(0000000002)             -
0               RUNTIME('2014.282 21:20:57.322246 -04:00')
0DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
0DSP0220I  COMMAND COMPLETION TIME 14.282 21:21:00.822641
1IMS DB REORG EXPERT                        "DBRC NOTIFICATION PROCESSING"
PAGE:       3
 5655-S35
10/09/2014  21.21.00

0 CHANGE.DB    DBD(T1CUST  ) AUTH READOFF
0DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
0DSP0220I  COMMAND COMPLETION TIME 14.282 21:21:00.831980
1IMS DB REORG EXPERT                        "DBRC NOTIFICATION PROCESSING"
PAGE:       4
 5655-S35
10/09/2014  21.21.00

0 CHANGE.DB    DBD(T1CUSTX ) AUTH READOFF
0DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
0DSP0220I  COMMAND COMPLETION TIME 14.282 21:21:00.841239
1IMS DB REORG EXPERT                        "DBRC NOTIFICATION PROCESSING"
PAGE:       5
 5655-S35
10/09/2014  21.21.00

0DSP0211I  COMMAND PROCESSING COMPLETE
 DSP0211I  HIGHEST CONDITION CODE = 00
```

6.1.3 Conditional reorg using IMS Database Reorganization Expert

IMS Database Reorganization Expert can also check the health of the database and determine whether the reorganization needs to run or not. IMS Database Reorganization Expert refers to this as a “conditional reorg”.

To accomplish the conditional reorg, IMS Database Reorganization Expert relies upon Policy Services and the IMS Knowledge Tools Base (IKTB). The conditional reorg has four phases:

1. First evaluation - In this phase, various statistics are collected on the database that is to be reorganized. The statistics are compared to the reorganization policy and if any

exceptions are noted, the tool will continue with the reorganization. If no exceptions are found, the database will not be reorganized.

2. Reorganization - In this phase the reorganization is run. Additional statistics are also collected.
3. Second evaluation - After the reorganization phase has completed, additional statistics are collected to evaluate the post-reorganized database. All of the statistics collected during the reorganization phase and the second evaluation phase are saved in the repository managed by the IKTB.
4. Reporting - The statistics and results of the reorganization job are written out. If the first evaluation determined no reorganization was necessary, a diagnostic report showing any detected conditions (if any) will be written out.

The job used for conditional reorgs is very similar to the job used in non-conditional reorgs. The JCL statements are the same, and there are slightly different control cards provided in the SYSIN data set. Example 6-3 shows a sample conditional reorg job.

Example 6-3 Reorg Expert conditional reorg

```
//REXPERTC JOB TIME=5,CLASS=A,MSGCLASS=H,NOTIFY=&SYSUID,REGION=0M
//REORG    EXEC PGM=HPSGMAIN,PARM='DBD=T1CUST,DBRC=Y,IMSID=IVP1'
//STEPLIB  DD DISP=SHR,DSN=HPS.SHPSLMD0
//         DD DISP=SHR,DSN=IIU.SIIULMOD
//         DD DISP=SHR,DSN=AII.SHKTLOAD
//         DD DISP=SHR,DSN=IMS13X.SDFSRESL
//IMS      DD DISP=SHR,DSN=IMS13X.DBDLIB
//HPSIN DD *
(REORG)
CONDREORG=YES
DELOLDDS=YES
DBRCAUTHCMD=YES
IC=NO
IMSCMD=NO
INDEXBLD=YES,NEW
ITKBSRVR=IMSTOOL
NAMESWAP=YES
SPACEALLOC=YES
(CONDREORG)
POLICYBY=DBTYPE
/*
```

In the (REORG) block, CONDREORG=YES identifies this job as a conditional reorg. The (CONDREORG) block is required for conditional reorg jobs. The parameter POLICYBY=DBTYPE tells the recovery expert to use the policies related to the type of database.

The output of the job is shown in Example 6-4.

Example 6-4 Reorg Expert - Conditional reorg

```
1                J E S 2  J O B  L O G  --  S Y S T E M  S C 5 3  --  N O D E  W T S C P L X 1
0
 11.51.11 JOB27564 ---- SATURDAY,  11 OCT 2014 ----
 11.51.11 JOB27564  IRR010I  USERID IMSRES9  IS ASSIGNED TO THIS JOB.
 11.51.11 JOB27564  ICH70001I IMSRES9  LAST ACCESS AT 11:32:02 ON SATURDAY, OCTOBER 11, 2014
 11.51.11 JOB27564  $HASP373 REXPERTC STARTED - INIT A    - CLASS A        - SYS SC53
 11.51.12 JOB27564  BSN2030I POLICY SERVICES HAS INITIALIZED THE BPE SERVICES.
```

```
 11.51.12 JOB27564  BSN2040I POLICY SERVICES HAS CONNECTED TO THE REPOSITORY.
 11.51.12 JOB27564  BSN3402I NO JOURNAL DD CARD PROVIDED, WILL USE DYNAMIC ALLOCATION OF SYSOUT=*
 11.51.12 JOB27564  BSN2015I POLICY SERVICES PHASE 1 EXCEPTION MESSAGE SYSTEM DEFAULT IS ENABLED.
 11.51.12 JOB27564  BSN2016I POLICY SERVICES PHASE 1 EXCEPTION MESSAGE FOR THIS EXECUTION IS CURRENTLY
ENABLED.
 11.51.12 JOB27564  BSN2029I THE POLICY SERVICES ENVIRONMENT WAS INITIALIZED.
 11.51.12 JOB27564  BSN2010I THE DATA DICTIONARY SERVICES VERSION 1.4.0 INITIALIZED.
 11.51.12 JOB27564  BSN2010I POLICY SERVICES VERSION 1.4.0 INITIALIZED.
 11.51.13 JOB27564  BBE1350I DB SENSOR STORED SENSOR DATA FOR DATABASE T1CUST
 11.51.13 JOB27564  BBE1350I DB SENSOR STORED SENSOR DATA FOR DATABASE T1CUSTX
 11.51.14 JOB27564  +HPSG2314I REORGANIZATION IS NOT NEEDED FOR DATABASE T1CUST
 11.51.14 JOB27564  BSN2012I THE DATA DICTIONARY SERVICES TERMINATED.
 11.51.14 JOB27564  BSN2012I THE POLICY SERVICES TERMINATED.
 11.51.14 JOB27564  BSN2042I POLICY SERVICES HAS DISCONNECTED FROM THE REPOSITORY.
 11.51.14 JOB27564  BSN2032I POLICY SERVICES HAS TERMINATED THE BPE SERVICES.
 11.51.14 JOB27564  +HPSG2201I OUTPUT REPOSITORY PROCESSING IS COMMITTED
 11.51.14 JOB27564  +HPSG0010I CONDREORG FUNC ENDED FOR DATABASE T1CUST   (RC=00)
 11.51.14 JOB27564  Jobname  Procstep Stepname  CPU Time      EXCPs     RC
 11.51.14 JOB27564  REXPERTC --None-- REORG     00:00:00      2,656     00
 11.51.14 JOB27564  $HASP395 REXPERTC ENDED
0------ JES2 JOB STATISTICS ------
-  11 OCT 2014 JOB EXECUTION DATE
-           21 CARDS READ
-          587 SYSOUT PRINT RECORDS
-            0 SYSOUT PUNCH RECORDS
-           33 SYSOUT SPOOL KBYTES
-         0.04 MINUTES EXECUTION TIME
         1 //REXPERTC JOB TIME=5,CLASS=A,MSGCLASS=H,NOTIFY=&SYSUID,REGION=0M       JOB27564
           IEFC653I SUBSTITUTION JCL - TIME=5,CLASS=A,MSGCLASS=H,NOTIFY=IMSRES9,REGION=0M
         2 //REORG    EXEC PGM=HPSGMAIN,PARM='DBD=T1CUST,DBRC=Y,IMSID=IVP1'
         3 //STEPLIB  DD DISP=SHR,DSN=HPS.SHPSLMD0
         4 //         DD DISP=SHR,DSN=IIU.SIIULMOD
         5 //         DD DISP=SHR,DSN=AII.SHKTLOAD
         6 //         DD DISP=SHR,DSN=IMS13X.SDFSRESL
         7 //IMS      DD DISP=SHR,DSN=IMS13X.DBDLIB
         8 //HPSIN DD *
 ICH70001I IMSRES9  LAST ACCESS AT 11:32:02 ON SATURDAY, OCTOBER 11, 2014
 IEF236I ALLOC. FOR REXPERTC REORG
 IEF237I D003 ALLOCATED TO STEPLIB
 IEF237I D003 ALLOCATED TO
 IEF237I D003 ALLOCATED TO
 IEF237I 9A8D ALLOCATED TO
 IEF237I 9A8D ALLOCATED TO IMS
 IEF237I JES2 ALLOCATED TO HPSIN
 IEF237I JES2 ALLOCATED TO HPSOUT
 IEF237I JES2 ALLOCATED TO IIUPRINT
 IEF237I JES2 ALLOCATED TO IIUCAPT
 IEF237I JES2 ALLOCATED TO IIUSNAP
 IEF237I JES2 ALLOCATED TO IIUSOUT
 IEF237I JES2 ALLOCATED TO HPSOUT2
 IEF237I JES2 ALLOCATED TO HPSSNAP
 IEF237I JES2 ALLOCATED TO BBERPRT
 IEF237I JES2 ALLOCATED TO HPSDSPAP
 IEF237I 9A8D ALLOCATED TO RECON1
 IEF237I 9A8D ALLOCATED TO RECON2
 IEF237I 9A8D ALLOCATED TO RECON3
 IGD104I IMS13X.RECON3                                RETAINED,  DDNAME=RECON3
 IEF237I 9A8D ALLOCATED TO RECON3
 IGD104I IMS13X.RECON3                                RETAINED,  DDNAME=RECON3
 IGD100I 9D14 ALLOCATED TO DDNAME BBESYSIN DATACLAS (        )
```

```
IGD100I 9516 ALLOCATED TO DDNAME IIUIN    DATACLAS (        )
IEF237I DMY  ALLOCATED TO BBESPRT
BSN2030I POLICY SERVICES HAS INITIALIZED THE BPE SERVICES.
BSN2040I POLICY SERVICES HAS CONNECTED TO THE REPOSITORY.
BSN3402I NO JOURNAL DD CARD PROVIDED, WILL USE DYNAMIC ALLOCATION OF SYSOUT=*
IEF237I JES2 ALLOCATED TO BSNJM01
BSN2015I POLICY SERVICES PHASE 1 EXCEPTION MESSAGE SYSTEM DEFAULT IS ENABLED.
BSN2016I POLICY SERVICES PHASE 1 EXCEPTION MESSAGE FOR THIS EXECUTION IS CURRENTLY ENABLED.
BSN2029I THE POLICY SERVICES ENVIRONMENT WAS INITIALIZED.
BSN2010I THE DATA DICTIONARY SERVICES VERSION 1.4.0 INITIALIZED.
BSN2010I POLICY SERVICES VERSION 1.4.0 INITIALIZED.
IEF237I C70F ALLOCATED TO T1CUST
IEF237I C01B ALLOCATED TO T1CUSTX
IEF237I C70F ALLOCATED TO SYS00001
IEF237I C70F ALLOCATED TO SYS00002
IEF285I   IMS13X.IMS13.T1CUST                          KEPT
IEF285I   VOL SER NOS= TST077.
IEF285I   IMS13X.IMS13.T1CUST                          KEPT
IEF285I   VOL SER NOS= TST077.
IEF285I   SYS1.VTOCIX.TST077                           KEPT
IEF285I   VOL SER NOS= TST077.
IEF285I   SYS1.VTOCIX.TST07E                           KEPT
IEF285I   VOL SER NOS= TST07E.
BBE1350I DB SENSOR STORED SENSOR DATA FOR DATABASE T1CUST
BBE1350I DB SENSOR STORED SENSOR DATA FOR DATABASE T1CUSTX
HPSG2314I REORGANIZATION IS NOT NEEDED FOR DATABASE T1CUST
IEF285I   IMS13X.IMS13.T1CUST                          KEPT
IEF285I   VOL SER NOS= TST077.
IGD104I IMS13X.IMS13.T1CUSTX                         RETAINED,  DDNAME=T1CUSTX
BSN2012I THE DATA DICTIONARY SERVICES TERMINATED.
BSN2012I THE POLICY SERVICES TERMINATED.
BSN2042I POLICY SERVICES HAS DISCONNECTED FROM THE REPOSITORY.
BSN2032I POLICY SERVICES HAS TERMINATED THE BPE SERVICES.
HPSG2201I OUTPUT REPOSITORY PROCESSING IS COMMITTED
IGD104I IMS13X.RECON1                                RETAINED,  DDNAME=RECON1
IGD104I IMS13X.RECON2                                RETAINED,  DDNAME=RECON2
HPSG0010I CONDREORG FUNC ENDED FOR DATABASE T1CUST   (RC=00)
IEF142I REXPERTC REORG - STEP WAS EXECUTED - COND CODE 0000
IEF285I   HPS.SHPSLMD0                                 KEPT
IEF285I   VOL SER NOS= IMST00.
IEF285I   IIU.SIIULMOD                                 KEPT
IEF285I   VOL SER NOS= IMST00.
IEF285I   AII.SHKTLOAD                                 KEPT
IEF285I   VOL SER NOS= IMST00.
IEF285I   IMS13X.SDFSRESL                              KEPT
IEF285I   VOL SER NOS= TOTIM4.
IEF285I   IMS13X.DBDLIB                                KEPT
IEF285I   VOL SER NOS= TOTIM4.
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000101.?         SYSIN
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000102.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000103.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000104.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000105.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000106.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000107.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000108.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000109.?         SYSOUT
IEF285I   IMSRES9.REXPERTC.JOB27564.D0000110.?         SYSOUT
IEF285I   SYS14284.T115112.RA000.REXPERTC.BBESYSIN.H10 DELETED
IEF285I   VOL SER NOS= TOTPB3.
```

```
 IEF285I   SYS14284.T115112.RA000.REXPERTC.IIUIN.H10    DELETED
 IEF285I   VOL SER NOS= TOTPB1.
 IEF285I   IMSRES9.REXPERTC.JOB27564.D0000111.?         SYSOUT
 IEF285I   IMSRES9.REXPERTC.JOB27564.D0000112.?         SYSOUT
 IEF285I   SYS14284.T115113.RA000.REXPERTC.R1041068     DELETED
 IEF285I   VOL SER NOS= TOTPB4.
 +- Step Statistics - WSCACTRT 3.4 --------------------------------- HBB7790 -+
 |JOB(REXPERTC) Step#  1 (*Noproc*.REORG   ) Pgm(HPSGMAIN) - Return Code    00 |
 +-------------------------------------------------------------------------+
 |Elapsed Time: 00:00:02.74  CPU Time(TCB): 00:00:00.20  (SRB): 00:00:00.02    |
 |RCT CPU Time: None         I/O Int. Time: None         ICSF Count: None      |
 |Service Units: CPU=   14,739  SRB=    1,148  I/O=    1,303  MSO=        0    |
 |Transactions: ended:None   Active for: 00:00:02.70 Resident for: 00:00:02.70 |
 |WLM: Workload: BATCH    Service Class:BATCHLOW  Resource Group: None         |
 +-------------------------------------------------------------------------+
 |Region Requested f/Step=8,168K,   Private Size=(8,168K/1,451M)   Key Used(8) |
 |Virtual Used Maximums:   For User=(  116K/   11M) For System=(  344K/   17M) |
 |Pvt Paging(I/O):     0 /    0  VIO(I/O/R):     0 /    0 /    0  Stolen:    0 |
 |Common Pagein:     0  LPA Pagein:     0  Data + Hiper space (MB):          0 |
 |Average Working Set (Page Seconds/CPU Time) for this step, this time:  1,557 |
 |There were no swap sequences recorded for this step.                         |
 +----------------------- I / O  Statistics Section -------------------------+
 | * JES Sysin/Sysout Datasets, DUMMY, and Unused Datasets are not included. * |
 | DDname   Dev#=    Count (BLKSZ/ConnT)| DDname   Dev#=    Count (BLKSZ/ConnT)|
 +--------------------------------------+--------------------------------------+
 | STEPLIB  5003=      635 (32760/  0.1)| (-SAME-) 1A8D=       76 (32760/  0.1)|
 | IMS      1A8D=       10 (32760/  0.0)| BBESYSIN 1D14=        3 ( 8000/  0.0)|
 | IIUIN    1516=        1 ( 8000/  0.1)| SYS00002 470F=       90 ( 6144/  6.0)|
 | SYS00001 470F=       90 ( 6144/  6.3)| SYS00003 470F=       34 ( 2048/  0.0)|
 | SYS00004 401B=        9 ( 2048/  0.0)| T1CUSTX  401B=       20 ( --- /  0.1)|
 | RECON1   1A8D=       38 ( --- /  0.0)| RECON2   1A8D=       33 ( --- /  0.0)|
 +-------------------------- I / O  ACTIVITY  TOTALS --------------------------+
 |DASD=  1,039  Tape=      0  VIO=      0  Other=      0  Without a DD=  1,617 |
 +-------------------------------------------------------------------------+
 IEF373I STEP/REORG   /START 2014284.1151
 IEF032I STEP/REORG   /STOP  2014284.1151
         CPU:     0 HR  00 MIN  00.20 SEC    SRB:     0 HR  00 MIN  00.02 SEC
         VIRT:   116K  SYS:   344K  EXT:    12284K  SYS:    18296K
         ATB- REAL:                   76K  SLOTS:                     OK
              VIRT- ALLOC:       4M SHRD:       0M
 +- Job  Statistics - WSCACTRT 3.4 --------------------------------- HBB7790 -+
 |JOB REXPERTC(JOB27564) ended: Steps(  1) Class(A) Userid(        )           |
 +-------------------------------------------------------------------------+
 |Elapsed Time: 00:00:02.74  CPU Time(TCB): 00:00:00.20  (SRB): 00:00:00.02    |
 |RCT CPU Time: None         I/O Int. Time: None         ICSF Count: None      |
 |Service Units: CPU=   14,739  SRB=    1,148  I/O=    1,303  MSO=        0    |
 |Transactions: ended:None   Active for: 00:00:02.70 Resident for: 00:00:02.70 |
 |WLM: Workload: BATCH    Service Class:BATCHLOW  Resource Group: None         |
 +-------------------------- I / O  ACTIVITY  TOTALS --------------------------+
 |DASD=  1,039  Tape=      0  VIO=      0  Other=      0  Without a DD=  1,617 |
 +-------------------------------------------------------------------------+
 IEF375I  JOB/REXPERTC/START 2014284.1151
 IEF033I  JOB/REXPERTC/STOP  2014284.1151
         CPU:     0 HR  00 MIN  00.20 SEC    SRB:     0 HR  00 MIN  00.02 SEC
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                                  "ENVIRONMENT"

 EXEC PARAMETERS
```

```
   DATABASE TO REORGANIZE.............. T1CUST
    PRIMARY INDEX...................... T1CUSTX
0  IMS ID.............................. IVP1
   GLOBAL SERVICE GROUP NAME.......... (SYSTEM DEFAULT)
   ACTIVATE DBRC...................... YES
   ACTIVATE IRLM FOR NATIVE DL/I CALLS... (SYSTEM DEFAULT)
   MAKE ADDRESS SPACE SWAPPABLE.......... NO


 SYSTEM ENVIRONMENT

   OPERATING SYSTEM..................... z/OS 02.01.00
   STORAGE MANAGEMENT................... DFSMS/zOS 02.01.00
   IMS.................................. IMS 13.1.0
   RECON DATA SET....................... IMS V13R1    (MINIMUM VERSION = 11.1)
     ACCESS=SERIAL
   PRODUCT VERSION...................... IMS DB REORG EXPERT V4.1.0
1IMS DB REORG EXPERT                                              PAGE:       1
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                           "DEFAULT OPTION TABLES"

       SYSTEM DEFAULT: HPSCOPTS IN HPS.SHPSLMD0
 INSTALLATION DEFAULT: HPSCOPTI NOT FOUND

 KEYWORD        SYSTEM DEFAULT
 ------------   ----------------
 CONDREORG      NO
 DECODEDBD      (NO,NO)
 DECODESXD      (NO,NO)
 DISPOLDDS      TEMPNAME
 HPIO           N/A
 ILDSBLD        (YES,DSPR)
 ITKBLOAD       *NO
 ITKBSRVR       *NO
 SINDEXSUF      NO
 STATRL         NO
1IMS DB REORG EXPERT                                              PAGE:       1
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                         "HPSIN CONTROL STATEMENTS"

 0........1.........2.........3.........4.........5.........6.........7.........8
 12345678901234567890123456789012345678901234567890123456789012345678901234567890
 (REORG)
 CONDREORG=YES
 DELOLDDS=YES
 DBRCAUTHCMD=YES
 IC=NO
 IMSCMD=NO
 INDEXBLD=YES,NEW
 ITKBSRVR=IMSTOOL
 NAMESWAP=YES
 SPACEALLOC=YES
 (CONDREORG)
 POLICYBY=DBTYPE
1IMS DB REORG EXPERT                                              PAGE:       2
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```

```
                          "HPSIN CONTROL STATEMENTS"

 "RUN TIME OPTIONS FOR THIS EXECUTION"

 OPTIONS FOR REORG FUNCTION:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 ADDBGRP        N/A (NOTE: THIS OPTION IS IGNORED WHEN ADXCFGRP=*NO)
 ADXCFGRP       *NO
 AUTHFAIL       ABORT
 CONDREORG      YES
 DALUNIT        SYSALLDA
 DBRCAPI        YES
 DBRCAUTHCMD    YES
 DBSHARE        NO
 DDNMAP         (T1CUST  ,TMPUST  )
 DDNMAP         (T1CUSTX ,TMPUSTX )
 DECODEDBD      (NO,NO)
 DECODESXD      (NO,NO)
 DELOLDDS       YES
 DISPOLDDS      DELETE    (IS IN EFFECT BECAUSE DELOLDDS=YES WAS SPECIFIED)
 DYNALLOC       (YES,YES,YES),Z
 HPIO           N/A (NOTE: THIS OPTION IS NOT SPECIFIED FOR DRIVER)
 IC             NO
 ICNEEDED       DEFAULT: 'ON' FOR RECOVABL DB AND 'OFF' FOR NONRECOV DB
 ICTYPE         N/A (NOTE: THIS OPTION IS IGNORED UNLESS IC=YES)
 ILDSBLD        N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO NON-HALDB)
 IMSCMD         NO
 IMSCMDOPT      N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 INDEXBLD       N/A (NOTE: THE DATABASE HAS NO SECONDARY INDEX)
 ITKBSRVR       IMSTOOL
 ITKBLOAD       *NO
 LASTAUTHFLAG   OFF
 NAMESWAP       YES
 NAMESWAPFAIL   ABORT
 NEWDBD         N/A (NOTE: THIS OPTION IS NOT SPECIFIED)
 PARTITION      N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO NON-HALDB)
 PREFIXRES      N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO THIS DATABASE)
 PSINDEXBLD     N/A (NOTE: THIS OPTION IS NOT APPLICABLE TO NON-HALDB)
 RC_CHANGE      NONE
 REORGINPUT     DBDS
 SINDEXSUF      N/A (NOTE: THIS OPTION IS IGNORED UNLESS INDEXBLD=YES,NEW)
 SPACEALLOC     YES
 STARTDB        N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 STATRL         NO
 STATUL         NO
 TOSITASK       N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 TOSIWAIT       N/A (NOTE: THIS OPTION IS IGNORED UNLESS IMSCMD=YES,TOSI)
 TOSIXCFGRP     N/A (NOTE: THIS OPTION IS NOT SPECIFIED)

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                          "HPSIN CONTROL STATEMENTS"

 "RUN TIME OPTIONS FOR THIS EXECUTION"

 OPTIONS FOR PIPE (ID=1) BETWEEN UNLOAD AND RELOAD:
```

```
 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 PIPEBLKSZ      32768
 PIPEDEPTH      62
 PIPEWAIT       15,RDWR
 PIPEWAIT       0.5,OPEN

 OPTIONS FOR PIPE (ID=2) BETWEEN RELOAD AND INDEX BUILDER:

 KEYWORD        VALUE
 ------------   ------------------------------------------------------------
 PIPEBLKSZ      32768
 PIPEDEPTH      62
 PIPEWAIT       15,RDWR
 PIPEWAIT       0.5,OPEN

  * PIPE (ID=2) IS NOT ALLOCATED BECAUSE INDEXBLD=NO AND PSINDEXBLD=NO.
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 Summary of Database Definition
 ------------------------------
 Database..........................  T1CUST
 Database Type.....................  HIDAM
 Data Set Organization.............  OSAM
 Number of Data Set Groups.........  1

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 Summary of Policy Evaluation (DBD: T1CUST  )
 -------------------------------------------------------------------
 Name of Policy Applied............  SYS.DBDTYPE.HIDAM
 Policy Locale.....................  Global
 Reorganization Need...............  No

 Exceptions before Reorganization
 ------------------------------------------------------------------------------
                      *** No exception was detected ***
0------------------------------------------------------------------------------



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 Database Statistics (DBD: T1CUST  )
 ------------------------------------------------------------------------------
                           ==============================
                             Database Record Statistics
                           ==============================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_NUM_ROOT              *            13,420              n/a                n/a
 DB_AVG_DBREC_LENGTH      *         9,313.07               n/a                n/a

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```

```
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 Database Statistics (DBD: T1CUST  )
 ------------------------------------------------------------------------------
                            ============================
                              Physical I/O Statistics
                            ============================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_ESTIMATED_DBREC_IO                  3.40              n/a                n/a
 DB_ESTIMATED_ROOT_IO                    n/a              n/a                n/a

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 Data Set Statistics (DBD: T1CUST  , DSG: 01)
 ------------------------------------------------------------------------------
                            ============================
                              Volume/Extent Statistics
                            ============================

 Note: The mark * in column P means that the data element is used in the policy.

 Data set definition and environment information
 ==============================================
 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_FLAG_SPACE_TYPE                       C              n/a                n/a
 DB_NUM_PRI_SPACE                       210              n/a                n/a
 DB_NUM_SEC_SPACE                       100              n/a                n/a
 DB_FLAG_SMS              *               N              n/a                n/a
 DB_MAX_EXT_DS                           60              n/a                n/a
 DB_MAX_EXT_VOL                          16              n/a                n/a

 Data set usage information
 ==========================
 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_NUM_EXT                               1              n/a                n/a
 DB_NUM_VOL                               1              n/a                n/a
 DB_NUM_UNUSED_VOL                        0              n/a                n/a
 DB_NUM_UNUSED_VOL_SER                    0              n/a                n/a
 DB_NUM_UNUSED_VOL_CAND   *               0              n/a                n/a

 Remaining available data set extent estimation
 ==============================================
 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_AVAIL_EXT_LESS_100    *               Y              n/a                n/a
 DB_NUM_AVAIL_EXT         *              15              n/a                n/a
 DB_AVAIL_EXT_LIMIT           OSAM_MAXIMUM              n/a                n/a

    Remark: If DB_NUM_UNUSED_VOL_CAND is not zero, more extents than those
            indicated by DB_NUM_AVAIL_EXT might be available.

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```

```
 Data Set Statistics (DBD: T1CUST  , DSG: 01)
 ------------------------------------------------------------------------------
                        ==================================
                          Data Set Space Usage Statistics
                        ==================================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_BLOCK_SIZE                        6,144              n/a                n/a
 DB_NUM_DBDS_BLOCKS                  20,448              n/a                n/a
 DB_MAX_DS_SIZE                         8G              n/a                n/a
 DB_PCT_OF_MAX_DS_SIZE    *             2%              n/a                n/a
 DB_RBA_HIGH_ALLOC              154,828,800              n/a                n/a
 DB_RBA_HIGH_USED               125,632,512              n/a                n/a
 DB_UNUSED_BYTES                 29,196,288              n/a                n/a
 DB_PCT_UNUSED_BYTES      *             19%              n/a                n/a

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 Data Set Statistics (DBD: T1CUST  , DSG: 01)
 ------------------------------------------------------------------------------
                       ==================================
                         IMS Space Utilization Statistics
                       ==================================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DB_BYTES_SEG                   124,981,464              n/a                n/a
 DB_BYTES_FREE_SPACE                549,812              n/a                n/a
 DB_BYTES_UNIDENTIFIED    *          13,144              n/a                n/a
 DB_PCT_BYTES_FREE_SPACE  *              0%              n/a                n/a
 DB_PCT_BYTES_SEG         *             99%              n/a                n/a
 DB_NUM_SEG                       2,008,985              n/a                n/a
 DB_NUM_VLSEG                             0              n/a                n/a
 DB_NUM_VLSEG_SPLIT       *               0              n/a                n/a
 DB_PCT_NUM_VLSEG_SPLIT   *              0%              n/a                n/a
 DB_NUM_UNIDENTIFIED      *           5,485              n/a                n/a
 DB_AVG_NUM_UNIDENTIFIED  *             .27              n/a                n/a
 DB_NUM_FSE               *          14,700              n/a                n/a
 DB_AVG_NUM_FSE           *             .72              n/a                n/a
 DB_NUM_FSE_MIN           *          10,136              n/a                n/a
 DB_NUM_FSE_MAX           *               1              n/a                n/a
 DB_AVG_NUM_NOREUSE_FSE   *             .22              n/a                n/a
 DB_NUM_PTR                       2,022,404              n/a                n/a
 DB_NUM_PTR_DIFF_BLK      *          69,593              n/a                n/a
 DB_PCT_NUM_PTR_DIFF_BLK  *              3%              n/a                n/a

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 Database Statistics (DBD: T1CUSTX )
 ------------------------------------------------------------------------------
                       ====================================
                         Index Space Utilization Statistics
```

```
                    ====================================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DBX_NUM_IPS                          13,421              n/a                n/a
 DBX_NUM_IPS_OVFL                        n/a              n/a                n/a
 DBX_PCT_IPS_OVFL                        n/a              n/a                n/a

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 Data Set Statistics (DBD: T1CUSTX , Primary Index Data Set)
 ---------------------------------------------------------------------------------
                           ============================
                             Volume/Extent Statistics
                           ============================

 Note: The mark * in column P means that the data element is used in the policy.

 Data set definition and environment information
 ================================================
 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DBX_FLAG_SPACE_TYPE                     C              n/a                n/a
 DBX_NUM_PRI_SPACE                       1              n/a                n/a
 DBX_NUM_SEC_SPACE                       1              n/a                n/a
 DBX_FLAG_SMS                            N              n/a                n/a
 DBX_MAX_EXT_DS                        251              n/a                n/a
 DBX_MAX_EXT_VOL                       123              n/a                n/a

 Data set usage information
 ============================
 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DBX_NUM_EXT                             1              n/a                n/a
 DBX_NUM_VOL                             1              n/a                n/a
 DBX_NUM_UNUSED_VOL                      0              n/a                n/a
 DBX_NUM_UNUSED_VOL_SER                  0              n/a                n/a
 DBX_NUM_UNUSED_VOL_CAND                 0              n/a                n/a

 Remaining available data set extent estimation
 ================================================
 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DBX_AVAIL_EXT_LESS_100                  N              n/a                n/a
 DBX_NUM_AVAIL_EXT                    >100              n/a                n/a
 DBX_AVAIL_EXT_LIMIT                     n/a              n/a                n/a

    Remark: If DB_NUM_UNUSED_VOL_CAND is not zero, more extents than those
            indicated by DB_NUM_AVAIL_EXT might be available.

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 Data Set Statistics (DBD: T1CUSTX , Primary Index Data Set)
 ---------------------------------------------------------------------------------
                         ==================================
                           Data Set Space Usage Statistics
```

```
                    ==================================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DBX_BLOCK_SIZE                       1,024              n/a                n/a
 DBX_NUM_DBDS_BLOCKS                    495              n/a                n/a
 DBX_MAX_DS_SIZE                         4G              n/a                n/a
 DBX_PCT_OF_MAX_DS_SIZE                  0%              n/a                n/a
 DBX_RBA_HIGH_ALLOC                  506,880              n/a                n/a
 DBX_RBA_HIGH_USED                   506,880              n/a                n/a
 DBX_UNUSED_BYTES                    344,064              n/a                n/a
 DBX_PCT_UNUSED_BYTES                    68%              n/a                n/a

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 Data Set Statistics (DBD: T1CUSTX , Primary Index Data Set)
 ------------------------------------------------------------------------------
                                ====================
                                  Index Statistics
                                ====================

 Note: The mark * in column P means that the data element is used in the policy.

 Data Element Name        P      Before Reorg      After Reorg         Difference
 ------------------------ -  ---------------- ---------------- ------------------
 DBX_NUM_CI_SPLIT                        0              n/a                n/a
 DBX_PCT_NUM_CI_SPLIT                    0%             n/a                n/a
 DBX_NUM_CA_SPLIT                        0              n/a                n/a
 DBX_PCT_NUM_CA_SPLIT                    0%             n/a                n/a
 DBX_LRECL_SIZE                         12              n/a                n/a

  2014-10-11 11:51:380@PVE : BSN4000I THE POLICY VALIDATION PROCESS HAS STARTED FOR THE RESOURCE T1CUST.
  2014-10-11 11:51:380@PVE : BSN4001I THE POLICY VALIDATION PROCESS HAS ENDED FOR THE RESOURCE T1CUST:
  2014-10-11 11:51:380@PVE : BSN4001I  RC=00, RSN=00.
  2014-10-11 11:51:394@PVE : BSN4002I THE POLICY EVALUATION PROCESS HAS STARTED FOR THE RESOURCE T1CUST.
  2014-10-11 11:51:394@PVE : BSN4012I NO EXCEPTION WAS DETECTED DURING THE POLICY EVALUATION PROCESS.
  2014-10-11 11:51:394@PVE : BSN4003I THE POLICY EVALUATION PROCESS HAS ENDED FOR THE RESOURCE T1CUST:
  2014-10-11 11:51:394@PVE : BSN4003I  RC=00, RSN=00.
```

There are a couple of messages that indicate that the database did not require a reorg. First, in the job log the message HPSG2314I REORGANIZATION IS NOT NEEDED FOR DATABASE T1CUST appears. At the end of the job is the message BSN4012I NO EXCEPTION WAS DETECTED DURING THE POLICY EVALUATION PROCESS. Both indicate that the sensor data collected does not suggest that a reorg is required. The sensor data is collected quickly, much faster than if a reorg was run.

With the use of IMS Database Reorganization Expert, the number of reorgs that are performed can be reduced. In addition, the simplified JCL and control cards can reduce the setup time that is required to implement a reorganization process.

6.2 Managing fragmentation

Fragmentation is the situation where a database has been divided into multiple extents due to frequent updates, to the point of impacting performance by increasing I/O or even reaching the physical data set size limits.

The High Availability Large Database (HALDB) capability was introduced with IMS Version 7 to allow IMS databases to grow to almost unlimited sizes while providing increased availability. One of the primary advantages of HALDB is its simplified and shortened reorganization process due to the use of one or more parallel processes and a self-healing internal process for pointers.

However, one of the tasks to manage a HALDB for a DBA is to monitor the partition sizes to avoid outages as individual partitions reach the data set size limits. If the key range option is used, it is easy to see the range of keys within the partition by looking at the RECON PART records. The PART record has the high key value so you know what the highest key could be. There are no IMS utilities that give you the range of keys in the partition.

In the IMS Database Solution Pack, there are several utilities that can be used in this process. High Performance Image Copy is used with High Performance Pointer Checker and well as the High Performance utilities to create reports stored in the IMS Tools Base Repository.

The database being used for this example is T1HCUST. It is a PHIDAM database with a secondary index of T1HNAMY. The HALDB has three partitions using the key range option. The key ranges are shown in a report from High Performance Load as shown in Example 6-5.

Example 6-5 Partition definition for test database

```
"HALDB PARTITION DEFINITION"

 PARTITIONS LISTED IN ORDER OF HIGH KEY

    SEQ PARTITION   ID PARTITION HIGH KEY
   ---- --------- ---- --------------------------------------------------
   0001 T1HCSTA      1 C'299999'
   0002 T1HCSTB      2 C'699999'
   0003 T1HCSTC      3 C'999999'
```

Of the three partitions, the second partition is the partition that is using the most space in the data sets. From a High Performance Pointer Checker report, a detailed segment statistics report gives the total number of segments by segment type. The report shown in Example 6-6 shows that there are 64,198 root segments in this partition.

Example 6-6 Report on segment statistics

```
--- PARTITION=T1HCSTB ---

SEGMENT STATISTICS

                  TOTAL <-----AVG OCCURRENCES----->    AVG <--CONTRIBUTION TO
                 NBR OF           PER           PER   SEGM    DB RECORD SIZE-->
  SEGMENT    OCCURRENCES        PARENT        RECORD LENGTH    PCT      CUM SIZE
  -------- ------------ ------------ ------------ ------ ------ ------------
  CUSTOMER       64,198          1.0          1.0    168   1.0%           168
  DISTRICT      580,523          9.0          9.0     80   4.2%           891
  CUSTLOCN       50,206          0.8          0.8     56   0.3%           935
  ADDRLINE            0          0.0          0.0      0   0.0%           935
```

```
CUSTORDN       702,884          14.0          10.9     78   5.0%          1,789
CUSTINVN     4,409,031          68.7          68.7     73  29.3%          6,803
PAYMENTS     4,506,190          70.2          70.2     43  17.6%          9,821
ADJUSTMT     6,344,637          98.8          98.8     74  42.7%         17,134

TOTAL SEGMENTS =    16,657,669
```

Looking at the data set allocation and usage is done using the Space Monitor program from High Performance Pointer Checker. This program reads the data sets information from the IBM MVS™ catalog and provides information about allocation and usage statistics. The allocations for the partitions show that the second partition (T1HCSTB) is using about twice the space as the other two. So, from the report shown in Example 6-7, partition T1CSTB is using 1600 cylinders and is 96% used. To split this partition into two partitions, we need to know what value to set the high key of a new partition, which will cause roughly half of the database records to be moved into the new partition.

Example 6-7 Space Analysis data set report for T1HCUST

```
IMS HIGH PERFORMANCE POINTER CHECKER FOR z/OS - SPMN          "SPACE ANALYSIS BY DATA SET REPORT"                    PAGE:     1
5655-U09                                              DATE: 07/28/2014  TIME: 02.43.47                        FABKSPMN - V3.R1

 MEMBER NAME : N/A
 ----------------------
 DBNAME          DDNAME      DSNAME                                          DBORG ACCM   CISP   CASP  UNIT     REORGDATE    HDPCDATE
 TYP     PRI     SEC EXT AEXT     ALLOC %FSP %NRUS   TOTBLK  BLKSZ LRECL  MXSEG ACTMX      ROOTS   TOTALSEG VOLSER EXT     ALLOC %USE

 --- ------ ------ ---  --- --------- ---- ----- --------- ----- ----- ------ -----  ----------  --------- ------ --- --------- ----
 T1HCSTA         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTA.A00001                          N/A    N/A  3390-9      NONE         NONE
 CYL     10     100  10    6       910    3 N/A     106080   6144  6144   N/A    N/A        N/A        N/A TST071  10       910   97

 T1HCSTB         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTB.A00002                          N/A    N/A  3390-9      NONE         NONE
 CYL    100     100  16    0      1600    5 N/A     181999   6144  6144   N/A    N/A        N/A        N/A TST07D  16      1600   95

 T1HCSTC         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTC.A00003                          N/A    N/A  3390-9      NONE         NONE
 CYL     10     100   9    7       810    4 N/A      93480   6144  6144   N/A    N/A        N/A        N/A TST078   9       810   96
```

The problem is finding a key in the range of keys for this partition, which will split the database records in half. The key range is 300000 - 699999. But we do not know that a value in the middle of that range will split the records into about half for each partition. The HALDB toolkit has a program that will analyze the keys within a partition and base on parameters, providing the key values required. In this example, the **PARTNUM** parameter will be used to provide two partitions of equal size.

The HALDB must be available to be authorized in DBRC as access intent of four, which is READ. The **PARTITION** keyword is used to name the partition to be analyzed and the **PARTNUM** keyword is used to specify two partitions that will be created from this one partition. The JCL is shown in Example 6-8.

Example 6-8 JCL for creating a two-partition HALDB

```
//ANAPART   JOB CLASS=A,MSGCLASS=X
/*JOBPARM SYSAFF=SC53
//*-------------------------------------------------
//*           CREATE PARTITION BOUNDARY REPORT
//*           READ DATABASE AND REPORT ON 2 PARTITIONS
//*-------------------------------------------------
//S2     EXEC PGM=IHCHALDB,DYNAMNBR=999,
//            REGION=80M
//STEPLIB  DD DISP=SHR,DSN=HPS.SIHCLOAD
//         DD DISP=SHR,DSN=IMS13X.SDFSRESL
//         DD DISP=SHR,DSN=HPS.SHPSLMD0
//DFSRESLB DD DISP=SHR,DSN=IMS13X.SDFSRESL
```

```
//IMS      DD DISP=SHR,DSN=IMS13X.DBDLIB
//IMSDALIB DD DISP=SHR,DSN=IMS13X.SDFSRESL
//TRACE    DD DUMMY
//MSGPRINT DD SYSOUT=*
//IHCSYSIN DD *
ANALYZEPART DBD(T1HCUST) -
             PARTITION(T1HCSTB) -
             PARTNUM(2)
/*
```

The output report for this is shown in Example 6-9.

Example 6-9 Report on the two-partition HALDB

```
Partitioning for DBD T1HCUST

Part            Roots     %     All Segments     %     Prefix Bytes     %       Data Bytes      %       Total Bytes    %

Total          64,198  100.00     16,657,669  100.00    301,523,650  100.00    798,468,513   100.00   1,099,992,163 100.00

     1         44,292   68.99      8,359,114   50.18    151,672,220   50.30    398,324,526    49.88     549,996,746  50.00
               Key:  440291
                     F4F4F0F2F9F1

     2         19,906   31.00      8,298,555   49.81    149,851,430   49.69    400,143,987    50.11     549,995,417  49.99
               Key:  699950
                     F6F9F9F9F5F0
```

The process to implement this split can be done by running an offline unload and reload of this partition with the introduction of the new partition between the unload and the reload:

1. Unload partition T1HCSTB using High Performance Unload.

   The unload can be for the single partition without affecting the other partitions. A JCL example is shown in Example 6-10.

Example 6-10 JCL for unload job

```
//UNLOAD   EXEC PGM=HPSCMAIN,REGION=0M,
//         PARM='FUNC=UL,DBD=T1HCUST,SWAP=N,DBRC=Y'
//STEPLIB  DD DSN=HPS.SHPSLMD0,DISP=SHR
//         DD DSN=IMS13X.SDFSRESL,DISP=SHR
//DFSRESLB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMS      DD DSN=IMS13X.DBDLIB,DISP=SHR
//HPSIN    DD *
OUTPUT=SYSUT2,*HD
DEC=NO
ITKBLOAD=AII.SHKTLOAD
ITKBSRVR=IMSTOOL
DBSTATS=YES
PARTITION=T1HCSTB
BYINDEX=NO
BUFS=*ALL,,8,,100,YES
//SYSPRINT DD SYSOUT=*
//HPSOUT   DD SYSOUT=*
//HPSSTAT  DD SYSOUT=*
//HPSSNAP  DD SYSOUT=*
//HPSTRACE DD DUMMY
//SYSUT2   DD DSN=IMSRES4.UNLD.T1HCSTB,
//            DISP=(,CATLG,DELETE),UNIT=(SYSDA,6),
//            SPACE=(CYL,(105,100),RLSE)
```

```
//SYSUT3   DD DUMMY
```

Example 6-11 shows just a single report from the unload to verify the number of segments unloaded.

Example 6-11 HP Unload Reports

```
IMS HIGH PERFORMANCE UNLOAD                                          PAGE:       1
5655-E06                                                        07/29/2014  23.04.36

                            "SEGMENT STATISTICS"

                          --- PARTITION=T1HCSTB ---

SEGMENT STATISTICS

                  TOTAL <-----AVG OCCURRENCES----->    AVG <--CONTRIBUTION TO
                 NBR OF           PER           PER   SEGM    DB RECORD SIZE-->
  SEGMENT    OCCURRENCES        PARENT        RECORD LENGTH    PCT      CUM SIZE
  -------- ------------ ------------ ------------ ------ ------ ------------
  CUSTOMER        64,198          1.0          1.0    168   1.0%           168
  DISTRICT       580,523          9.0          9.0     80   4.2%           891
  CUSTLOCN        50,206          0.8          0.8     56   0.3%           935
  ADDRLINE             0          0.0          0.0      0   0.0%           935
  CUSTORDN       702,884         14.0         10.9     78   5.0%         1,789
  CUSTINVN     4,409,031         68.7         68.7     73  29.3%         6,803
  PAYMENTS     4,506,190         70.2         70.2     43  17.6%         9,821
  ADJUSTMT     6,344,637         98.8         98.8     74  42.7%        17,134

  TOTAL SEGMENTS =    16,657,669
```

2. Define the new partition T1HCSTD.

   Defining the new partition is done using the normal DBRC utility. See Example 6-12 where the KEYSTRNG value is taken from the database analysis report shown in Example 6-9 on page 138.

Example 6-12 DBRC INIT.PART commands to add new partition

```
//STEP1   EXEC PGM=DSPURX00,REGION=4096K
//STEPLIB  DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//DFSRESLB DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//JCLOUT   DD  SYSOUT=(*,INTRDR)
//SYSPRINT DD  SYSOUT=*
//IMS      DD  DSN=IMS13X.DBDLIB,DISP=SHR
//SYSIN   DD  *
 INIT.PART DBD(T1HCUST)                -
           PART(T1HCSTD)                -
           DSNPREFX(IMS13X.IMS13.T1HCUST.T1HCSTD) -
           KEYSTRNG('440291') -
           BLOCKSZE(6144) -
           GENMAX(03)
```

3. Reload both partitions (T1HCSTB,T1HCSTD).

   Reloading the partitions is done using HP Reload. No special information is needed by the reload utility as the RECON now has the new key ranges defined. The utility will automatically put the records in to the correct partition based on the key ranges. Example 6-13 on page 140 shows the JCL used.

Example 6-13 HP Reload JCL

```
//RELOAD   EXEC PGM=HPSCMAIN,REGION=0M,
//         PARM='FUNC=RL,DBD=T1HCUST,SWAP=N,DBRC=Y'
//STEPLIB  DD DSN=HPS.SHPSLMD0,DISP=SHR
//         DD DSN=IMS13X.SDFSRESL,DISP=SHR
//DFSRESLB DD DSN=IMS13X.SDFSRESL,DISP=SHR
//IMS      DD DSN=IMS13X.DBDLIB,DISP=SHR
//DFSUINPT DD DSN=IMSRES4.UNLD.T1HCSTB,DISP=SHR
//HPSIN    DD *
ITKBLOAD=AII.SHKTLOAD
ITKBSRVR=IMSTOOL
INPUT=DFSUINPT
OUTPUT=DFSURWF1
//DFSURWF1 DD DUMMY,DSN=IMSRES4.WF1.T1HCUST,
//            DISP=(,CATLG,DELETE),
//            UNIT=SYSDA,
//            SPACE=(CYL,(5,100),RLSE)
//OVERFLOW DD UNIT=SYSDA,SPACE=(CYL,(100,100),RLSE)
//POINTERS DD UNIT=SYSDA,SPACE=(CYL,(10,10))
//SEQERROR DD DUMMY,DSN=IMSRES4.SEQ.T1HCUST,
//            DISP=(NEW,CATLG,DELETE),
//            UNIT=SYSDA,
//            SPACE=(CYL,(100,10),RLSE)
//SYSPRINT DD SYSOUT=*
//HPSOUT   DD SYSOUT=*
//HPSSTAT  DD SYSOUT=*
//HPSSNAP  DD SYSOUT=*
//HPSTRACE DD DUMMY
```

The reports from High Performance Reload show the segment statistics for both partitions as well as the overall statistics. The reports in Example 6-14 show that 44,292 database records were placed in the new partition T1HCSTD. These would be the keys under 440291. This is not an equal number of root segments from the original partition but the total number of segments in each partition are about the same.

Example 6-14 HP Load Reports

```
IMS HIGH PERFORMANCE LOAD                                        PAGE:       1
5655-M26                                                  07/29/2014  23.08.56

                          "SEGMENT COUNT SUMMARY"

SEGMENT COUNTS IN ENTIRE DATABASE

                                                    DELETED BY     DELETED BY
  SEGMENT            READ       RELOADED          RANDOMIZER      USER EXIT
  --------  -------------  -------------  -------------  -------------
  CUSTOMER         64,198         64,198            N/A            N/A
  DISTRICT        580,523        580,523            N/A            N/A
  CUSTLOCN         50,206         50,206            N/A            N/A
  ADDRLINE              0              0            N/A            N/A
  CUSTORDN        702,884        702,884            N/A            N/A
  CUSTINVN      4,409,031      4,409,031            N/A            N/A
  PAYMENTS      4,506,190      4,506,190            N/A            N/A
  ADJUSTMT      6,344,637      6,344,637            N/A            N/A
  --------  -------------  -------------  -------------  -------------
```

```
  TOTALS       16,657,669     16,657,669            N/A            N/A

"SEGMENT STATISTICS"

                           --- PARTITION=T1HCSTD ---

SEGMENT STATISTICS

                  TOTAL <-----AVG OCCURRENCES----->    AVG <--CONTRIBUTION TO
                NBR OF           PER           PER   SEGM    DB RECORD SIZE-->
  SEGMENT    OCCURRENCES        PARENT        RECORD LENGTH    PCT      CUM SIZE
  -------- ------------ ------------ ------------ ------ ------ -------------
  CUSTOMER        44,292          1.0           1.0    168   1.4%           168
  DISTRICT       250,562          5.7           5.7     80   3.6%           621
  CUSTLOCN        40,291          0.9           0.9     56   0.4%           672
  ADDRLINE             0          0.0           0.0      0   0.0%           672
  CUSTORDN       564,074         14.0          12.7     78   8.0%         1,665
  CUSTINVN     2,008,929         45.4          45.4     73  26.7%         4,976
  PAYMENTS     2,379,569         53.7          53.7     43  18.6%         7,286
  ADJUSTMT     3,071,397         69.3          69.3     74  41.3%        12,418

  TOTAL SEGMENTS =     8,359,114

  ILDS RECORDS   =        44,292

"SEGMENT STATISTICS"

                           --- PARTITION=T1HCSTB ---

SEGMENT STATISTICS

                  TOTAL <-----AVG OCCURRENCES----->    AVG <--CONTRIBUTION TO
                NBR OF           PER           PER   SEGM    DB RECORD SIZE-->
  SEGMENT    OCCURRENCES        PARENT        RECORD LENGTH    PCT      CUM SIZE
  -------- ------------ ------------ ------------ ------ ------ -------------
  CUSTOMER        19,906          1.0           1.0    168   0.6%           168
  DISTRICT       329,961         16.6          16.6     80   4.8%         1,494
  CUSTLOCN         9,915          0.5           0.5     56   0.1%         1,522
  ADDRLINE             0          0.0           0.0      0   0.0%         1,522
  CUSTORDN       138,810         14.0           7.0     78   2.0%         2,066
  CUSTINVN     2,400,102        120.6         120.6     73  31.9%        10,868
  PAYMENTS     2,126,621        106.8         106.8     43  16.6%        15,461
  ADJUSTMT     3,273,240        164.4         164.4     74  44.0%        27,630

  TOTAL SEGMENTS =     8,298,555

  ILDS RECORDS   =        19,906
```

The other useful report out of the reload step is the new partitions key sequence information, as shown in Example 6-15. The new partition T1HCSTD is now second in the sequential processing of the root keys and T1HCSTB is now third in sequence.

Example 6-15 HP Reload partition definition report

```
"HALDB PARTITION DEFINITION"
```

```
PARTITIONS LISTED IN ORDER OF HIGH KEY

   SEQ PARTITION   ID PARTITION HIGH KEY
  ---- --------- ---- --------------------------------------------------
  0001 T1HCSTA      1 C'299999'
  0002 T1HCSTD      4 C'440291'
  0003 T1HCSTB      2 C'699999'
  0004 T1HCSTC      3 C'999999'
```

4. Rerun Space Monitor program

   The Space Monitor program report now shows that the four partitions are all using about the same amount of space. The report in Example 6-16 shows that all the partitions are now about the same size.

Example 6-16 HPPC Space Monitor Report after split

```
IMS HIGH PERFORMANCE POINTER CHECKER FOR z/OS - SPMN          "SPACE ANALYSIS BY DATA SET REPORT"                    PAGE:
5655-U09                                                DATE: 07/29/2014  TIME: 23.21.14                     FABKSPMN - V3.R

 MEMBER NAME : N/A
 ----------------------
 DBNAME          DDNAME      DSNAME                                          DBORG ACCM   CISP   CASP  UNIT     REORGDATE    HDPCDATE
 TYP    PRI    SEC EXT AEXT     ALLOC %FSP %NRUS   TOTBLK  BLKSZ LRECL  MXSEG ACTMX      ROOTS   TOTALSEG VOLSER EXT     ALLOC %USE


 --- ------ ------ ---  --- --------- ---- ----- --------- ----- ----- ------ -----  ---------  --------- ------ --- --------- ----
 T1HCSTA         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTA.A00001                        N/A    N/A  3390-9      NONE         NONE
 CYL     10    100  10    6       910    3 N/A     106080   6144  6144   N/A    N/A        N/A        N/A TST071  10       910   97

 T1HCSTB         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTB.A00002                        N/A    N/A  3390-9      NONE         NONE
 CYL    100    100   8    8       800    5 N/A      91069   6144  6144   N/A    N/A        N/A        N/A TST070   8       800   95

 T1HCSTC         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTC.A00003                        N/A    N/A  3390-9      NONE         NONE
 CYL     10    100   9    7       810    4 N/A      93480   6144  6144   N/A    N/A        N/A        N/A TST078   9       810   96

 T1HCSTD         T1HCSTAA    IMS13X.IMS13.T1HCUST.T1HCSTD.A00004                        N/A    N/A  3390-9      NONE         NONE
 CYL     50    100   9    7       850   11 N/A      90930   6144  6144   N/A    N/A        N/A        N/A TST078   9       850   89
```

7

Health management for IMSplex

In this chapter, we provide guidance to database administrators who want to use the Tools Base Administration Console for z/OS 1.4 to monitor the health of their IMSplex, databases, programs, and transactions to do problem determination, issue IMS commands. We also show examples of how to fix the problems found by the tool.

The IBM Management Console for IBM and DB2 for z/OS is a web-based tool using IMS Connect and Distributed Access Infrastructure (DAI) to talk to IMS, the Knowledge Base server, and the IMS Autonomics Director. Other tools like IMS Autonomics Director are running in the background sensor jobs to collect statistics about databases. The statistics are stored in IMS Knowledge Base repositories and the IMS Autonomics Director server does the evaluations invoking Policy Services by passing the sensor data and storing the evaluation results in IMS Tools Knowledge Base.

IMS Policy Services are used to send out pagers, mails, and alerts to the Management Console whenever a database reaches one of the thresholds defined by user for each database, group of databases, or for each type of database (HDAM, HIDAM, HALDP, Fast Path, and so on). The evaluation of selected databases by Autonomics Director server can be triggered multiple ways:

- Notification from a tool on storing new sensor data in IMS Tools Knowledge Base
- Notification from an Autonomics Director submitted sensor job
- On-demand request for evaluation of a DB (via a command the Autonomics Director server)
- Periodic evaluations were requested for a DB and the period is up

This chapter includes the following topics:

- Using IBM Management Console for IMS and DB2 for z/OS to understand the health of databases
- Database troubleshooting sample: Limited availability of data set extents
- Using IBM Management Console for IMS and DB2 for z/OS to manage transaction or program status

7.1 Using IBM Management Console for IMS and DB2 for z/OS to understand the health of databases

IBM Management Console for IMS and DB2 for z/OS V1.1 is a web tool that is used for database administration and monitoring by utilizing a graphical interface.

Some of the Management Console benefits that facilitate the DBA work are:

- Provides options for managing automatic database evaluations. Management Console integrates with IBM Tools Base Autonomics Director for z/OS (Autonomics Director) to give you control over the autonomics settings for your environment. You can designate which databases receive automatic evaluations by adding databases to monitor lists, and you can schedule the evaluations around your processing demands by managing schedules. With Management Console, you have access to an intuitive interface for automating routine database monitoring tasks.
- Provides comprehensive and customizable views of all IMS environments across your enterprise.
- Organizes and displays exceptions. These exceptions are generated when database states cross thresholds that are specified in policies that you define in IBM Tools Base Policy Services for z/OS (Policy Services).
- Provides automatic recommendations to help you address certain types of database exceptions.
- Provides centralized access to reports that are generated by many IBM IMS Tools and that are stored in the IBM Tools Base IMS Tools Knowledge Base for z/OS repository.
- Includes a robust integrated help system that describes how to use Management Console and includes relevant IMS reference information.

For benefits, configuration, and how to use Management Console, see IBM Management Console for IMS and DB2 for z/OS (Management Console) available at the following site:

`http://www.ibm.com/support/knowledgecenter/SSEUZQ_1.1.0/topics/dyw_welcome.dita`

7.2 Database troubleshooting sample: Limited availability of data set extents

A common preventive work that the DBA does is increase the space of database data sets when it cannot take more extents. It happens because sometimes the databases grow more than expected. It is very important that the DBA take a quick action before the database becomes full.

The Management Console facilitates the troubleshooting because this tool provides many statistics. The following topics show how much easier it is to navigate in the Manage Console alerts, graphics, and statistics.

7.2.1 Checking an Exception Message

The first step is to display the database exceptions messages reported by Management Console. Consider that you have Management Console properly configured.

By clicking Resource, you have in the left your Environment, consisting your IMSplex and your IMS Region. Figure 7-1 shows the Environment IMS_Redbook, the IMSplex (PLX13), and the IMS Region IVP1 under PLX13. In the right pane, the databases from IVP1 IMS Region are listed.

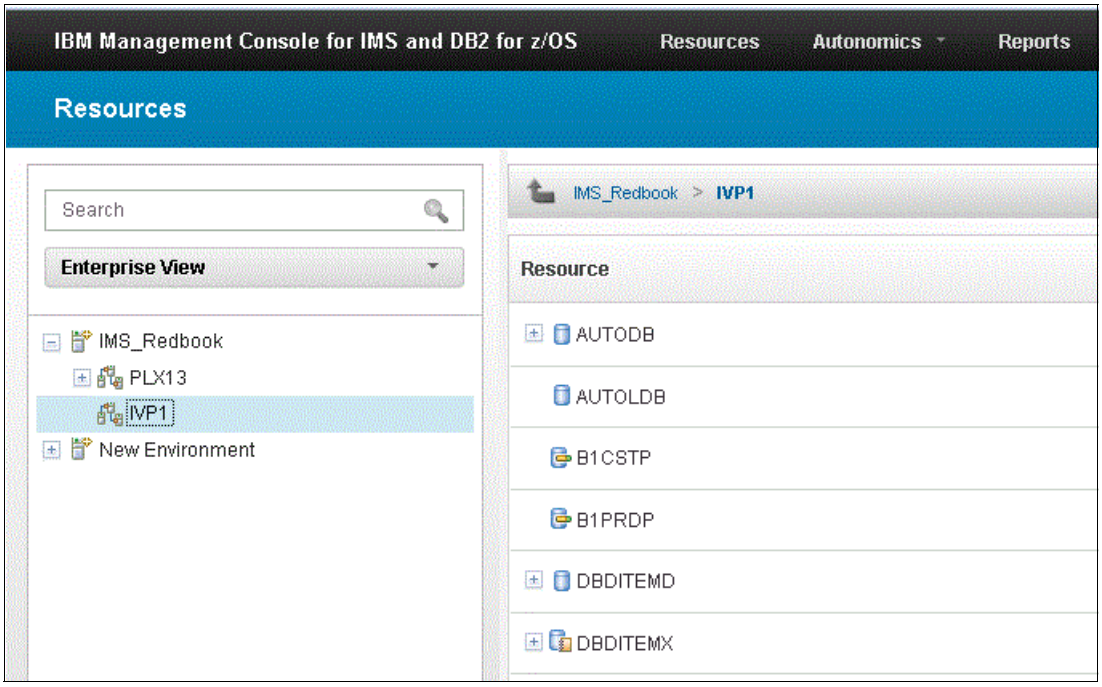

Figure 7-1 Display databases

To display your resources that have exception messages, you need to click the Enterprise View button and select the option Resources with Exception, as shown on Figure 7-2.

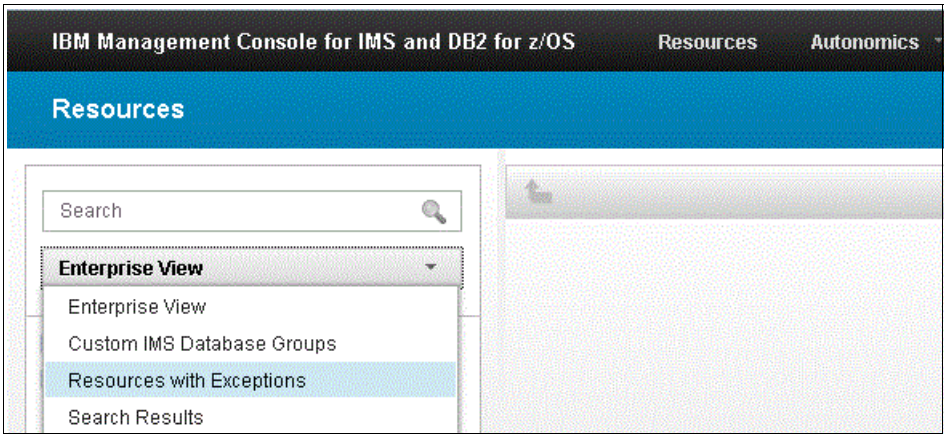

Figure 7-2 Resources with Exceptions

Expanding Resources with Exceptions you are able to see three types of exception messages: Critical, Severe, and Warning. In this chapter, a warning message for database DBDITEMD is covered.

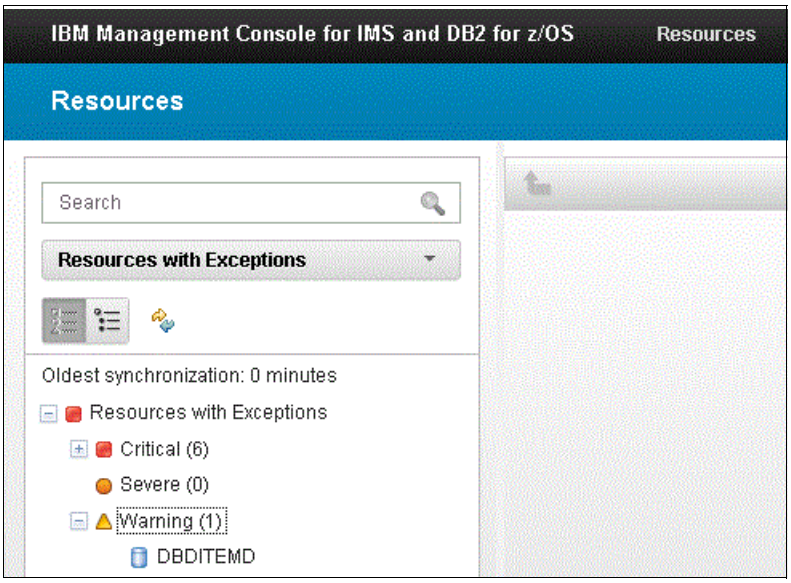

Figure 7-3 Warning Message to the database DBDITEMD

By clicking over the database name, the panes Properties, Exceptions, Reports, Space Use, Optimization, and Fragmentation appear. The exceptions messages are reported on the Exception pane.

The Exception pane shows four types of message: Actions, Critical, Severe, and Warning. In this example, we used a warning message for troubleshooting.

The warning message displayed is related to the DBDITEMD database. This is an HDAM database with two data set groups, DBDITEM1 and DBDITEM2, and one secondary index, DBDITEMX.

In this case, the database DBDITEMD received the Warning message (Limited availability of data set extents) as represented in Figure 7-4 on page 147.

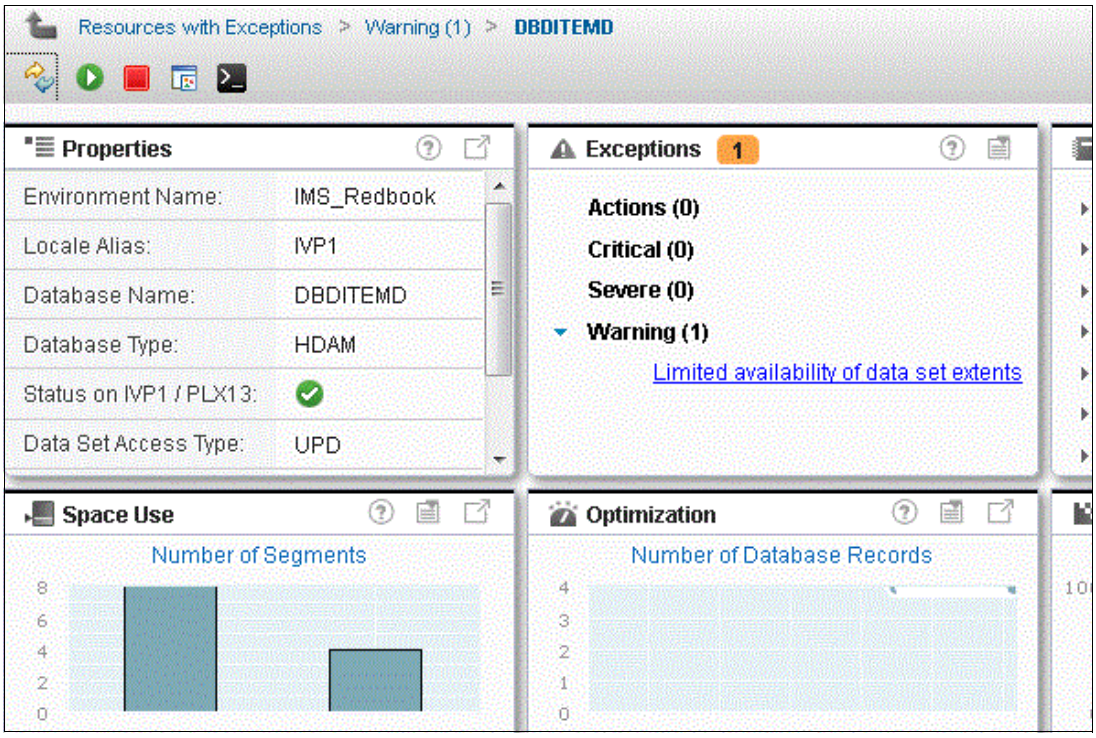

Figure 7-4 Exception pane

If you click over the warning link “Limited availability of data set extents”, an explanation about this message and how to resolve it is displayed on the Help pane. This way, you know what is happening with the database and how to figure it out quickly. Figure 7-5 on page 148 shows the Help pane related to the “Limited availability of data set extents” exception.

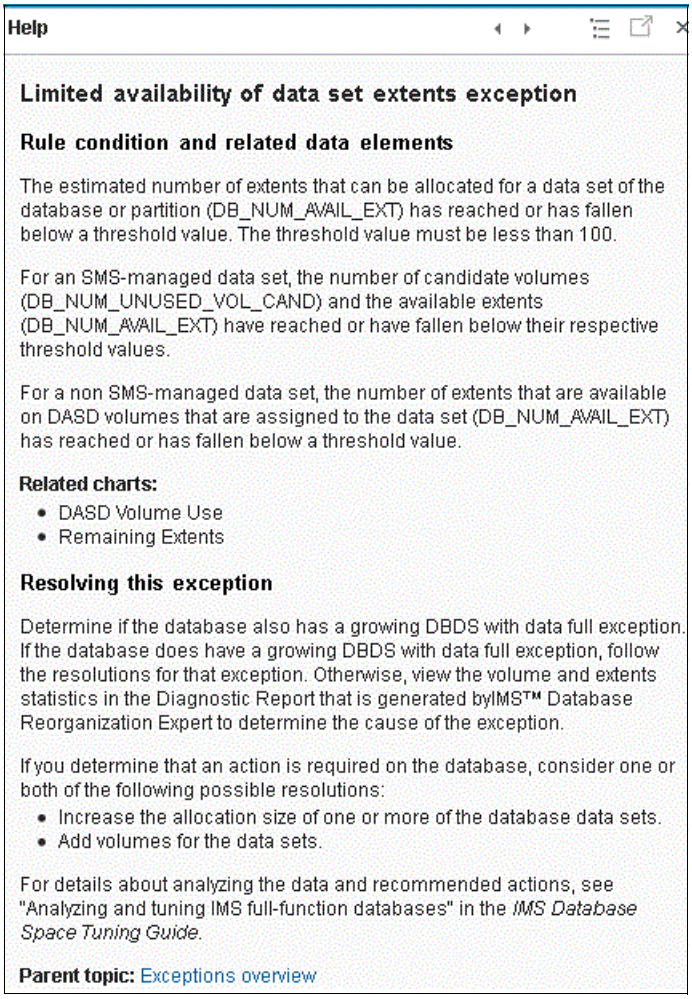

Figure 7-5 Help pane for Limited availability of data set extents exception

According to the Exception message, explanation is required to get more space use information utilizing volumes and extents statistics using Management Console.

Example 7-1 and Example 7-2 on page 149 show the current data set allocations for DBDITEM1 and DBDITEM2.

Example 7-1 DBDITEM1 data set allocation

```
Data Set Name . . . . : IMS13X.IMS13.DBDITEM1

General Data                          Current Allocation
 Management class . . : **None**       Allocated tracks  . : 15
 Storage class  . . . : **None**       Allocated extents . : 11
  Volume serial . . . : TSTO7E
  Device type . . . . : 3390
 Data class . . . . . : **None**
  Organization  . . . : PS            Current Utilization
  Record format . . . : FBS            Used tracks . . . . : 15
  Record length . . . : 4096           Used extents  . . . : 11
  Block size  . . . . : 4096
  1st extent tracks . : 5
  Secondary tracks  . : 1             Dates
```

```
  Data set name type  :                 Creation date . . . : 2014/08/27
                                        Referenced date . . : 2014/08/29
                                        Expiration date . . : ***None***
  SMS Compressible  . : NO
```

Example 7-2 DBDITEM2 data set allocation

```
Data Set Name . . . . : IMS13X.IMS13.DBDITEM2

General Data                          Current Allocation
 Management class . . : **None**       Allocated tracks  . : 5
 Storage class  . . . : **None**       Allocated extents . : 1
  Volume serial . . . : TST076
  Device type . . . . : 3390
 Data class . . . . . : **None**
  Organization  . . . : PS            Current Utilization
  Record format . . . : FBS            Used tracks . . . . : 1
  Record length . . . : 4096           Used extents  . . . : 1
  Block size  . . . . : 4096
  1st extent tracks . : 5
  Secondary tracks  . : 1             Dates
  Data set name type  :                Creation date . . . : 2014/08/27
                                       Referenced date . . : 2014/08/29
                                       Expiration date . . : ***None***
  SMS Compressible  . : NO
```

Management Console enables you to get more space statistics by clicking in the highlighted icon as shown in Figure 7-6 on page 150.

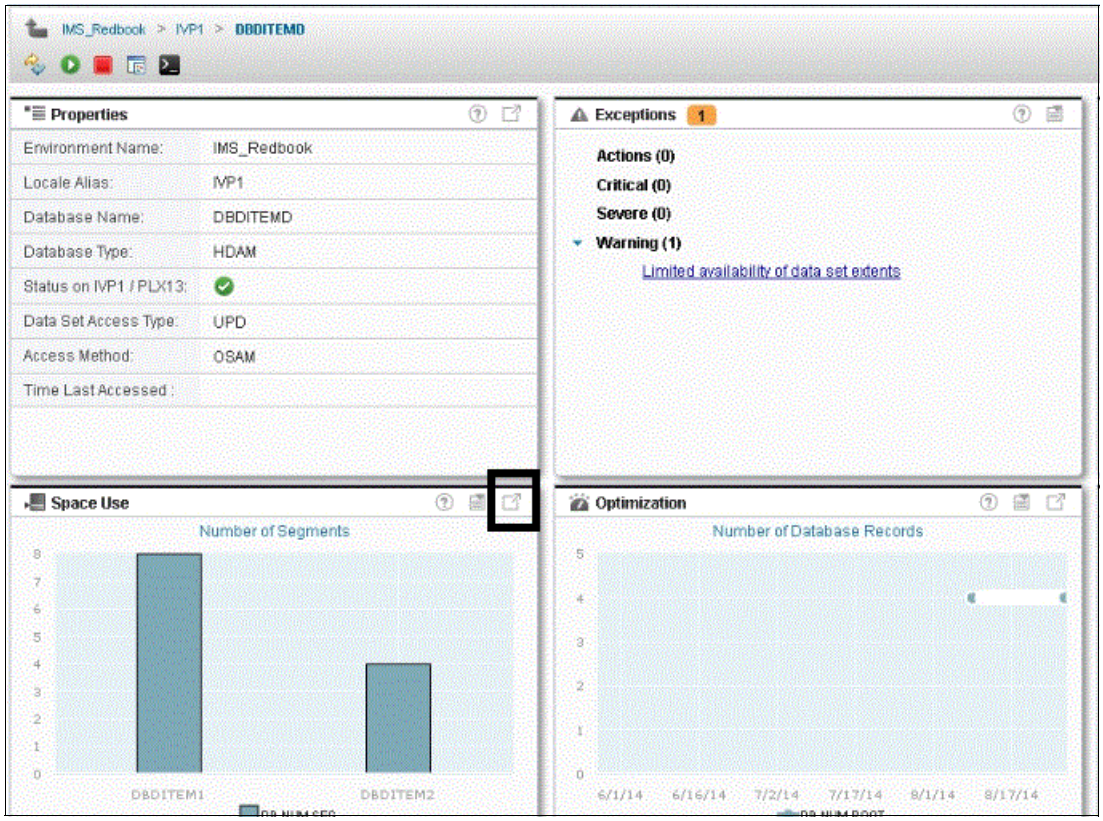

Figure 7-6 Checking Space Use graphics

Note the Remaining Extents pane showing DBDITEM1 with only five more available extents.

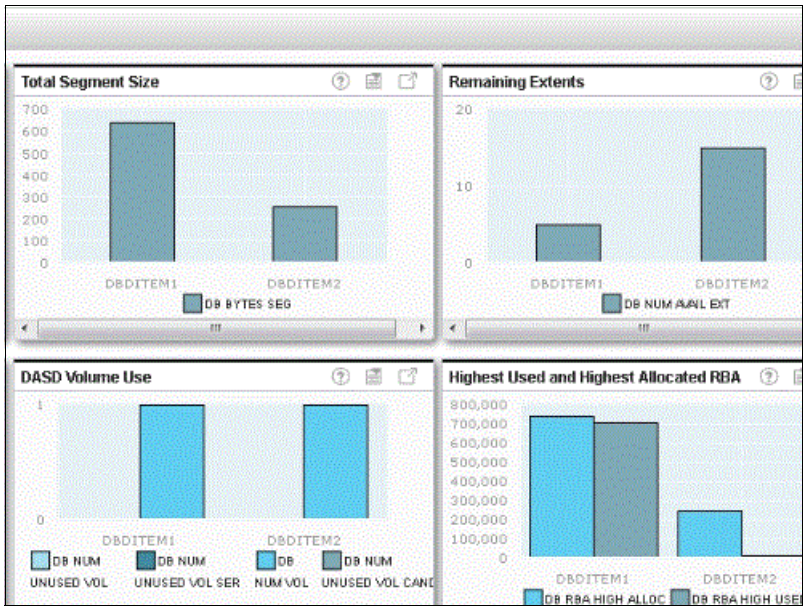

Figure 7-7 Space use panes

We conclude that the current allocation to the data set group where the root segment resides (DBDITEM1) is very small compared to the number of database occurrences and it cannot take more than five extents.

7.2.2 Resolving limited availability of data set extents

To allow the OSAM file to extend to more space, we used Smart Reorg utility to increase the data set space.

A Smart Reorg utility job is controlled by the Smart Reorg Driver. It uses the Conditional Reorganization Support Service, Parallel Reorganization Service to conditionally reorganize an IMS full-function database and it allows you to reorganize your database in a single step.

Example 7-3 shows the Smart Reorg JCL for reorganizing DBDITEMD (HDAM database) and its secondary index DBDITEMX.

Example 7-3 Smart Reorg Utility JCL

```
//DEF      EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
 DELETE IMS13X.IMS13.DBDITEM1.Z
 DELETE IMS13X.IMS13.DBDITEM2.Z
 DELETE IMS13X.IMS13.DBDITEMX.Z
 DELETE IMS13X.IMS13.DBDITEM1.T
 DELETE IMS13X.IMS13.DBDITEM2.T
 DELETE IMS13X.IMS13.DBDITEMX.T
 SET MAXCC=0
 ALLOCATE DATASET('IMS13X.IMS13.DBDITEM1.Z') -
      DSORG(PS) -
      SPACE(40,4) -
      UNIT(3390,2) -
      BLOCK(6144) -
      TRACKS
 ALLOCATE DATASET('IMS13X.IMS13.DBDITEM2.Z') -
      DSORG(PS) -
      SPACE(5,1) -
      UNIT(3390,2) -
      BLOCK(6144) -
      TRACKS
 DEFINE CLUSTER (NAME(IMS13X.IMS13.DBDITEMX.Z) -
      VOLUMES (TSTO7C) -
      CYLINDERS (1 1)  -
      RECORDSIZE (16 16) -
      SHR(3 3 ) -
      FREESPACE (10 10) -
      CISZ(1024) -
      KEYS (10 5)) -
   INDEX(NAME(IMS13X.IMS13.DBDITEMX.Z.INDEX)) -
   DATA (NAME(IMS13X.IMS13.DBDITEMX.Z.DATA))
//REORG    EXEC PGM=HPSGMAIN,PARM='DBD=DBDITEMD,DBRC=Y,IMSID=IVP1'
//STEPLIB  DD DISP=SHR,DSN=HPS.SHPSLMDO
//         DD DISP=SHR,DSN=IIU.SIIULMOD
//         DD DISP=SHR,DSN=FOI.SFOILOAD
//         DD DISP=SHR,DSN=IMS13X.SDFSRESL
//IMS      DD DISP=SHR,DSN=IMS13X.DBDLIB
//HPSIN DD *
(REORG)
IMSCMD=YES
DBRCAUTHCMD=YES
```

```
NAMESWAP=YES
INDEXBLD=YES
/*
```

Notice that the **Space** parameter for IMS13X.IMS13.DBDITEM1.Z was increased to 40,4. The Smart Reorg utility process flow is shown in Example 7-4.

Example 7-4 Smart Reorg utility process flow

```
DBDNAME  USAGE  ALLOC BY DD NAME  DATA SET NAME(S)
-------- ------ -------- -------- ---------------------------
DBDITEMD (DSG-1)
         DBRC            DBDITEM1 IMS13X.IMS13.DBDITEM1
         UNLOAD STEPLIB  DBDITEM1 IMS13X.IMS13.DBDITEM1
         RELOAD DYNALLOC TMPITEM1 IMS13X.IMS13.DBDITEM1.Z

DBDITEMD (DSG-2)
         DBRC            DBDITEM2 IMS13X.IMS13.DBDITEM2
         UNLOAD STEPLIB  DBDITEM2 IMS13X.IMS13.DBDITEM2
         RELOAD DYNALLOC TMPITEM2 IMS13X.IMS13.DBDITEM2.Z

DBDITEMX (SINDEX, BUILT TO NEW DATA SET)
         DBRC            DBDITEMX IMS13X.IMS13.DBDITEMX
                         *ORG-(C) IMS13X.IMS13.DBDITEMX
                         *ORG-(D) IMS13X.IMS13.DBDITEMX.DATA
                         *ORG-(I) IMS13X.IMS13.DBDITEMX.INDEX
         IDXBLD DYNALLOC DBDITEMX IMS13X.IMS13.DBDITEMX.Z
                     (D) IMS13X.IMS13.DBDITEMX.Z.DATA
                     (I) IMS13X.IMS13.DBDITEMX.Z.INDEX
1IMS DB REORG EXPERT                              "RESULT OF NAME SWAPPING"
 5655-S35

0
  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.DBDITEM1                       -
      NEWNAME(IMS13X.IMS13.DBDITEM1.T                    )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEM1 ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0

0
    END

  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.DBDITEM2                       -
      NEWNAME(IMS13X.IMS13.DBDITEM2.T                    )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEM2 ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO
```

```
      ALTER   IMS13X.IMS13.DBDITEMX                        -
      NEWNAME(IMS13X.IMS13.DBDITEMX.T                     )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEMX ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.DBDITEMX.DATA                   -
      NEWNAME(IMS13X.IMS13.DBDITEMX.DATA.T                )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEMX.DATA ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.DBDITEMX.INDEX                  -
      NEWNAME(IMS13X.IMS13.DBDITEMX.INDEX.T               )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEMX.INDEX ALTERED

1IMS DB REORG EXPERT                              "RESULT OF NAME SWAPPING"
 5655-S35

0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.DBDITEM1.Z                      -
      NEWNAME(IMS13X.IMS13.DBDITEM1                       )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEM1.Z ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO
      ALTER   IMS13X.IMS13.DBDITEM2.Z                      -
      NEWNAME(IMS13X.IMS13.DBDITEM2                       )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEM2.Z ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

  IF MAXCC EQ 0 THEN -
    DO

      ALTER   IMS13X.IMS13.DBDITEMX.Z                      -
      NEWNAME(IMS13X.IMS13.DBDITEMX                       )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEMX.Z ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
      ALTER   IMS13X.IMS13.DBDITEMX.Z.DATA                 -
      NEWNAME(IMS13X.IMS13.DBDITEMX.DATA                  )


0IDC0531I ENTRY IMS13X.IMS13.DBDITEMX.Z.DATA ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
```

```
0
      ALTER   IMS13X.IMS13.DBDITEMX.Z.INDEX               -
1IMS DB REORG EXPERT                            "RESULT OF NAME SWAPPING"
 5655-S35

0     NEWNAME(IMS13X.IMS13.DBDITEMX.INDEX                )
0IDC0531I ENTRY IMS13X.IMS13.DBDITEMX.Z.INDEX ALTERED
0IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
0
    END

0IDC0002I IDCAMS PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0



IMS DB REORG EXPERT                           "DBRC NOTIFICATION PROCESSING"
5655-S35

 NOTIFY.REORG DBD(DBDITEMD) DDN(DBDITEM1) USID(0000000001)            -
              RUNTIME('2014.239 09:25:55.434403 -04:00')
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 14.239 09:25:58.938579
IMS DB REORG EXPERT                           "DBRC NOTIFICATION PROCESSING"
5655-S35

 NOTIFY.REORG DBD(DBDITEMD) DDN(DBDITEM2) USID(0000000001)            -
              RUNTIME('2014.239 09:25:55.434403 -04:00')
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 14.239 09:25:58.954873
IMS DB REORG EXPERT                           "DBRC NOTIFICATION PROCESSING"
5655-S35

 NOTIFY.REORG DBD(DBDITEMX) DDN(DBDITEMX) USID(0000000001)            -
              RUNTIME('2014.239 09:25:55.434403 -04:00')
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 14.239 09:25:58.962322
IMS DB REORG EXPERT                           "DBRC NOTIFICATION PROCESSING"
5655-S35

 CHANGE.DB    DBD(DBDITEMD) AUTH READOFF
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 14.239 09:25:58.971633
IMS DB REORG EXPERT                           "DBRC NOTIFICATION PROCESSING"
5655-S35

 CHANGE.DB    DBD(DBDITEMX) AUTH READOFF
DSP0203I  COMMAND COMPLETED WITH CONDITION CODE 00
DSP0220I  COMMAND COMPLETION TIME 14.239 09:25:58.981065

IMS DB REORG EXPERT                           "DBRC NOTIFICATION PROCESSING"
5655-S35

DSP0211I  COMMAND PROCESSING COMPLETE
DSP0211I  HIGHEST CONDITION CODE = 00
```

The database is now reorganized in a shadow database. This prevents the Production database from crashing.

For more information, refer to IMS Database Solution Pack for z/OS manual at the following site:

http://www-304.ibm.com/support/knowledgecenter/SSS8QJ_1.2.0/com.ibm.imstools.did.doc/didhome.htm

When a Reorg job runs, the next step is to take a backup and the IMS Database Recovery Control (DBRC) sets the Image Copy Needed Count different of 0. It means you must run a Backup job. See Example 7-5, which represents a DBRC listing after the Smart Reorg execution.

Example 7-5 DBRC Image Copy Needed Count

```
DBD=DBDITEMD                  IRLMID=*NULL        DMB#=64      TYPE=IMS
SHARE LEVEL=3                GSGNAME=**NULL**     USID=0000000001
AUTHORIZED USID=0000000000  RECEIVE USID=0000000000 HARD USID=0000000000
RECEIVE NEEDED USID=0000000000
DBRCVGRP=**NULL**
FLAGS:                              COUNTERS:
  BACKOUT NEEDED        =OFF          RECOVERY NEEDED COUNT   =0
  READ ONLY             =OFF          IMAGE COPY NEEDED COUNT =2
  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
```

To remove this DBRC flag, we used IBM IMS High Performance Image Copy. The JCL used is shown in Example 7-6.

Example 7-6 IBM IMS High Performance Image Copy JCL

```
//COPY     EXEC  PGM=FABJMAIN,REGION=0M
//*
//STEPLIB  DD DSN=HPS.SHPSLMD0,DISP=SHR
//         DD DSN=IMS13X.SDFSRESL,DISP=SHR
//*
//DFSRESLB DD  DSN=IMS13X.SDFSRESL,DISP=SHR
//IMS      DD  DSN=IMS13X.DBDLIB,DISP=SHR
//*
//PRIMAPRT DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//STATIPRT DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//VALIDPRT DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//EVALUPRT DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//SNAPPIT  DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//*
//MSGOUT   DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//REPORTS  DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//SNAPDPIT DD  SYSOUT=*,DCB=BLKSIZE=6118,OUTLIM=0
//*
//SORTIN   DD  UNIT=SYSDA,SPACE=(CYL,(10,10))
```

```
//SORTOUT  DD  UNIT=SYSDA,SPACE=(CYL,(10,10))
//SORTWK01 DD  UNIT=SYSDA,SPACE=(CYL,(10,10))
//*
//ICEIN    DD  *
  GLOBAL    COMP=Y,              /* COMPRESS OUTPUT  IC DATASET  */
            COMPRTN=FABJCMP2,    /* COMPRESSION ROUTINE USED     */
            DBBUF=30,            /* NUMBER OF BUFFERS FOR DB ACS */
            DBRC=Y,              /* DBRC INDICATOR               */
            DEDBPC=N,            /* INVOKE DEDB HASH CHECK       */
            HDPC=Y,              /* INVOKE FFUNC HASH CHECK      */
            DBDALLOC=Y,          /* DYNAMIC ALLOCATION FOR DB DS */
            DSDALLOC=Y,          /* DYNAMIC ALLOCATION FOR IC DD */
            ICDALLOC=Y,          /* DYNAMIC ALLOCATION FOR IC DS */
            ICBUF=50,            /* OUTPUT IMAGE COPY DS BUFFERS */
            ITKBLOAD=AII.SHKTLOAD,  /* KNOWLEDGE BASE LOADLIB    */
            ITKBSRVR=IMSTOOL,    /* KNOWLEDGE BASE SERVER        */
            VOLCNT=25,           /* OUTPUT IMAGE COPY VOL COUNT  */
            UNIT=SYSDA,          /* OUTPUT IMAGE COPY UNIT       */
            SPACE=(CYL,5,100,RLSE), /* OUTPUT IMAGE COPY SPACE   */
            RETPD=21,            /* OUTPUT IMAGE COPY RETENTION  */
            ICCAT=Y,             /* OUTPUT IMAGE COPY CATALOG    */
            ICNMRULE=N,          /* OUTPUT IMAGE COPY DSN RULE N */
            ICHLQ=IMSRES7,       /* OUTPUT IMAGE COPY HLQ 1      */
            DSN=&ICHLQ..IC.&DBD..&DDN..D&JDAY.&HOUR.&MINUTE.,
            WAITTIME=999,        /* WAIT TIME FOR TAPE DRIVES MIN*/
            WAITMSG=N            /* WTOR MESSAGE                 */
    IC DBD=DBDITEMD
//*DFSVSAMP DD  DSN=&CONTROL3(&VSAMP),DISP=SHR
//*
//ICEPRINT DD  SYSOUT=*
//DFSPRINT DD  SYSOUT=*
//SYSPRINT DD  SYSOUT=*
//SYSOUT   DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//SYSABEND DD  SYSOUT=*
//ABNLIGNR DD DUMMY
//*
//DMBDUMP  DD  SYSOUT=*
//*
//HISTORY  DD  DUMMY
```

After High Performance Image Copy execution, we listed the DBRC again and the Image Copy Needed Count is 0. This means that no Image Copy is still required. See Example 7-7.

Example 7-7 DBRC list after High Performance Image Copy execution

```
DB
 DBD=DBDITEMD                 IRLMID=*NULL        DMB#=64      TYPE=IMS
 SHARE LEVEL=3               GSGNAME=**NULL**     USID=0000000001
 AUTHORIZED USID=0000000000  RECEIVE USID=0000000000 HARD USID=0000000000
 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
```

Figure 7-8 and Figure 7-9 on page 158 show that the database DBDITEMD has no Exception message and the Space Use graphics with the new allocation after Reorg.

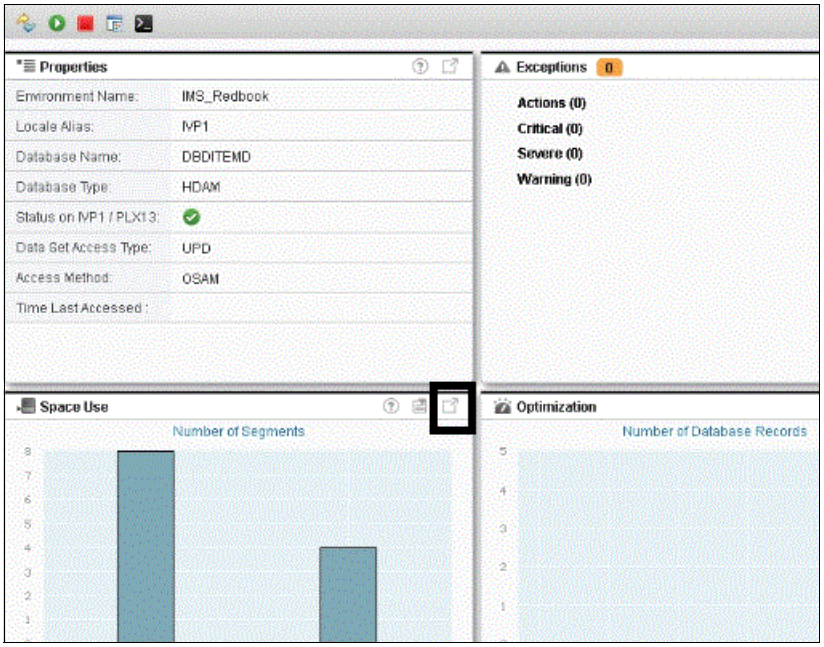

Figure 7-8 DBDITEMD Display after Smart Reorg

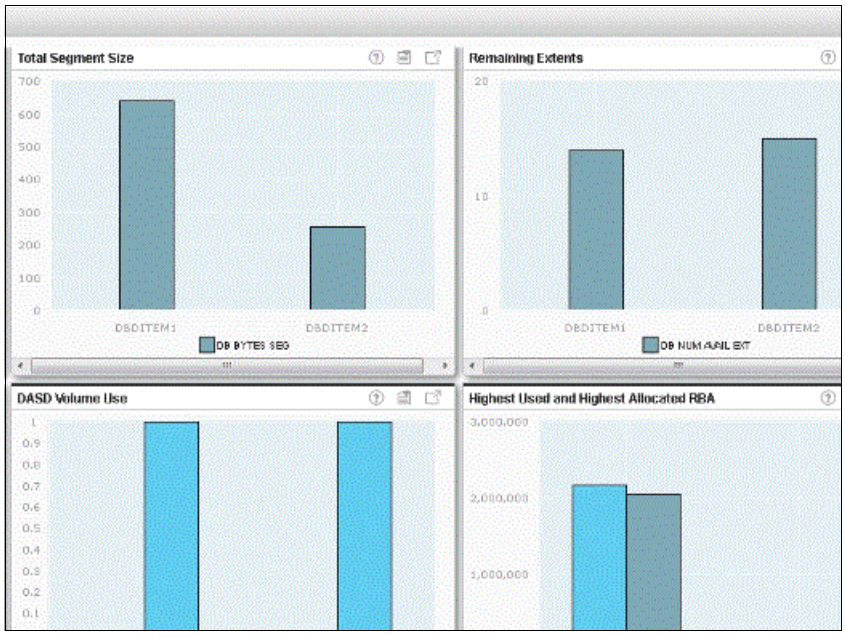

Figure 7-9 Space Use graphics after Smart Reorg

The Remaining Extents pane shows the data set group DBDITEM1 with 14 available extents.

Example 7-8 and Example 7-9 provide the new space allocations for DBDITEM1 and DBDITEM2.

Example 7-8 DBDITEM1 data set allocation after reorganization

```
Data Set Name . . . . : IMS13X.IMS13.DBDITEM1

General Data                            Current Allocation
 Management class . . : **None**         Allocated tracks  . : 44
 Storage class  . . . : **None**         Allocated extents . : 2
  Volume serial . . . : TST071
  Device type . . . . : 3390
 Data class . . . . . : **None**
  Organization  . . . : PS              Current Utilization
  Record format . . . : FBS              Used tracks . . . . : 42
  Record length . . . : 4096             Used extents  . . . : 2
  Block size  . . . . : 4096
  1st extent tracks . : 40
  Secondary tracks  . : 4               Dates
  Data set name type  :                  Creation date . . . : 2014/08/29
                                         Referenced date . . : 2014/08/29
                                         Expiration date . . : ***None***
  SMS Compressible  . : NO
```

Example 7-9 DBDITEM2 Dataset Space allocation after Reorganization

```
Data Set Name . . . . : IMS13X.IMS13.DBDITEM2

General Data                            Current Allocation
 Management class . . : **None**         Allocated tracks  . : 5
 Storage class  . . . : **None**         Allocated extents . : 1
  Volume serial . . . : TST070
```

```
 Device type . . . . : 3390
Data class . . . . . : **None**
 Organization  . . . : PS             Current Utilization
 Record format . . . : FBS             Used tracks . . . . : 1
 Record length . . . : 4096            Used extents  . . . : 1
 Block size  . . . . : 4096
 1st extent tracks . : 5
 Secondary tracks  . : 1              Dates
 Data set name type  :                 Creation date . . . : 2014/08/29
                                       Referenced date . . : 2014/08/29
                                       Expiration date . . : ***None***
 SMS Compressible  . : NO
```

7.3 Using IBM Management Console for IMS and DB2 for z/OS to manage transaction or program status

Besides troubleshooting databases problems, IBM Management Console for IMS and DB2 for z/OS can also be used to troubleshoot problems with transactions and programs.

In this scenario, one of your applications recently migrated to a new release and users are complaining about problems with transactions ORD1 and ORD2 not running. Instead of using your Personal Communications to get into ISPF to check the problem, we are going to use the Management Console to find out the root cause, and if necessary use the ISPF.

Go to the Management Console website, select Environment, select your IMS, and then change the resource type to Transactions, as shown in Figure 7-10.

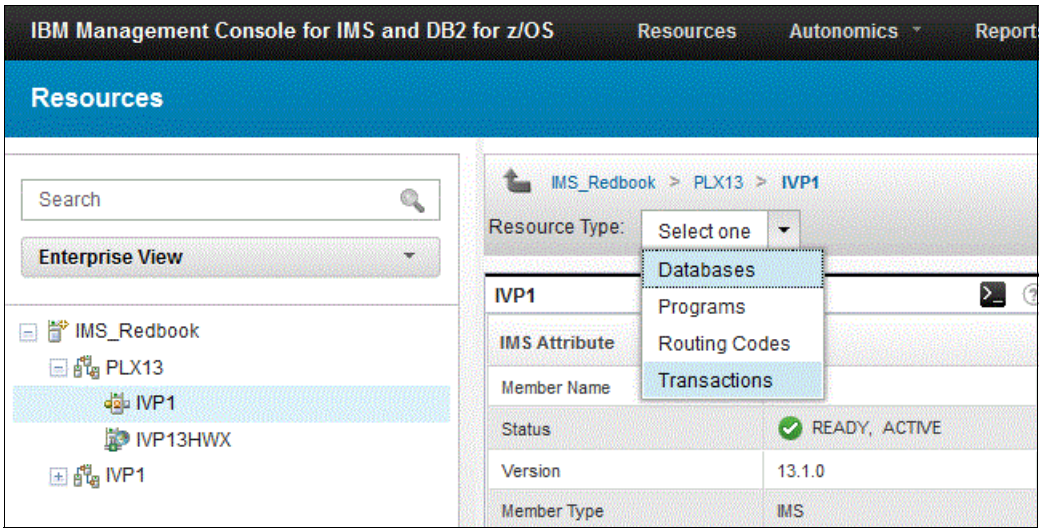

Figure 7-10 Selecting different resource types

When the page with all the transactions is loaded, your shop probably has many transactions defined, so it might be a good idea to create a filter to see only those transactions that belong to the application having problem. To create a filter, click the icon with three little arrows pointing to the right, as shown in Figure 7-11 on page 160.

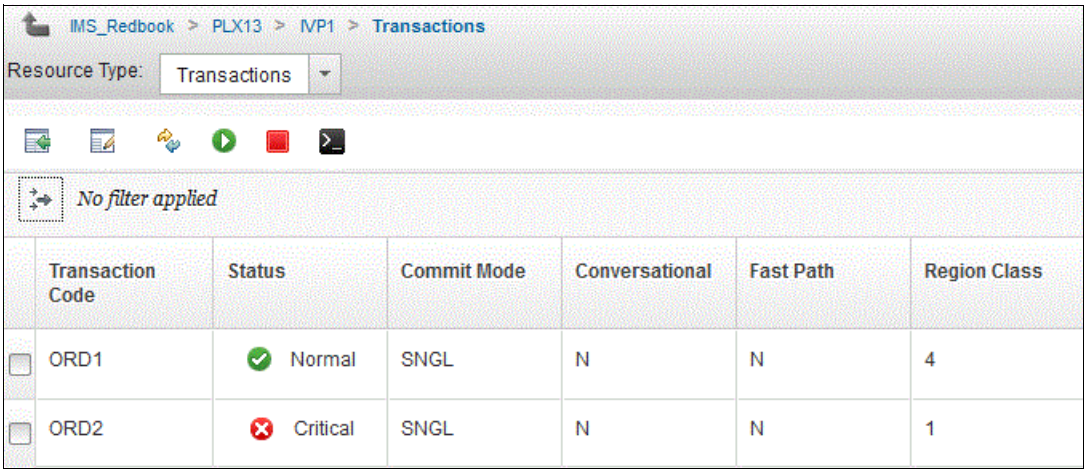

Figure 7-11 Creating filters

Different filters can be created and multiple filters can be applied at the same time. Figure 7-12, Figure 7-13, and Figure 7-14 show different kinds of filters that you might want to apply depending on which kind of problem your application might have.

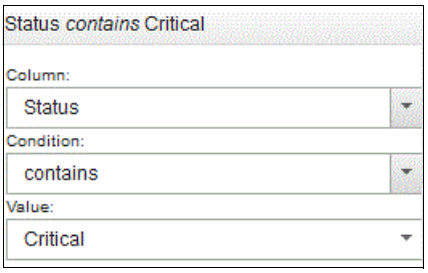

Figure 7-12 Transactions in critical status

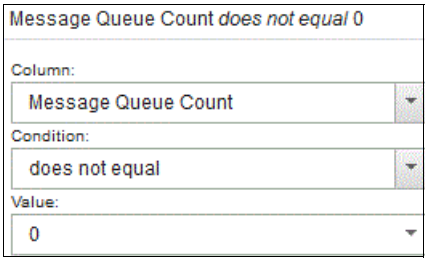

Figure 7-13 Transactions with msg queue count not equal to 0

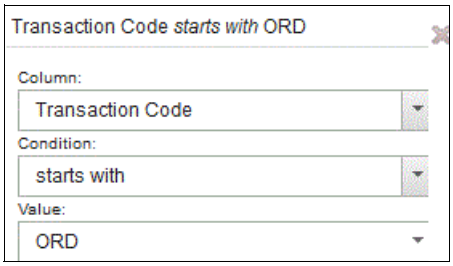

Figure 7-14 All the transactions starting with ORD

According to Figure 7-11 on page 160, transaction ORD1 does not seem to have problems because the status is green and normal but the problem can be in the program, not in the transaction. Double-click ORD1 to have access to more information about the transactions and you get Figure 7-15.

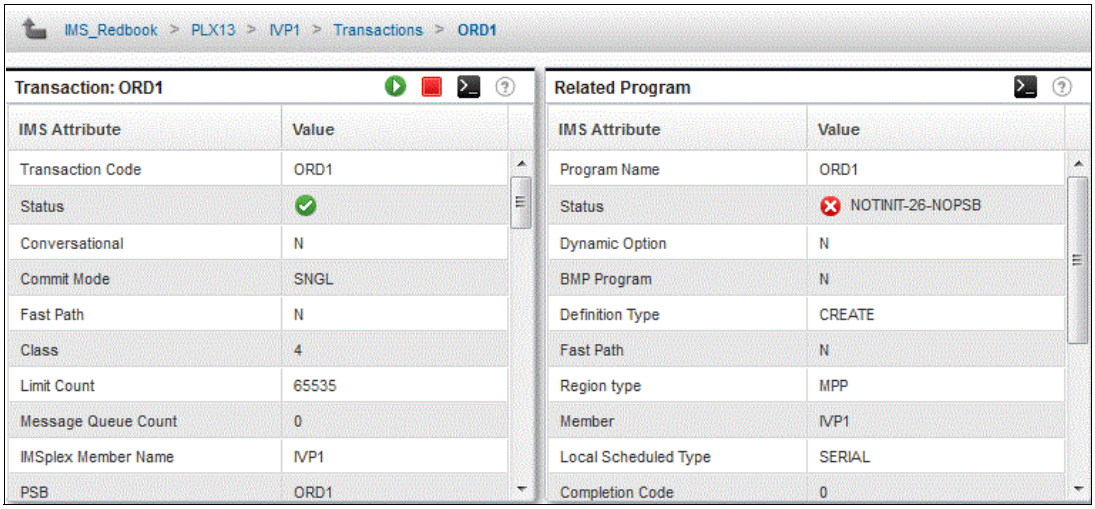

Figure 7-15 Details about ORD1 transactions

According to Figure 7-15, the problem is that the program has the same name as the transaction. The status NOTINIT-26-NOPSB means that program ORD1 has no PSB in ACBLIB. It is possible that the application team did not run an ACBGEN for this program for the new release. If only the ACB is missing, ask your application to run an ACBGEN combined with the catalog populate utility as described at 2.3, “Combined ACBGEN utility and Catalog Populate utility” on page 24.

However, if not only the ACB is missing but not even the PSB for ORD1 exist. Then, ask your application to code a new PSB using PSB creation using IMS Enterprise Suite Explorer for Development. The process is described at 2.1, “PSB creation using IMS Enterprise Suite Explorer for Development” on page 14, and then run an ACBGEN.

When the ACBGEN and the PSBGEN are complete, the status of the program in the Management Console gets changed to green, as shown in Figure 7-16.

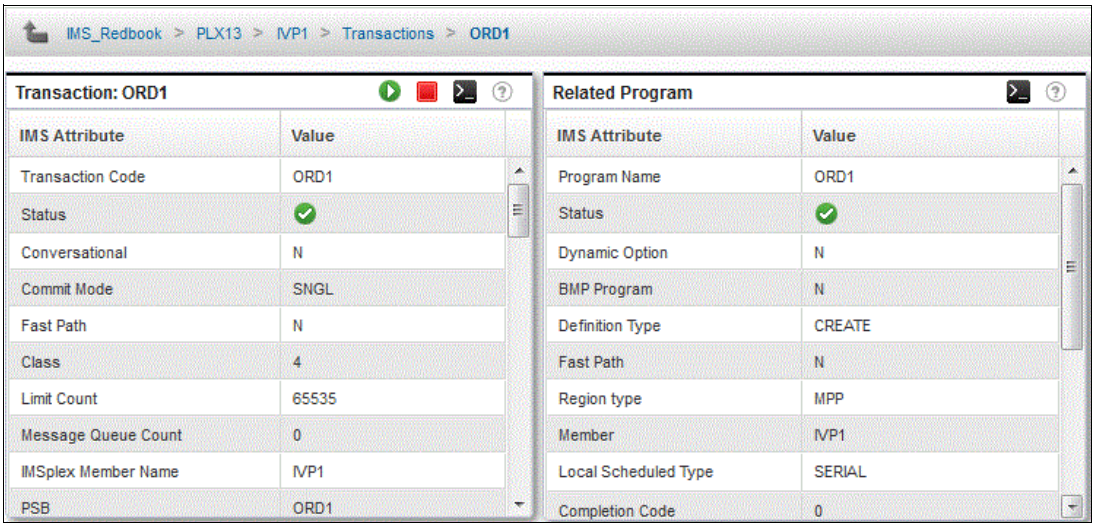

Figure 7-16 Management Console showing ORD1 program green status

Now look at transaction ORD2. According to Figure 7-11 on page 160, the status of ORD2 is critical with a red X icon. Double-click the transaction and the details about ORD2 are loaded.

As you see in Figure 7-17, the only problem with the transaction is that someone issued a type 2 command “CMD(UPDATE TRAN NAME(ORD2) STOP(Q,SCHD)) ROUTE(IVP1)” to prevent ORD2 to be scheduled to run and to enqueue messages to be processed.

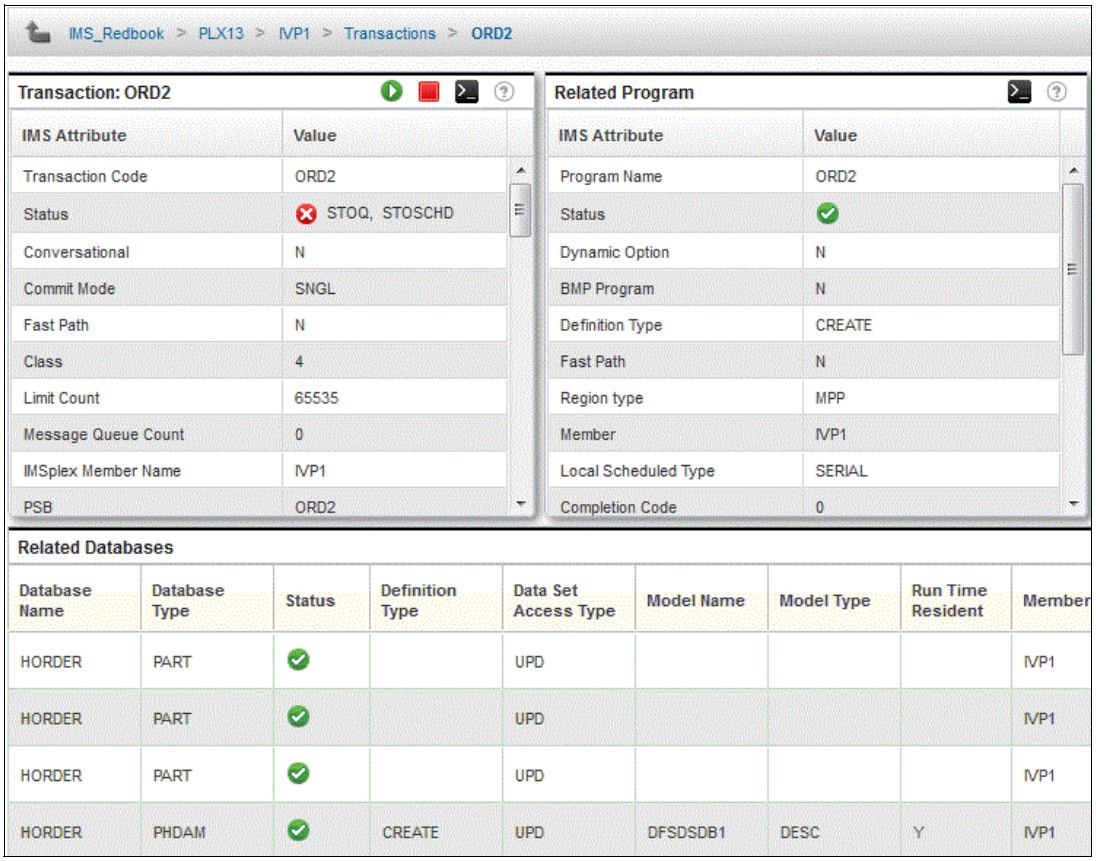

Figure 7-17 Details about transaction ORD2

Click the round and green button with a white triangle in the middle at the right top side of the transaction detail box to start the transaction. A pop-up menu appears just like Figure 7-18 on page 163 asking which commands you want to include in the UPDATE type 2 command.

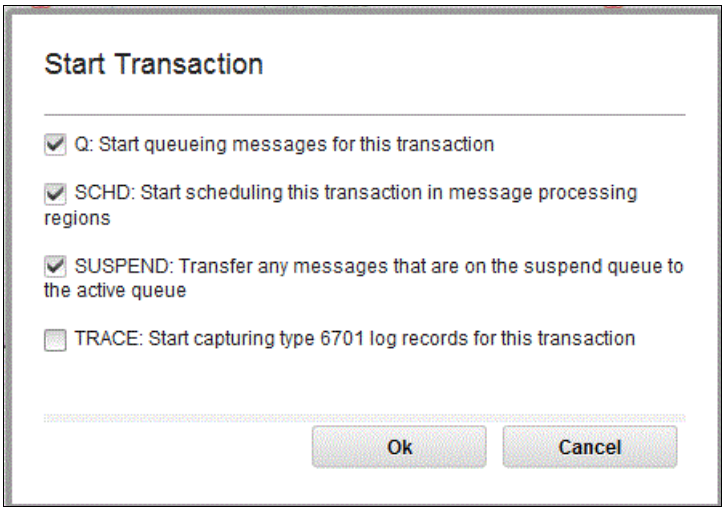

Figure 7-18 Starting a transaction using the Management Console

Select Q, SCHD, and SUSPEND to notify the IMS that ORD2 is available for scheduling to start enqueuing messages and to transfer messages that were on the suspended queue to the short or long message queues. Click **OK** to issue the command and the transaction looks like Figure 7-19 once the **`UPDATE`** command is issued.

Figure 7-19 Transaction started using Management Console

You notify your application team to test ORD2 transaction again but they say they made a mistake with the stage1 source and coded the transaction to run under class 4 when it should be on class 1. To fix the class problems, we use the Management Console again to assign the transaction to class 4.

In Figure 7-19, you see a black icon that resembles a Microsoft command on the upper right corner of transaction details. The Management Console takes you to a web interface to issue IMS commands. To update the transaction class using type 2 commands, type “UPDATE TRAN NAME(ORD2) CLASS(4) SET(CLASS(1))” in the IM command box just like the example on Figure 7-20 on page 164 and click **Submit**.

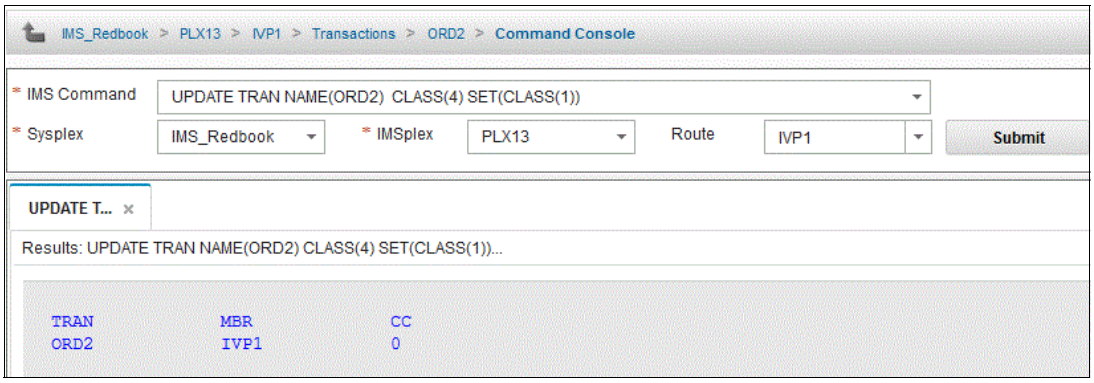

Figure 7-20 Updating the class of ORD2 transaction using Management Console

To double-check if the class was changed, issue command “QUERY TRAN NAME(ORD2) SHOW(CLASS)” and the response shows the LCLS = 1.

In this example, IMS IVP1 has AUTOEXPORT=AUTO set in member DFSDFxxx in the IMS proclib so the change made to the class is permanent. If your shop does not take the advantages of auto export to RDDS, the change made to ORD2 transaction will go away on the next cold start.

A

Referenced IMS tools

This appendix lists and briefly describes the IMS tools used during this project:

- IBM IMS Enterprise Suite Explorer for Development
- IBM IMS Recovery Expert
- IBM IMS Database Recovery Facility for z/OS
- IBM IMS Configuration Manager for z/OS
- IBM IMS Cloning Tool for z/OS
- IBM Management Console for IMS and DB2 for z/OS V1.1
- IMS Database Solution Pack

For a more general introduction to IMS tools, see Chapter 12 “IMS tools” of *IMS 13 Technical Overview*, SG24-8224, and the website DB2 and IMS Tools for System z at http://www.ibm.com/software/data/db2imstools and the IBM Knowledge Center at http://www-01.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.rpg/ims_coex_over.htm

A.1 IBM IMS Enterprise Suite Explorer for Development

The IMS Enterprise Suite Explorer for Development (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. IMS Enterprise Suite Version 3.1.1 components, including IMS Explorer, are available to IMS Version 11 and later customers, at no additional cost.

Use the IMS Explorer graphical editors to import, visualize, and edit IMS database and program definitions. You can also use the IMS Explorer to access and manipulate data stored in IMS by using standard SQL.

The IMS Explorer supports all IMS database types, and also supports secondary indexes and logical relationships.

IMS Explorer runs on Windows systems and supports cross-product integration (shell-sharing) with the following products:

- IBM Rational Developer for System z
- IBM Data Studio
- IBM Problem Determination Tools Plug-ins for Eclipse
- IBM Explorer for z/OS
- IBM CICS Explorer® Software Development Kit (SDK)
- IBM Rational Team Concert™

IMS Explorer for Development provides enhanced support over most DLIModel utility plug-in functions and it functionally replaces it.

We provide sample DBA scenarios using this tool in Chapter 2, “Defining a PSB” on page 13.

A.2 IBM IMS Recovery Expert

IBM IMS Recovery Expert (program number: 5655-S98) is a storage-aware backup and recovery solution, integrating storage processor fast-replication facilities with backup and recovery operations.

IMS Recovery Expert allows instantaneous backups with no application downtime, reduced recovery time, and simplified disaster recovery procedures while using less CPU, I/O, and storage resources. IMS Recovery Expert validates backups to ensure that all data has a backup and that it is recoverable.

IMS Recovery Expert has integrated Intelligent Recovery and Disaster Recovery Managers that analyze recovery assets and establish optimal recovery procedures to minimize recovery time and recovery point objectives. Recovery jobs are tailored specifically to available backup and hardware resources.

Intelligent Recovery Manager performs efficient local recoveries using available recovery resources:

- Analyzes recovery assets and establishes optimal recovery procedures to minimize recovery time and recovery point objectives.
- Fast restore and parallel recovery (log apply) reduces recovery time and complexity.
- Recovery jobs are tailored specifically to available backup and hardware resources.
- Performs coordinated application recovery with DB2 Recovery Expert for z/OS.

Intelligent Disaster Recovery Manager performs the following:

- Uses local site procedures to prepare for offsite disaster recovery or disaster restart.
- Performs intelligent remote site restore operations and appropriate recovery or restart procedures.
- Reduces recovery time objectives by transforming disaster recovery into a disaster restart process.
- Performs coordinated disaster recovery with DB2 Recovery Expert for z/OS.

IMS Recovery Expert supports IBM, EMC, and Hitachi Data Systems fast-replication services.

We provide sample DBA scenarios using this tool in Chapter 3, “Setting up recovery” on page 37, and Chapter 5, “Cloning IMS databases” on page 93.

A.3 IBM IMS Database Recovery Facility for z/OS

IMS Database Recovery Facility (program number 5655-N47) increases availability by applying database changes to multiple database data sets simultaneously.

IMS Database Recovery Facility recovers database data sets and fast path areas quickly, increasing database availability by reducing recovery time:

- Creates image copy data sets during the recovery process eliminating the need to follow recovery with a separate image copy.
- Creates index data sets during recovery, including primary, secondary, and HALDB index list data sets, eliminating the need to follow recovery with a separate index build.
- Validates data during the recovery process eliminating the need to follow recovery with a separate validation procedure.
- Allows creation of cloned copies of the database that can be used for application program testing, audit, and database recovery.

IMS Database Recovery Facility is also included in the IMS Recovery Solution Pack (program number 5655-V86), which bundles the following tools:

- IMS Database Recovery Facility
- IMS Database Recovery Facility: Extended Functions
- IMS High Performance Change Accumulation Utility for z/OS
- IBM IMS Index Builder for z/OS
- IBM IMS High Performance Image Copy for z/OS

We provide sample DBA scenarios using this tool in Chapter 3, “Setting up recovery” on page 37, and Chapter 5, “Cloning IMS databases” on page 93.

A.4 IBM IMS Configuration Manager for z/OS

The IMS Configuration Manager for z/OS, V2.1 tool (program number 5655-WR2) is a configuration management tool that you can use to analyze, modify, and deploy IMS resources and parameters.

IMS Configuration Manager makes changing resources and parameters quicker, easier, and more reliable. IMS Configuration Manager builds on the dynamic resource definition (DRD)

process by combining DRD with the ability to work with resources offline, apply change control processes, and annotate resource definitions.

IMS Configuration Manager consists of an ISPF dialog for editing resources and parameters, a graphical user interface for viewing resources and managing systems, a repository, and batch utilities that help you integrate IMS Configuration Manager into your existing change control practices. IMS Configuration Manager itself requires minimal configuration to set up, and provides an easy-to-use approach for creating and maintaining IMS system parameters and using DRD functions.

The main functions are:

- Provides support to transition to DRD
- Validates settings helping prevent errors in definitions
- Logs changes and provides backout facility
- Upgrades parameters, automatically easing migration from one IMS version to the next
- Provides for deployment of changes to dozens of global sites from a single location

We provide sample DBA scenarios using this tool in Chapter 4, “Configuring IMS” on page 69.

A.5 IBM IMS Cloning Tool for z/OS

IBM IMS Cloning Tool for z/OS, V1.2 (program number 5655-U91) makes it easy for you to quickly clone IMS subsystems and databases in order to increase data availability. By employing fast copy technology combined with automation and by eliminating manual efforts, IMS Cloning Tool will help to increase productivity and significantly reduce production online downtime and the costs associated with creating an exact copy or cloning an IMS subsystem and database.

By augmenting any volume-level or data-set-level fast replication tool or on-site mirroring tool, IMS Cloning Tool can quickly clone an IMS subsystem while the subsystem is offline (while IMS is stopped and started) or online (IMS is suspended and resumed), increasing the availability of IMS data. After the clone is created, the IMS data sets are conditioned so that the source subsystem and the subsystem clone can be accessed from the same z/OS image.

Every hardware vendor and some software vendors use replication products to create replicas of data. However, these products rarely rename and catalog the data sets on the target volumes to produce usable clones that can be quickly accessed. IMS Cloning Tool can leverage fast-replication tools or on site mirroring tools to create the clones and then “condition” the IMS data sets on the target to allow the IMS clone data to be accessed.

IMS Cloning Tool assumes that both the source and target volumes will be accessed from the same z/OS image by using the same ICF master catalog. To enable access to the data sets on the target volumes (clone volumes), the target data sets are renamed and cataloged. The customer is responsible for ensuring that the volume serial numbers (VOLSERs) of the source and target volumes are unique.

The target volumes are exact replicas of the source volumes except for the volume label. To create these replicas, IMS Cloning Tool leverages the available fast-replication and on site mirroring tools.

To create the copy, IMS Cloning Tool automatically initiates IBM FlashCopy® or STK SnapShot by using the DFSMSdss ADRDSSU program. If another copy tool is used, it must be run before IMS Cloning Tool.

After the copy is created, IMS Cloning Tool renames and catalogs the data sets on the target volumes, fixes the volume internals, and updates the IMS internals. This processing enables you to access the source and target volumes from the same z/OS image.

IMS Cloning Tool provides a significant improvement over the existing manual methods of creating usable clones. It can clone entire IMS subsystems while the subsystems are in offline or online mode, and solves the dilemma of meeting critical time constraints on the IMS cloning window. IMS Cloning Tool is designed to minimize the amount of time that is required to rename and catalog target-volume data sets.

IMS Cloning Tool can be used to perform the following tasks:

- Clone entire IMS subsystems or refresh databases quickly
- Clone databases on the same LPAR without manually updating data set and volume names
- Copy production data for testing purposes

We provide sample DBA scenarios using this tool in Chapter 5, “Cloning IMS databases” on page 93.

A.6 IBM Management Console for IMS and DB2 for z/OS V1.1

IBM Management Console for IMS and DB2 for z/OS V1.1 (Management Console) is an application server that consolidates key IMS and DB2 information into a single, intuitive, graphical web interface. This interface is used on a client to connect to different IMS and DB2 Tools and IBM Tools Base for z/OS components. Management Console can accelerate your analysis of your IMS environment and reduce the need for advanced IMS skills.

You can use Management Console to manage automated database evaluations and monitor IMS environments across an enterprise. You can view aggregate statistics for groups of IMS resources and detailed information for individual IMS resources. You can use this information to identify databases that require your attention and to prevent problems.

The information in Management Console is gathered from various sources, including IBM Tools Base for z/OS components, other IMS Tools products, IMS Operations Manager, and other sources.

Management Console provides solutions for database administration and monitoring challenges.

Management Console integrates with many IMS and DB2 Tools products and IBM Tools Base for z/OS components to consolidate different pieces of information into one interface.

Extensions from other products provide enhancements to Management Console.

After the SMP/E installation of IBM Tools Base for z/OS (Tools Base) is complete, the application server for Management Console for z/OS can be installed on Windows or z/OS. Management Console can then connect to various IMS and DB2 Tools products and Tools Base components through a Secure Sockets Layer (SSL) TCP/IP connection through IBM Tools Base Distributed Access Infrastructure for z/OS (Distributed Access Infrastructure).

Only authorized users can use Management Console for z/OS to access z/OS systems through IBM Tools Base Distributed Access Infrastructure for z/OS (Distributed Access Infrastructure). Management Console also provides secure communication between distributed clients and the z/OS systems that they are connected to.

We provide sample DBA scenarios using this tool in Chapter 7, “Health management for IMSplex” on page 143.

A.7 IMS Database Solution Pack

IBM IMS Database Solution Pack for z/OS (program number 5655-DSP) enables your organization to manage IMS full function and high availability large databases (HALDBs) in one solution. It integrates all IMS database software and offers features to help ensure that your databases are tuned and operational. The solution pack helps reduce operational complexity and the impact of database reorganization on your system resources.

IMS Database Solution Pack provides the following features and benefits:

- Offers high performance utilities to unload, load, index build, reorganize, backup, verify, and report on your IMS Full Function and HALDB databases.
- Uses an autonomics director to help you manage the functions associated with maintaining the health, performance, and recoverability of IMS Full Function and HALDB databases.
- Extends the capabilities of the Management Console by using a simpler web interface, which provides detailed insight into the health and availability of your IMS Full Function and HALDB databases.
- Runs load, unload, index building, and image copy tasks concurrently to improve reorganization efficiency.
- Offers high speed unloading and prefix resolution for logically related databases.
- Using advanced copy technology provides fast backup and recovery of your data sets.

The products included in this solution pack are:

- IMS Online Reorganization Facility
- IMS High Availability Large Database (HALDB) Toolkit
- IBM IMS Database Solution Pack for z/OS: Database Sensor
- IBM IMS Database Reorganization Expert for z/OS
- IBM IMS High Performance Unload for z/OS
- IBM IMS High Performance Load for z/OS
- IBM IMS High Performance Prefix Resolution for z/OS
- IBM IMS Index Builder for z/OS
- IBM IMS High Performance Image Copy for z/OS
- IBM IMS Library Integrity Utilities for z/OS
- IBM IMS High Performance Pointer Checker for z/OS
- IBM IMS Database Repair Facility

We describe the use of IBM IMS Database Reorganization Expert for z/OS in two scenarios in 6.1, “Autonomics for database reorganization” on page 114.

High Performance Image Copy, High Performance Pointer Checker, and the High Performance Unload and Reload utilities are used to manage fragmentation and create reports stored in the IMS Tools Base Repository at 6.2, “Managing fragmentation” on page 136.

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. Note that some publications referenced in this list might be available in softcopy only.

- *IMS 13 Technical Overview,* SG24-8224
- *IMS Integration and Connectivity Across the Enterprise,* SG24-8174
- *IBM Cognos Business Intelligence 10.2.0 Reporting on IMS,* REDP-5091
- *IMS 12: The IMS Catalog,* REDP-4812-00
- *IMS 12 Selected Performance Topics,* SG24-8071
- *IBM IMS Version 12 Technical Overview,* SG24-7972

You can search for, view, download, or order these documents and other Redbooks, Redpapers, Web Docs, draft, and additional materials, at the following website:

ibm.com/redbooks

Other publications

These publications are also relevant as further information sources:

- *IMS Version 13 Application Programming,* SC19-3646
- *IMS Version 13 Communications and Connections,* SC19-3651
- *IMS Version 13 Commands, Volume 1: IMS Commands A - M,* SC19-3648
- *IMS Version 13 Commands, Volume 2: IMS Commands N - V,* SC19-3649
- *IMS Version 13 Commands, Volume 3: IMS Component and z/OS Commands,* SC19-3650
- *IMS Messages and Codes, Volume 1: DFS Messages,* GC18-9712-11
- *IMS Messages and Codes, Volume 2: Non-DFS Messages,* GC18-9713-11
- *IMS Messages and Codes, Volume 3: IMS Abend Codes,* GC18-9714-11
- *IMS Messages and Codes, Volume 4: IMS Component Codes,* GC18-9715-11
- *IMS Version 13 Database Administration,* SC19-3652
- *IMS Version 13 Diagnosis,* GC19-3654
- *IMS Version 13 Database Utilities,* SC19-3653
- *IMS Version 13 Exit Routines,* SC19-3655
- *IMS Version 13 Installation,* GC19-3656

- *IMS Version 13 Operations and Automation,* SC19-3657
- *IMS Version 13 Release Planning,* GC19-3658
- *IMS Version 13 System Definition,* GC19-3660
- *IMS Version 13 System Administration,* SC19-3659
- *IMS Version 13 System Definition,* GC19-3660
- *IMS Version 13 System Utilities,* SC19-3662
- *Program Directory for Information Management System Transaction and Database Servers V13.0*, GI10-8914
- *IBM IMS Configuration Manager for z/OS Version 2 Release 1 User's Guide,* SC19-3228
- *IBM Management Console for IMS and DB2 for z/OS, V1.1 User's Guide*, SC27-6714
- *IBM Tools Base for z/OS Version 1 Release 4 Autonomics Director User's Guide*, SC19-3765
- *IBM Tools Base for z/OS Version 1 Release 4 IMS Tools Knowledge Base User's Guide*, SC19-3768
- *IBM Tools Base for z/OS Version 1 Release 4 IMS Tools Common Services User's Guide*, SC19-3767
- *IBM Tools Base for z/OS Version 1 Release 4 Policy Services User's Guide*, SC19-3770
- *IBM Tools Base for z/OS Version 1 Release 4 Distributed Access Infrastructure User's Guide*, SC19-3771
- *IBM Tools Base for z/OS Version 1 Release 4 IMS Hardware Data Compression Extended User's Guide*, SC19-3769
- *IMS Fast Path Solution Pack for z/OS V1.3: Overview and Customization*, SC19-4009
- *IBM IMS Fast Path Solution Pack for z/OS Version 1 Release 3 IMS High Performance Fast Path Utilities User's Guide*, SC19-4010
- *IBM IMS High Performance Image Copy for z/OS Version 4 Release 2 User's Guide*, SC19-2756
- *IBM IMS Library Integrity Utilities for z/OS Version 2 Release 2 User's Guide*, SC19-3979
- *IBM IMS Database Solution Pack for z/OS Version 2 Release 1 Overview and Customization*, SC19-4007
- *IBM IMS Database Repair Facility for IMS Solution Packs User's Guide*, SC19-2916
- *IBM IMS Database Reorganization Expert for z/OS Version 4 Release 1 User's Guide*, SC19-1137
- *IBM IMS Recovery Expert User's Guide*, SC19-2473
- *IBM IMS High Performance Load for z/OS Version 2 Release 1 User's Guide*, SC18-9222
- *IBM IMS Index Builder for z/OS Version 3 Release 1 User's Guide*, SC18-9101
- *IBM IMS High Performance Unload for z/OS Version 1 Release 2 User's Guide*, SC27-0936
- *IBM IMS High Performance Load for z/OS Version 2 Release 1 User's Guide*, SC18-9222
- *IBM IMS High Performance Prefix Resolution for z/OS Version 3 Release 1 User's Guide*, SC18-9230
- *IBM IMS Index Builder for z/OS Version 3 Release 1 User's Guide*, SC18-9101
- *IBM IMS High Performance Pointer Checker for z/OS Version 3 Release 1 User's Guide*, SC19-2401

- *IBM IMS Database Solution Pack for z/OS Version 2 Release 1 IMS High Availability Large Database Toolkit User's Guide*, SC19-4102
- *IBM IMS Database Solution Pack for z/OS Version 2 Release 1 IMS Online Reorganization Facility User's Guide*, SC19-4103
- *IBM Tools Base for z/OS Version 1 Release 4 IMS Tools Common Services User's Guide*, SC19-3767
- *IBM IMS Recovery Solution Pack for z/OS Version 1 Release 1 IMS Database Recovery Facility User's Guide and Reference*, SC19-2903
- *IBM IMS Recovery Solution Pack for z/OS Version 1 Release 1 IMS High Performance Change Accumulation Utility User's Guide*, SC19-2905

Online resources

These websites are also relevant as further information sources:

- DB2 and IMS Tools for System z

  http://www.ibm.com/software/data/db2imstools
- IBM IMS Tools

  http://www.ibm.com/software/data/db2imstools/products/ims-tools.html
- IBM Knowledge Center

  http://www-01.ibm.com/support/knowledgecenter/SSEPH2_13.1.0/com.ibm.ims13.doc.rpg/ims_coex_over.htm
- IMS Tools for z/OS Wiki

  https://w3-connections.ibm.com/wikis/home?lang=#!
- IMS Information Management Tools and IMS Version 13 Compatibility

  http://www-01.ibm.com/support/docview.wss?uid=swg21611198

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ibm.com/support

IBM Global Services

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Index

(0.2”spine)
0.17”<->0.473”
90<->249 pages

IBM IMS Solutions for Automating Database Management

Understand main DBA tasks

Follow sample processes

Apply the use of tools to simplify processes

Over the last few years, IBM IMS and IMS tools have been modernizing the interfaces to IMS and the IMS tools to bring them more in line with the current interface designs. As the mainframe software products are becoming more integrated with the Windows and mobile environments, a common approach to interfaces is becoming more relevant. The traditional 3270 interface with ISPF as the main interface is no longer the only way to do some of these processes. There is also a need to provide more of a common looking interface so the tools do not have a product-specific interface. This allows more cross product integration.

Eclipse and web-based interfaces being used in a development environment, tooling using those environments provides productivity improvements in that the interfaces are common and familiar. IMS and IMS tools developers are making use of those environments to provide tooling that will perform some of the standard DBA functions. This book will take some selected processes and show how this new tooling can be used. This will provide some productivity improvements and also provide a more familiar environment for new generations DBAs. Some of the functions normally done by DBA or console operators can now be done in this eclipse-based environment by the application developers. This means that the need to request these services from others can be eliminated.

This IBM Redbooks publication examines specific IMS DBA processes and highlights the new IMS and IMS tools features, which show an alternative way to accomplish those processes. Each chapter highlights a different area of the DBA processes like:

- PSB creation
- Starting/stopping a database in an IMS system
- Recovering a database
- Cloning a set of databases

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