SAP R/3 on DB2 UDB for OS/390: Application Servers on OS/390

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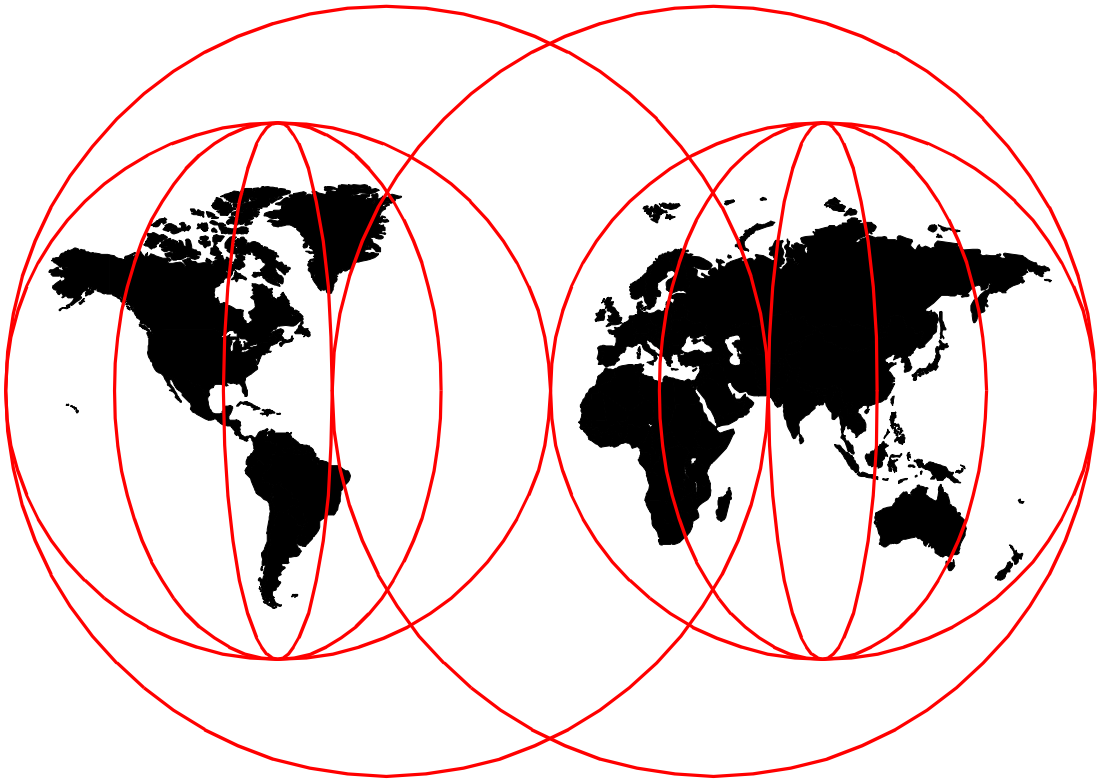

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SAP R/3 on DB2 UDB for OS/390: Application Servers on OS/390

April 2000

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix F, “Special notices” on page 127.

First Edition (April 2000)

This edition applies to SAP R/3 4.6B for use with DB2 UDB for OS/390 Version 6 (5645-DB2) as used with OS/390 Release 2.8 (5645-001); external servers use AIX 4.3.3 (5765-603) as an operating system.

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Preface

This redbook describes the installation and operation of SAP R/3 4.6B with application servers on OS/390 using DB2 UDB for OS/390 as the SAP R/3 database server. The redbook is one of a series that focus on SAP R/3 when DB2 UDB for OS/390 is used as a database server.

A large portion of the redbook is devoted to installation of the SAP product when application servers are to be on OS/390; how to use CDs from another platform to install, how to configure the software, and how to migrate from an SAP R/3 system that is using the 4.5B release.

The focus of the operations section of the redbook is on the usages of the S/390 application server in the following areas:

1. As an SAP R/3 central instance: We concentrate on how the central instance is placed on OS/390 and how to achieve operations, availability, and performance benefits in that configuration.

2. Executing SAP R/3 batch and update processes: We mainly concentrate on configuring batch application servers on OS/390. We also examine how OS/390 can provide asynchronous update processing and allow SAP R/3 installations to obtain general OS/390 benefits, as well as the benefits of being on the same processor as the database server.

3. Performing SAP R/3 printing functions on OS/390. We examine how to take advantage of OS/390 printing and spooling capabilities from SAP R/3.

The team that wrote this redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization Poughkeepsie Center.

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Chapter 1. Introduction

This chapter gives a brief overview of the architecture of SAP R/3 and how that architecture is implemented in hardware/software configurations when DB2 UDB for OS/390 is used. The rest of the chapter explains modifications to the logical structures and supporting software when application servers exist on OS/390 instead of external UNIX-managed or Windows NT-managed computers (again assuming the SAP R/3 database server is DB2 UDB for OS/390).

The chapter is similar to the introductory chapters in other redbooks in the SAP R/3 on DB2 UDB for OS/390 series. The series includes:

- *SAP R/3 on DB2 for OS/390: Implementing with AIX or Windows NT Applications Servers*, SG24-4945
- *Database Administration Experiences: SAP R/3 on DB2 for OS/390*, SG24-2078
- *High Availability Considerations: SAP R/3 on DB2 for OS/390*, SG24-2003
- *SAP R/3 on DB2 for OS/390: Disaster Recovery*, SG24-5343

Much of the new material in this chapter is taken from two papers:

1. *R/3 System SAP R/3 on OS/390* by Roland Keller from SAP AG, available at the following Web site: www.s390.ibm.com/sap/
2. Presentation material *SAP R/3 on DB2 for OS/390 Application Server on OS/390* by Wolfgang Reichert of the Joint SAP & IBM development team.

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1.1 SAP R/3 design

SAP R/3 includes a suite of client/server data processing products that is based on the concept of combining all the business activities and technical processes of a company into a single, integrated software solution.

The power of SAP software lies in *real-time integration*, linking a company's business processes and applications, and supporting immediate responses to change throughout the organization - on a departmental, divisional, or global scale.

Its applications cover a wide variety of areas, including financial, asset management, controlling, production planning, project system, quality assurance, and human resources.

1.1.1 SAP R/3 architecture

SAP R/3 is designed around software services rather than hardware platforms. Note the distinction between software services, which logically have no dependency on hardware; and servers, which are machines.

There are three categories of services:

- Presentation Services: SAP R/3 graphical interfaces on Windows, OS/2, or MAC platforms. There are also interfaces that are Web-based and others that are Java-based.

- Application Services: SAP R/3 application logic running on one or more systems, including batch and interactive SAP programs. SAP R/3 also provides monitoring utilities.
- Database Services: Vendor-provided database systems. SAP R/3 uses the database systems to store data from various application servers.

An application service is designed and implemented in layers isolating the SAP R/3 application logic from the operating system-dependent services. A middleware layer, called the *basis layer,* communicates with the operating system and the network.

Figure 1 illustrates the layering of the application service.

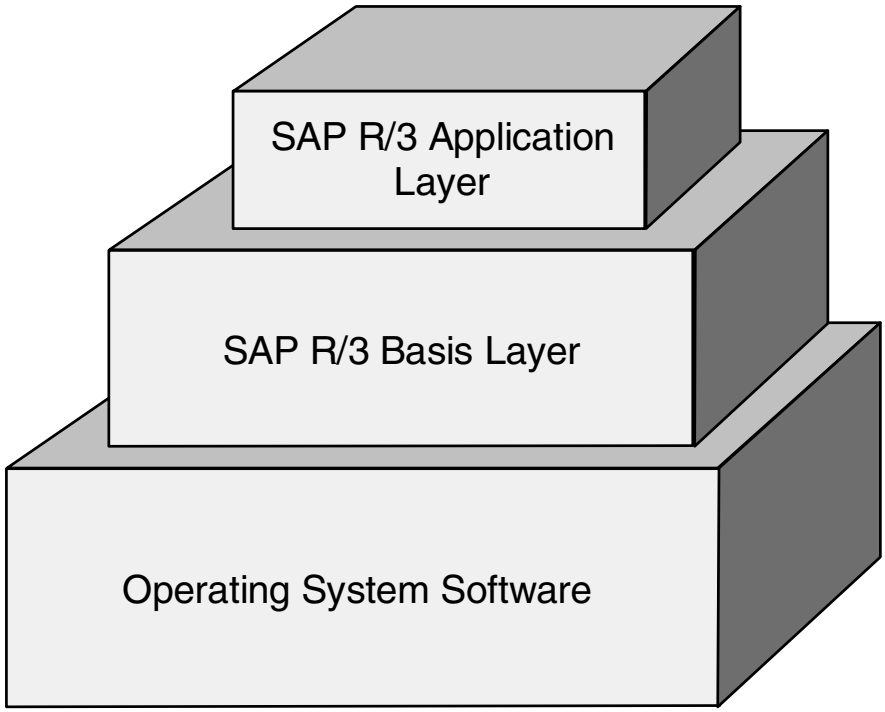

Figure 1. SAP R/3 basis and application layers

The client/server architecture employed by SAP R/3 removes many configuration details about the network and individual machines in use by SAP R/3 from administration tasks. In addition, SAP has been careful to implement this architecture at the level of work items and services. An application task can be scheduled on any application server within the same SAP R/3 system. Further, this application task can use services from the server it is on and from other servers in the SAP system. The SAP R/3 system routes requests to the appropriate server.

Applications services are provided by administrative units called *instances* that group together components of SAP R/3. When first installed, the SAP R/3 system has a *central instance* (CI), which has services such as dialog, update, enqueue, batch, message, gateway, and spool. After installation, some of these services can be moved or replicated to other application servers in order to balance workloads.

This architecture allows a more dynamic approach to managing workloads, because customers can organize their SAP R/3 systems into *tiers*. Some installations have the application services, database service, and presentation service on the same machine. This is a *single-tier* system. Usually, though, the presentation service is moved to workstations, making the SAP R/3 system a *two-tier* system. Other installations wish to optimize database performance; they place the database service on a system separate from the other services. This is a *three-tier* system.

Figure 2 illustrates the three-tiered architecture of SAP R/3.

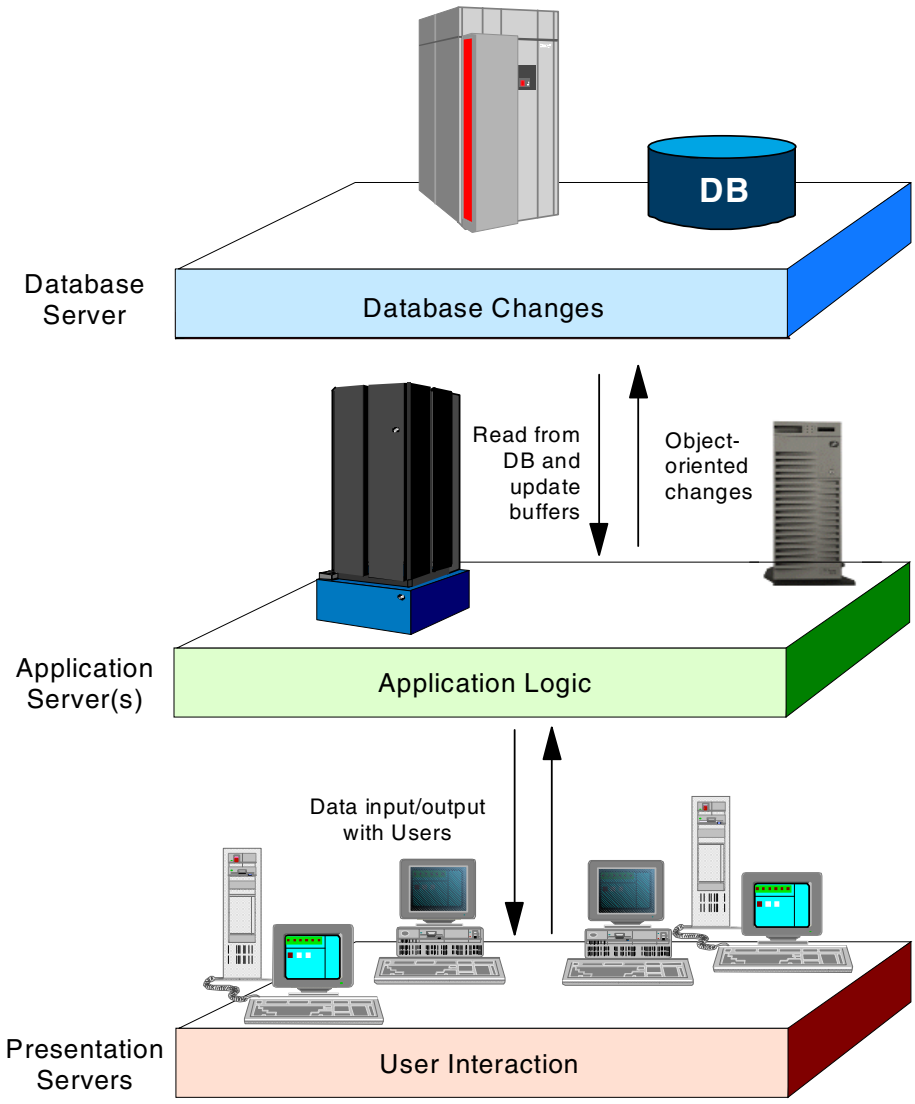

Figure 2. SAP R/3 three-tiered architecture

SAP R/3 customers can use SAP-supplied utilities to add more machines for application and presentation services to the existing SAP R/3 system. Thus, SAP R/3 can support centralized or decentralized computing with its distributed client/server architecture.

This architecture is implemented with a group of services designed to provide simple, consistent interfaces to SAP R/3 programs and support the largest possible number of operating systems,

1.1.2 Application server processes

This redbook is focused on application servers on OS/390. In later chapters we discuss specifics of that implementation. Therefore, we provide the following explanation so readers will understand the basics of how application servers function.

Early implementations of SAP R/3 used UNIX platforms as application servers. Within those platforms, the units for dispatching work are called *processes;* these are similar to OS/390 tasks or Windows NT tasks, if you are more familiar with those systems. When SAP R/3 designers categorized the units that perform application server work, the units were called processes because they were implemented as processes on the platforms where they operated.

The application server processes are given specific functions in an SAP R/3 installation. The processes have the following functions:

dispatcher Processing requests from SAP R/3 end users, those from the SAPGUI presentation level, and those received from external interfaces are routed here. They are then passed to functional SAP R/3 applications for further processing.

dialog Functional SAP R/3 applications execute in these processes, communicating directly (using the SAPGUI presentation layer) with online SAP R/3 end users. Dialog processes also perform the work required by remote function call (RFC) requests.

update SAP R/3 end-user requests for updates to the SAP R/3 database are processed here asynchronously to the batch or dialog work processes. This allows end users to continue their dialogs with SAP R/3 applications without waiting for the completion of updates.

batch Pre-defined SAP R/3 processes are executed separately from SAP R/3 end-user dialogs. Requests for updates to the SAP R/3 database are, like dialog processes, handled asynchronously by update processes.

spool The spool work process is in charge of formatting the data for printing and passing it to the host spool system. It is also responsible for querying the status of an output request which has been handed over to the host spool system, and for updating its status within R/3.

The spool requests are generated during dialog or background processing and are held in the spool database. When data is to be printed for a spool job, an output request is generated and is handled by the spool work process. Once the spool work process has formatted the data for printing, it sends a print request to the operating system.

message This process is responsible for communications between SAP R/3 application servers. It routes messages between application servers and is also used for license checking and workload balancing, together with the SAP logon utility. If several application servers are allocated to an SAP R/3 application, the communication mechanism

insures that SAP R/3 end users are assigned to the server with the most available capacity.

enqueue This process uses locking logic to guarantee the SAP R/3 database is consistent as viewed from the business process level. Consistency is assured even if the database management system (DBMS) has no guaranteed consistency logic. There is only one enqueue server in an SAP R/3 instance.

gateway This process is used when some application servers are not directly linked to the SAP R/3 database server. Gateway processes perform routing functions to provide multi-hop paths to the database server.

Because the work the application server processes perform relates to specific functions, some of the processes benefit to a greater degree when placed on OS/390. Note also that dialog and batch processes contain the logic required for user business functions, whether written by SAP, a customer, or an SAP partner. Some of these processes contain platform-specific instructions, so they *cannot* be moved to OS/390 until those functions are updated. If you wish to place these processes on OS/390, you should contact your SAP representative to determine whether the necessary processes are supported there.

1.2 SAP R/3 on DB2 UDB for OS/390 structure

This section provides more detail on the modular structure of an installation of SAP R/3 when DB2 UDB for OS/390 is used to provide database services. The components of that structure are somewhat different if external application servers are used than if an application server resides on OS/390. We also show the structure when both types of application server are present in an installation; we believe this will be the case for most installations of SAP R/3 when the database server is DB2 UDB for OS/390.

1.2.1 Structure with external application servers

As can be seen in Figure 3, the implementation of SAP R/3 on DB2 UDB for OS/390 with external application servers uses a three-tier structure. Presentation services are on workstation platforms composed of one of a variety of hardware and operating system types. Presentation servers are connected to application servers; those application servers use AIX, Windows NT, or Sun Solaris as an operating system.

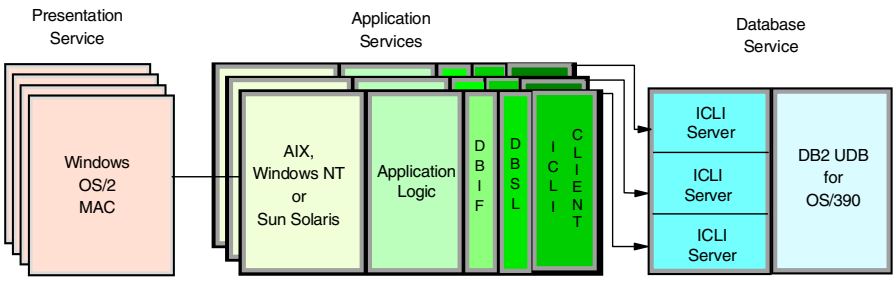

Figure 3. SAP R/3 structure on DB2 UDB for OS/390 - external application servers

Within each application server, application logic is found. When that logic determines that database services are necessary, communications to support

logic called the Database Interface (DBIF) is performed. Among other functions, the DBIF determines whether the application's Structured Query Language (SQL) must be simplified before being transmitted to database services. DBIF then passes the user request to the Database Service Layer (DBSL).

The DBSL has the responsibility of adapting SQL to the specific requirements of a Database Management System (DBMS), in this case DB2 UDB for OS/390. In addition, the DBSL forwards the adapted SQL to the appropriate communications software.

When external application servers communicate with a DB2 UDB for OS/390 database server, client/server logic called the Integrated Call Level Interface (ICLI) is used. The client component of ICLI consists of a program that resides in a UNIX shared library or a Windows NT dynamic link library and an executable called the *Keep-Alive Executable*. The server component of ICLI is a program that uses functions of OS/390 UNIX System Services. Most installations assign one ICLI server task to each application server, although this is not a requirement.

Figure 4 on page 7 shows the relationship between the work processes discussed in "Application server processes" on page 4 and DB2 *threads* that are used to group together the DB2 logical resources (prepared statements, open cursors, locks, etc.) required for the process.

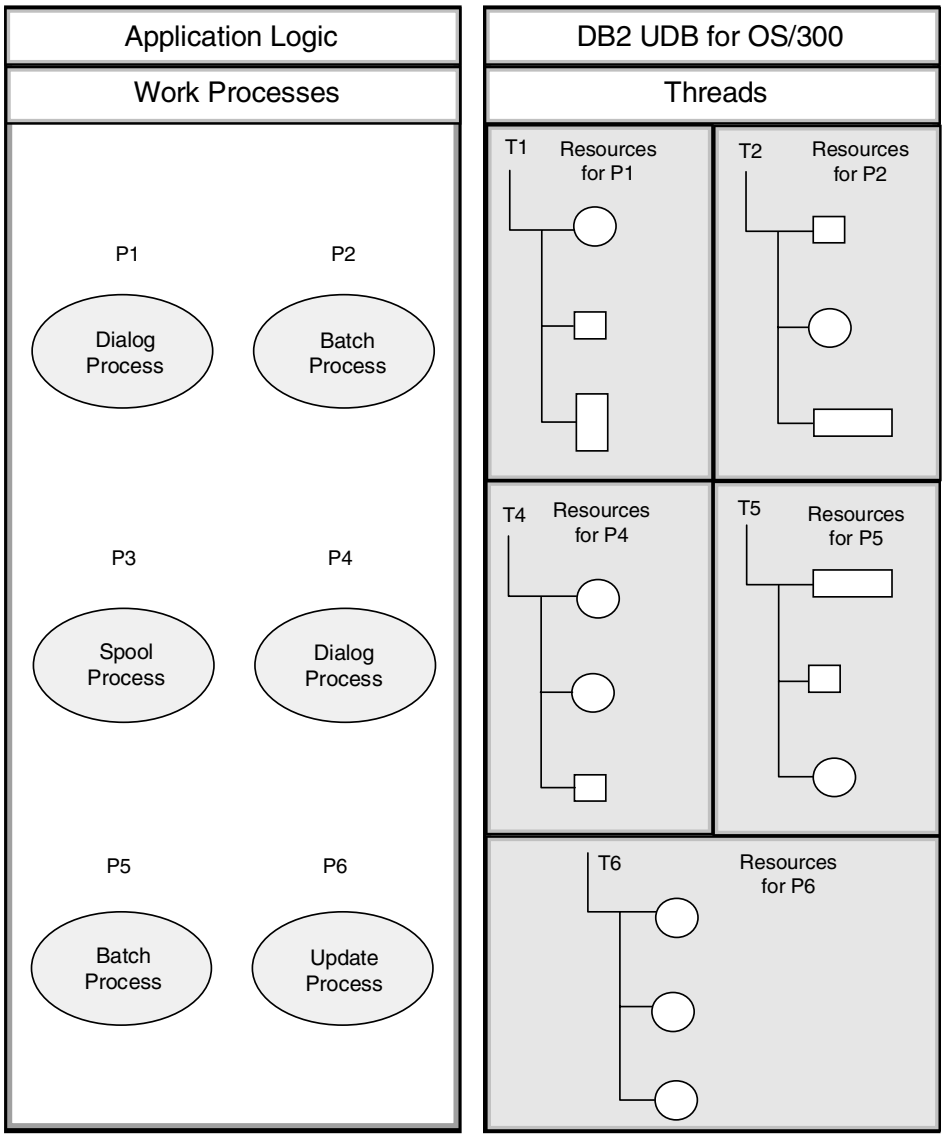

Figure 4. SAP R/3 work processes and DB2 UDB for OS/390 threads

Each work process that does database work is associated with a DB2 thread for the life of the process. (Note that Figure 4 shows no threads for P3, a spool process, even though some might exist for SAP R/3 accounting of spool activity.)

1.2.1.1 Connectivity considerations - external application servers

The connection from the SAP R/3 external application server to the SAP R/3 database server is a crucial element in the performance of the installation. In earlier versions of SAP R/3 on DB2 UDB for OS/390, there were special protocols for this connectivity. With SAP R/3 4.6, TCP/IP is the only protocol used for the ICLI client-to-ICLI server communication.

The hardware used for the connection must be capable of providing high-speed transmission with enough bandwidth to allow the transmission of the installation's required database requests and responses in the time required to meet end-user response time goals. The document, *SAP R/3 on DB2 for OS/390: Connectivity*

Guide, SC33-7965, contains recommendations for this connectivity and the connections supported by SAP AG for SAP R/3 installations.

Additional communication does take place; SAP R/3 application servers must communicate with the CI. The communication is not used nearly as heavily as from application server to database server, but TCP/IP routings must be in place to allow it.

Some installations use a secondary LAN to provide the SAP R/3 communication to the CI.

1.2.2 Structure with OS/390 UNIX System Services Application Servers

When application services are placed on OS/390, the structure of the SAP R/3 implementation changes, as shown in Figure 5.

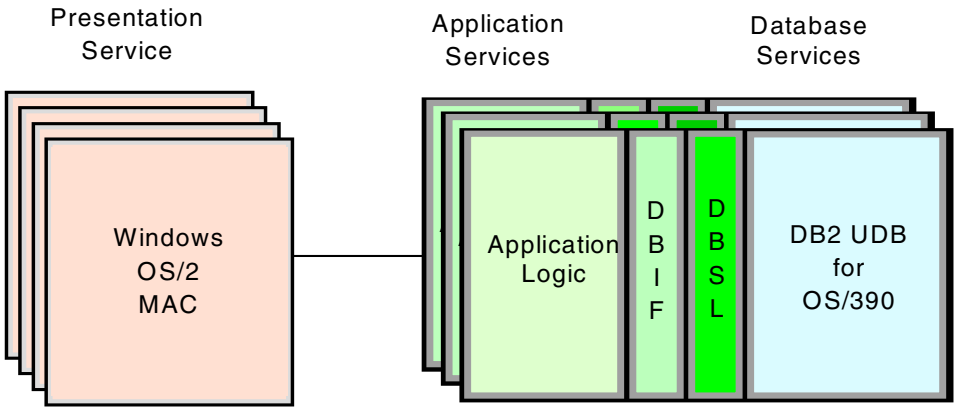

Figure 5. SAP R/3 structure on DB2 UDB for OS/390 - OS/390 Application Server

The structure no longer contains ICLI clients nor ICLI servers. This is because the DBSL uses cross-memory services (XMS), which is a supplied component of OS/390, to allow DB2 UDB for OS/390 to access the SQL.

In addition, note that a hardware connectivity element is no longer required; the physical connectivity hardware that is used for ICLI client-to-ICLI server communication is not necessary because XMS communication is used. This physical proximity to the database server is an important element in the discussion in “Which processes benefit from OS/390 placement” on page 11.

Refer to Figure 4 on page 7. The work processes found in the application server cause the creation of DB2 threads, the same as work processes from external application servers. However, now that the application server is on the same machine (or LPAR) as the database server, the DBSL directly calls the RRSAF interface of DB2 UDB for OS/390. DB2 UDB for OS/390 then uses XMS facilities without the necessity of any external hardware devices and without transmission of SQL; the copying of data occurs by moving the data directly from DB2 buffers to user buffers by DB2 service routines using access register mode, so no interprocess communication is necessary.

In terms of the architectural tiers (refer to Figure 2 on page 3), it can be seen that the application server and the database server are on the same platform, so that this could be called a two-tier structure. This is the best conceptual view, even

though the application server and the database server are in separate address spaces, because no interprocess communication is necessary, as discussed previously.

1.2.2.1 Connectivity considerations - OS/390 application servers

As has been mentioned previously, the communications from application server to database server uses XMS, so the communications protocol and the hardware required to transmit elements of the protocol are no longer necessary.

The database access (the work done within DB2 UDB for OS/390) is performed under control of the task control block (TCB) of the work process. This means that no change of process occurs for the DB2 work and much of the dispatching work for process changes is no longer necessary.

1.2.3 Structure with both types of application servers

Although the structure shown in Figure 5 on page 8 has the appeal of simplicity, an installation of SAP R/3 release 4.6 is likely to have the more complex structure shown in Figure 6. There are several reasons for this; the discussion in “Application server process placement considerations” on page 10 provides details.

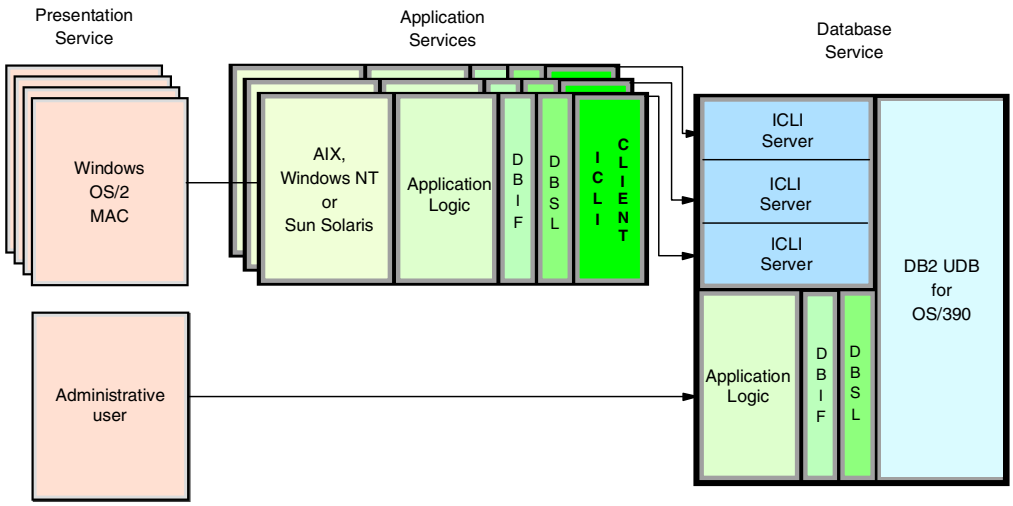

Figure 6. SAP R/3 structure on DB2 UDB for OS/390 - both types of application server

Figure 6 shows the structure of an implementation when external application servers exist along with an application server on OS/390. Most end users are connected to external application servers, so only occasionally do administrative functions require the connection to an OS/390 application server.

1.2.4 Connectivity considerations - both types of application servers

In an implementation like the one shown in Figure 6, there is another communications necessity: all SAP R/3 application servers must communicate with the SAP R/3 application server designated as the CI in order to post notifications of status changes, to indicate locking requests for database elements, or to transmit processing requests. This communication does not use ICLI, and it has different characteristics from database server requests:

- Messages are small and fixed in format.

- Processing of the messages does not have great impact on user response time.
- Handling of the messages is asynchronous with user transactions.

These characteristics imply that different hardware (such as a low-speed LAN) can be used for this communication or more paths must be defined in TCP/IP for the communication. Designers of the SAP R/3 configuration must recognize that this communication does take place, so TCP/IP routings must exist that allow all application servers access to the CI. If the CI is on OS/390, this secondary communication must also be performed, although it is possible to use the same facilities as the ICLI client/server communication.

1.3 Application server process placement considerations

As previously mentioned, most installations will have application servers on OS/390 and on external platforms. One of the reasons for having external application servers is a fixed requirement, in that some of the SAP R/3 industry applications have not (at the time of writing this redbook) been certified to execute on OS/390. For some installations, an equally important requirement is that the supporting infrastructure programs (for accounting, monitoring, billing, performance evaluation, or other functions) have not been ported to OS/390. In this section we discuss the characteristics of application server processes that make those processes good candidates for moving to OS/390.

1.3.1 OS/390 benefits for SAP R/3 application servers

Placing SAP R/3 application server processes on OS/390 would obviously gain the benefits of any operation on that platform, but there are specific areas that apply to SAP R/3 installations:

- Performance - OS/390 runs on S/390 hardware; this implies the ability to make use of some of the fastest processors available in the information technology industry, and with software organized to take advantage of those processors. SAP R/3 configurations also gain a performance advantage by being in proximity to the database server; as described in “Structure with OS/390 UNIX System Services Application Servers” on page 8, one layer of hardware connectivity is saved.
- Systems management - The management tools available for OS/390 cover a spectrum of functions necessary for any large applications structure such as SAP R/3. These functions include:
  - Operations Automation
  - Performance Reporting
  - Performance Management
  - Security Management
  - Capacity Planning
  - Operations Management
  - Change Management
  - Configuration Management
- Availability - Utilization of an OS/390 Parallel Sysplex environment can provide significant increases in availability. The SAP AG document, *R/3 System - SAP R/3 on OS/390* quotes an ITG study that credits this environment with an availability of 99.998%, corresponding to an annual downtime of ten minutes.

- Integration - The utilization of file input/output or direct input/output for SAP R/3 communications with other applications is facilitated since those applications are usually also on OS/390. File systems and OS/390 services can be used without the complexities of cross-system communication and translation.
- Proximity to other OS/390 applications - SAP AG and IBM jointly offer a set of tools between SAP R/3 and existing OS/390 applications. These tools support both synchronous and asynchronous connections. This facilitates the use of IMS, CICS, or Batch/TSO applications that will be upgraded to SAP R/3 at a later time or that will be kept in use.
- Scalability - The System/390 platform ranges from entry-point Multiprise 3000 to 12-way processors to Parallel Sysplex environments that allow you to connect up to 32 OS/390 systems. The platform can support thousands of users. The architecture of the S/390 I/O subsystem and OS/390 support of that architecture allow data to be transferred into memory from many devices simultaneously at high data rates. It is therefore possible to access data from repositories consisting of several terabytes (TB - one TB = 10^{12} bytes).
- Disaster recovery - Recovering from a disaster situation is simplified when more of the processing is done on the OS/390 platform. For more information on this subject see *SAP R/3 on DB2 for OS/390: Disaster Recovery*, SG24-5343.

1.3.2 Which processes benefit from OS/390 placement

The importance of the OS/390 benefits to application server processes depends on the function of the processes. Specific benefits to SAP R/3 application server processes are:

update process Benefits in performance due to proximity to the database server. This is because of database access via OS/390 cross-memory services, hence bypassing communication via the network and the ICLI server.

batch process Benefits in performance due to proximity to the database server and to utilization of high-speed disk hardware for flat file access; also benefits in integration with existing OS/390 files and other OS/390 applications.

spool process Benefits from integration with an OS/390 spool subsystem that provides a variety of locally-attached printers and network-attached printers to the service; also benefits in performance from using OS/390 facilities to buffer and store print data until printers become available. Having the spool work process on the same application server on OS/390 eliminates transferring of data when printing to OS/390-attached printers.

enqueue process Benefits from the availability factors of OS/390; this can be very significant to SAP R/3 installations with a requirement for high availability since there is usually only one enqueue process. Even with multiple enqueue processes, they are restricted to running on a single machine, which then is a single point of failure.

Future plans for the enqueue server include having a copy of the enqueue table (which resides in memory) in the Coupling Facility, which will facilitate recovery of the process, since a new enqueue server can then reconstruct the table with the help of the enqueue shadow table in the Coupling Facility and thus avoid SAP R/3 downtime.

message process Benefits from availability factors similar to the enqueue process, benefits in performance due to proximity to the enqueue process.

dialog process Benefits in integration with existing OS/390 applications; does *not* benefit as much in performance since, for these processes, the dominant performance impact is from network connections from the application servers to the presentation servers. However, with the application server on OS/390, data required bypasses the ICLI server, thus reducing network overhead.

1.3.3 Reasons for having external application servers

We previously mentioned two reasons you may be forced to have external application servers:

- Important SAP R/3 applications are not certified for operation on OS/390.
- Required infrastructure programs for accounting, monitoring, or other company functions contain platform dependencies.

There are other reasons that most installations will have some external application servers, either temporarily or for the forseeable future. Some of these reasons are:

- The processing capacity for an application is not available.

  At this time, the performance benefits and CPU utilizations of processes have not been measured; our work is unable to make such measurements since we have no production loads.

  In most SAP R/3 systems, the total application server resources are significantly greater than the database server resources. How much greater varies from enterprise to enterprise as well as within an enterprise with varying workloads. Therefore, an enterprise may decide to continue to use external application servers until capacity can be made available in their OS/390 complex. An enterprise may also want to use the existing investment placed in external application servers rather than increase the size of their S/390 complex to meet the processing power requirements.

  To make your decisions, it is very important to make performance measurements and perform capacity planning on the application server load you are considering to move to S/390.

- The central processor memory requirement for SAP R/3 may be greater than is possible to install on an S/390 processor.

  This is expected to be of less concern with a release of OS/390 that has 64-bit addressing capability to real memory, which will allow more of this crucial resource to be installed. The limitation of 32-bit virtual addressibility (2 GB for all the logical resources discussed in Chapter 2, “Installation of SAP R/3

application servers on OS/390" on page 15) might also cause an enterprise to use external application servers that have 64-bit virtual addressing capability.

- The communications network for end users is not available on OS/390.

  If your external network is only connected to external application servers, it may require additional OSA adapters and some network planning to connect presentation servers to OS/390 application servers.

- Resource management for the environment with OS/390 application servers is not complete.

  Some planning is required for the OS/390 Workload Manager (WLM) to assure the application server on OS/390 is providing the required service; so an enterprise might plan the phased movement of application server workload to OS/390 sometime after an installation of SAP R/3 4.6B to allow for completing and testing the WLM plan.

- Benefits obtained from database proximity are not substantial.

  Some processes on the application server do not obtain performance increases with OS/390 application servers if database access is not a significant part of their processing requirement.

One or more of these factors will apply to most early installations of SAP R/3 with OS/390 application servers. This why you should expect the structure for your installation will correspond to the view shown in Figure 6 on page 9.

Chapter 2. Installation of SAP R/3 application servers on OS/390

This chapter details the steps followed in an upgrade of an SAP R/3 4.5B system to SAP R/3 4.6B. We first outline the preparation work that brought the configuration elements to the levels required for 4.6B. This is followed by the actual procedures we performed in order to create our 4.6B system.

When there are alternative ways to perform the installation, we try to choose the one that is most strategic, in the sense of being the likely alternative for future upgrades. If the strategic implications seem equal, we try to choose the approach that we believe most customers will choose.

2.1 Existing configuration

Reference

The configuration used in this redbook is based mainly on the one described in redbook *SAP R/3 on DB2 for OS/390: Implementing with AIX or Windows NT Applications Servers,* SG24-4945.

The differences are:

- The DB2 used is a member of a data sharing group.
- The application layer runs on two UNIX servers, with the central instance running on an RS/6000 S7A.

As a starting point, we used a physical three-tier environment with S/390 as the database server and two RS/6000 machines (one F50, one S7A) for the application servers. The SAPGUIs run on Windows NT-servers. The database, DB2 UDB for OS/390 V6.1, is set up as a data sharing group with two members, as shown in Figure 7 on page 16. The reason for the data sharing is that the same system is to be used for a redbook on high availability. Since our concern is the upgrade on SAP R/3 4.6B with an application server on OS/390, we used only one member of this data sharing group.

The hardware of the database layer (which is also to become part of the application layer afterwards) consists of a 7-way G5 and a 7-way G6 server. The DASD used is located on two Enterprise Storage Servers. The OS/390 image we used runs in an LPAR called SC42 with three central processors on the G5.

The second tier consists of two RS/6000 AIX servers, an S7A running the central instance, and an F50 running another dialog instance. The S7A is connected to the S/390 host via Gigabit ethernet, which is the way SAP and IBM recommend. The second physical application server is connected to the host via FDDI.

Both AIX servers can be accessed by PC servers running the SAPGUI through an IBM internal token ring network.

We run two different TCP/IP stacks on the OS/390 image SC42, which are identified as TCPIPMVS and TCPIPOE. Under TCPIPMVS, the token ring connections normally used to access the host are defined. These connections are not displayed in Figure 7 on page 16, since they are not relevant for the

current SAP R/3 configuration. The OSA-Express Gb ethernet and the FDDI adapter are both defined under TCPIPOE.

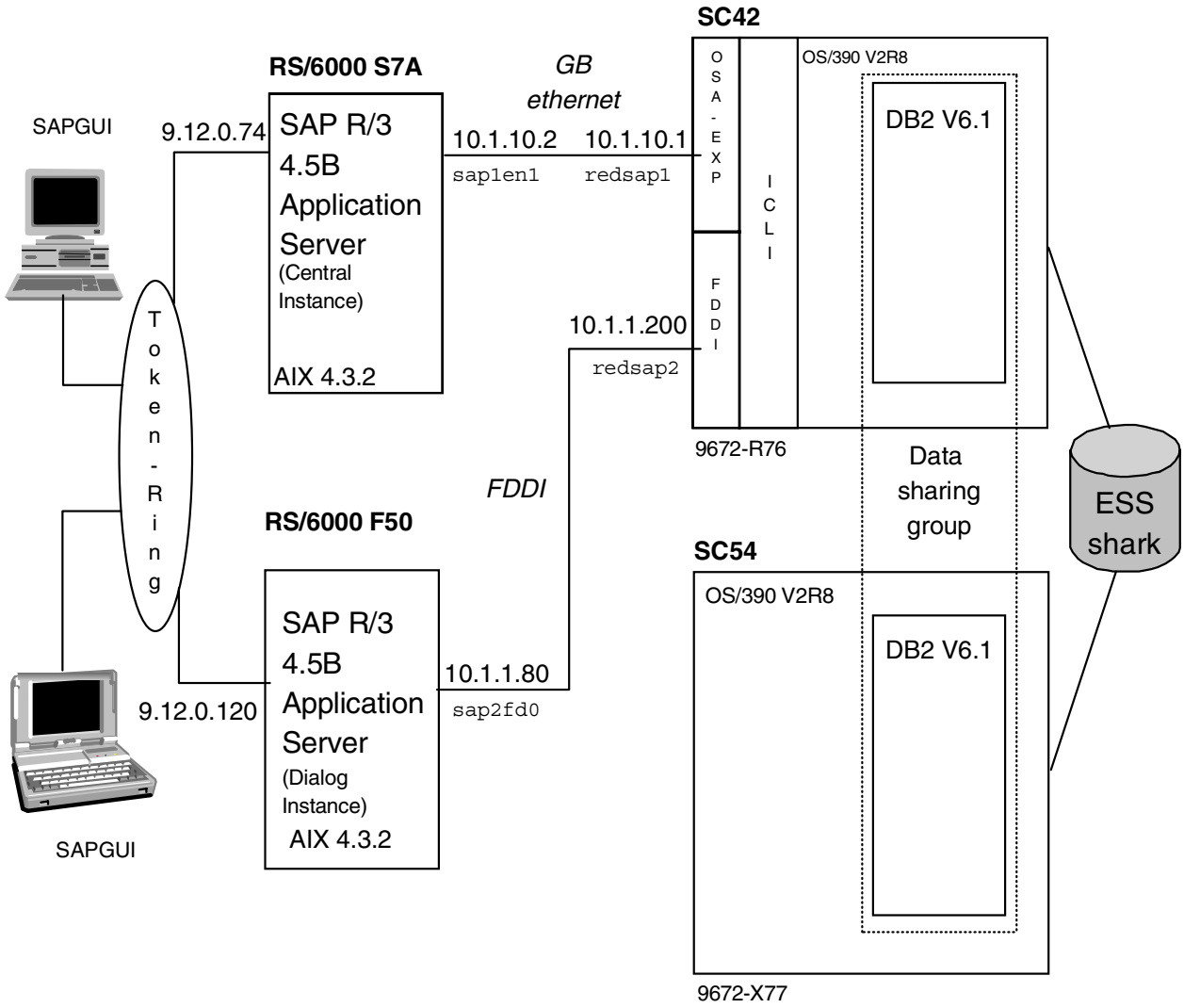

Figure 7. System configuration prior to the upgrade

2.2 System preparation

This section gives details about the requirements and preparation steps necessary to install or upgrade SAP R/3 4.6B.

Depending on whether your current system environment meets all requirements for the SAP R/3 application server, you may need additional planning and preparation time to upgrade SAP R/3, e.g. migrating to OS/390 2.8 or DB2 V6.

2.2.1 Checking the hardware prerequisites

When starting your upgrade with SAP R/3 4.5B and lower, a central instance will be installed on your OS/390 machine for the very first time. Make sure you meet the hardware requirements outlined in *R/3 Installation on OS/390 UNIX System*

Services: DB2 UDB for OS/390, 1.3, “Hardware and Software Requirements Check”.

2.2.2 Checking operating system, database and connectivity

When you plan to upgrade your SAP R/3, you should first take care that your system landscape fits the release matrix given by SAP R/3 note number 156554. It may be necessary to upgrade your database or the operating system to fit the basic requirements. For details see *Upgrade to Release 4.6B: OS/390 UNIX System Services*.

SAP R/3 4.6B only supports TCP/IP as communication protocol for the ICLI server. You have to take this into consideration if you plan to use external application servers. Information about connectivity can be found in SAP R/3 note number 0138906 and *SAP R/3 on DB2 for OS/390: Connectivity Guide*.

2.2.3 Automated PTF check

We recommend that, in accordance with SAP and IBM recommendations, you verify that your environment meets the required PTF level of DB2 UDB for OS/390 and OS/390 software. A complete list of the required PTFs is available under SAP R/3 note number 81737.

Note

The check is performed only for DB2 UDB for OS/390 and OS/390. Although the AIX PTFs are documented in SAP R/3 note number 81737, it is your responsibility to check them.

2.2.3.1 Software requirements for automated PTF check

Following are the minimum software levels required to run the automated PTF Check. For a further description, see SAP R/3 note number 183311.

- SAP Release 3.0F or higher
- OS/390 Version 2.6 or higher
- DB2 UDB for OS/390 Version 5.1 or higher

2.2.3.2 Workflow on automated PTF check

Figure 8 shows the necessary input files for the automated PTF check in SAP R/3 and on OS/390. As long as this program runs on the AIX environment the communication between R/3 and GIMSMP is done via saposcol and rfcoscol. After the migration, when an SAP R/3 instance runs on OS/390, rfcoscol is no longer needed and can be removed. See “Removing rfcoscol” on page 40 for details.

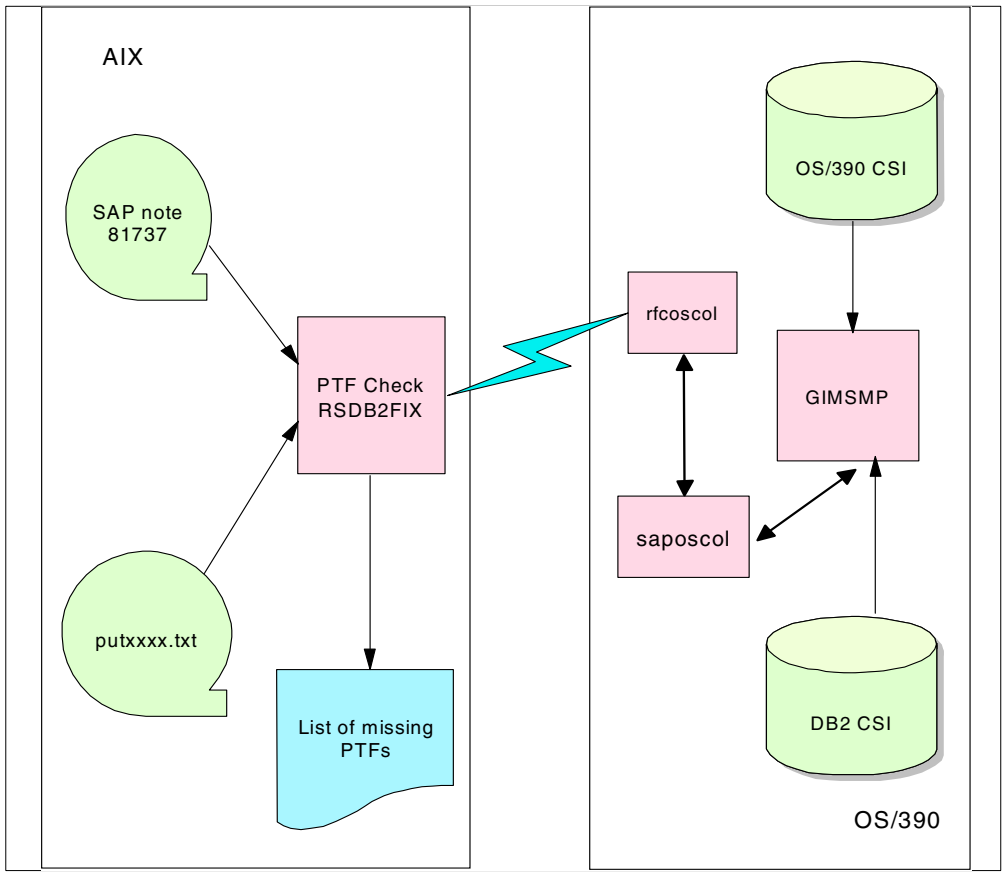

Figure 8. Data flow for R2DB2FIX

2.2.3.3 Set up the automated PTF check

To set up the automated PTF check, perform the following steps:

1. Verify that you are running the latest version of saposcol. It must be at least version 4.6B. If it is not running, install saposcol for OS/390 or migrate to the current level. See SAP R/3 note numbers 103135 and 183311.
2. Download all files located in /general/R3server/abap/note.0183311 from sapserv3 to your environment.
3. Import this transport into your SAP R/3 system.

2.2.3.4 Run the automated PTF check

Before running the automated PTF check, you have to download two files that contain the list of PTFs and are input for the check program:

1. Download the latest version of SAP R/3 note number 81737 to the system where you want to run the PTF check. Even if this note contains unformatted text, it can be interpreted by the check program. Be careful to download the English version.
2. Download the file putxxxx.txt from sapserv3, where xxxx represents the required put level of DB2 UDB for OS/390 and OS/390. The file is located in /general/R3server/abap/note.0183311.
3. Start program RSDB2FIX in your SAP R/3 using transaction se38. You are prompted to type in the required information as shown in Table 1. Press F8 to execute.

Table 1. Input parameters for RSDB2FIX

Parameter	Description	Sample value
SAP note 81737	File name of the downloaded note 81737	/usr/sap/tmp/81737.txt
Service level info	File name of file putxxxx.txt	/usr/sap/tmp/putxxxx.txt
SAP system	RFC destination of your current check system	RED
OS/390 host (TCP/IP)	RFC destination of your OS/390 SAPOSCOL	SAPOSCOL_REDSAP1
CSI library	Data set name of the CSI and target zone	O390V2R8.GLOBAL.CSI MVST100
Up to 4 further CSI libraries, depending on the number of CSI containing your DB2 and OS/390 environment	Data set name of the CSI and target zone	DSN610.SMPCSI.CSI DSNTARG

2.2.3.5 Interpreting the output of RSDB2FIX

Depending on your environment, you will receive output similar to that shown in Figure 9 on page 20.

In the output, steps 1 to 8 give information about the settings of your environment and outline the tasks the check program has done.

The most important section of the output is shown in step 9. This step reports either your missing PTFs or the text `No missing PTFs found` if your environment meets the required PTF level.

If step 10 shows that an FMID is missing, you might have forgotten to include all CSIs on the input screen of RSDB2FIX. Otherwise, the missing FMID has to be installed.

```
STEP 01  15.02.2000 14:04:49  Start Out

INFO     15.02.2000 14:04:49
Please see SAP note 183311 for details on how to use this check report.

-----------------------------------------
| RFC Settings                          |
-----------------------------------------
| Parameter            | Value          |
-----------------------------------------
| SAP System (R/3)     | RED            |
| OS/390 Host (TCP/IP) | SAPOSCOL_REDSAP |
-----------------------------------------

-----------------------------------------
| CSI libraries                         |
-----------------------------------------
| # | Data set            | Target Zone |
-----------------------------------------
| 1 | O390V2R8.GLOBAL.CSI | MVST100     |
| 2 | DSN610.SMPCSI.CSI   | DSNTIARG    |
-----------------------------------------

STEP 02  15.02.2000 14:04:49  Call R/3 System

----------------------------
| R/3 System               |
----------------------------
| Parameter          | Value |
----------------------------
| SAP system ID      | RED   |
| SAP version        | 45B   |
| OS AppServer       | AIX   |
| Kernel release     | 45B   |
| Kernel patch level | 349   |
| DB2 version        | 6.1   |
| OS/390 version     | 2.8   |
----------------------------

STEP 03  15.02.2000 14:04:54  Upload SAP Note

STEP 04  15.02.2000 14:04:54  Analyze SAP Note

STEP 05  15.02.2000 14:04:54  Upload Put Level Information

STEP 06  15.02.2000 14:04:54  Check Put Level Information

STEP 07  15.02.2000 14:04:54  Get SMP/E Data

STEP 08  15.02.2000 14:14:01  Check SMP/E Setting

STEP 09  15.02.2000 14:14:01  Check PTFs

INFO     15.02.2000 14:14:01
The following PTFs are missing.

-----------------------------------------------------
| Missing PTFs                                      |
-----------------------------------------------------
| FMID    | APAR    | PTF     | Info               |
-----------------------------------------------------
| HDB6610 | PUT9910 | UQ35342 |                    |
| HDZ11TS | OW40848 | UW65549 | NFS synchronization |
-----------------------------------------------------

STEP 10  15.02.2000 14:14:01  Check PMIDs

INFO     15.02.2000 14:14:01
All APARs checked.
```

Figure 9. Sample output of RSDB2FIX

Note

We recommend that you rerun this job from time to time to check for the latest PTF level. Be aware of the requirement to download the newest versions of note 81737 and the putxxxx file.

2.2.4 OS/390 RACF setup

Reference

- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966

***** Important Note *****

RACF settings have been found to be very important for performance of SAP R/3 4.6B. New recommendations for the definitions are to be placed in *SAP R/3 on DB2 for OS/390: Planning Guide (IBM),* SC33-7962. It is of vital importance that you consult that material for these recommendations, especially if you are using a release higher than 4.6B.

At this time the following recommendations are planned for a later version of *SAP R/3 on DB2 for OS/390: Planning Guide (IBM)*:

1. Provide READ access to the profile SUPERUSER .FILESYS.PSFCTL of the UNIXPRIV class of RACF.
2. Define the profile BPX.SAFFASTPATH of the FACILITY class of RACF. This profile has important impact on performance, hence it is highly recommended. If this profile is defined after an IPL, you must issue one of the commands `SETOMVS` or `SET OMVS` to activate FastPath support.

For the SAP R/3 application server we had to implement the following RACF definitions.

Add a new user REDADM as shown in Figure 10. The user ID (UID) must be the same UID as used on the AIX application server. The startup program has to be the new C shell. The directory /u/redadm will be set up as shown in “OS/390 UNIX System Services: basic setup” on page 22.

```
ADDUSER (REDADM) DFLTGRP(SAPSYS)          -
         OMVS(                            -
              UID(204)                    -
              HOME(/u/redadm)             -
              PROGRAM(/bin/csh)           -
              ASSIZEMAX(2147483647)       -
              CPUTIMEMAX(2147483647)      -
             )
```

Figure 10. RACF definition for user REDADM

Additionally, you have to define a lowercase alias for this user ID in a OS/390 UNIX file that has been specified in USERIDALIASTABLE in parmlib member BPXPRM8A. Again, see “OS/390 UNIX System Services: basic setup” on page 22.

Add a new group SAPSYS as shown in Figure 11 on page 22. The group ID (GID) must match the GID used on the AIX application server.

```
ADDGROUP (SAPSYS) OMVS(GID(202))
```

Figure 11. RACF definition for group SAPSYS

We had the following FACILITY profile defined on our system. Information concerning those profiles can be found in *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*.

- BPX.DAEMON
- BPX.WLMSERVER
- BPX.STOR.SWAP
- BPX.MAP

For user ID REDADM, we granted READ access to those profiles. To activate the grants, a RACF SETROPTS REFRESH has to be done. The steps to do this can be seen in Figure 12.

```
PERMIT BPX.MAP ACCESS(READ) CLASS(FACILITY) ID(REDADM)
PERMIT BPX.WLMSERVER ACCESS(READ) CLASS(FACILITY) ID(REDADM)
PERMIT BPX.SUPERUSER ACCESS(READ) CLASS(FACILITY) ID(REDADM)
PERMIT BPX.STOR.SWAP ACCESS(READ) CLASS(FACILITY) ID(REDADM)
SETROPTS CLASS(FACILITY) REFRESH
```

Figure 12. RACF permits for FACILITY classes

2.2.5 OS/390 UNIX System Services: basic setup

References

- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966
- *Upgrade to Release 4.6B: OS/390 UNIX System Services*, material number: 51009018
- *R/3 Installation on UNIX - OS-Dependencies*, material number: 5100 8168
- OSS note 193208 (presently available in German only; will be available in English at a later date)

We added _BPX_SHAREAS=NO in file /etc/profile as described in *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*. Figure 13 shows the statements we used in /etc/profile.

```
_BPX_SHAREAS=NO
export _BPX_SHAREAS
```

Figure 13. /etc/profile definitions

We created two additional HFS datasets, which are necessary for the application server. This is mentioned in SAP R/3 note number 193208. The dataset mounted in directory /usr/sap/RED is OMVS.SC42.SAP.RED.HFS. The size of this dataset should be 350 MB. The dataset mounted in directory /sapmnt/RED is named OMVS.SC42.SAPMNT.RED.HFS and has a size of 300 MB.

We also created an HFS dataset, to be used for the migration process. We called this dataset OLAP.SC42.SAP.MULTI.HFS and mounted it in directory /usr/sap/put. According to *Upgrade to Release 4.6B: OS/390 UNIX System Services,* the size of this dataset should be 2.5 GB. The JCL for creating the HFS datasets is shown in Figure 14 on page 23.

Note

If you plan to migrate all your global filesystems to OS/390 with the CI, you should create the dataset OMVS.SC42.SAPMNT.RED.HFS with at least the size of the corresponding filesystem /sapmnt/RED on AIX.

```
//SAPRES5  JOB (999,POK),CLASS=A,MSGCLASS=T,
//         NOTIFY=&SYSUID,TIME=1440,REGION=0M
//IKJEFT01 EXEC PGM=IKJEFT1A
//HFSSAP   DD DSN=OMVS.SC42.SAP.RED.HFS,DISP=(,CATLG),
//            STORCLAS=SCCOMP,DATACLAS=DCPDSE,
//            SPACE=(CYL,(450,50,1)),DSNTYPE=HFS
//HFSSAPM  DD DSN=OMVS.SC42.SAPMNT.RED.HFS,DISP=(,CATLG),
//            STORCLAS=SCCOMP, DATACLAS=DCPDSE,
//            SPACE=(CYL,(400,50,1)),DSNTYPE=HFS
//HFSSAPP  DD DSN=OLAP.SC42.SAP.MULTI.HFS,DISP=(NEW,CATLG),
//            STORCLAS=OLAP,DATACLAS=OLAP,
//            SPACE=(CYL,(3331,200,1)),DSNTYPE=HFS
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD DUMMY
```

Figure 14. JCL for allocation of HFS datasets

The HFS datasets were mounted in OS/390 UNIX at the mount points /usr/sap/RED, /sapmnt/RED, and /usr/sap/put. The mount statements we used in parmlib member BPXPRM8A are shown in Figure 15.

```
MOUNT FILESYSTEM('OMVS.SC42.SAP.RED.HFS')                          +
      MOUNTPOINT('/usr/sap/RED')                                   +
      TYPE(HFS)  MODE(RDWR)
MOUNT FILESYSTEM('OMVS.SC42.SAPMNT.RED.HFS')                       +
      MOUNTPOINT('/sapmnt/RED')                                    +
      TYPE(HFS)  MODE(RDWR)
MOUNT FILESYSTEM('OLAP.SC42.SAP.MULTI.HFS')                        +
      MOUNTPOINT('/usr/sap/put')                                   +
      TYPE(HFS)  MODE(RDWR)
```

Figure 15. MOUNT commands

Note

There are other important entries in your BPXPRMxx member of SYS1.PARMLIB. See the list of entries we thought relevant in Figure 80 on page 90. Also you should be aware of the notes associated with that figure.

SAP requires the username to be in lowercase. This is accomplished by performing two steps. First the user alias feature in BPXPRM8A has to be enabled, as shown in Figure 16.

```
USERIDALIASTABLE('/etc/ualiastable')  /* HFS file /tablename will
                                      contain the list of MVS userids
                                      and their corresponding XPG4
                                      compliant alias names.        */
```

Figure 16. Enable user aliases in BPXPRM8A

Second, the corresponding file /etc/ualiastable in OS/390 UNIX must be set up. This can be seen in Figure 17. Be careful when editing this file; the lowercase name must start in column 10. Do not use tabs.

```
REDADM   redadm
```

Figure 17. /etc/ualiastable

Note that subsequent to the work for this redbook, it was recommended to make a similar entry for group SAPSYS (SAPSYS sapsys) in the :Groups section of this file as well.

The commands shown in Figure 18 were used to set up the home directory of user ID redadm.

```
mkdir /u/redadm
chown redadm:SAPSYS /u/redadm
chmod 700 /u/redadm
```

Figure 18. Set up home directory

Note that if you made the recommended entry as in the note following Figure 17, the second command would use lower case (sapsys, not SAPSYS).

2.2.6 OS/390 UNIX System Services: C shell (tcsh)

References

- UNIX System Services tcsh (C shell) Kit Support Guide
- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966
- *OS/390 V2R9.0 UNIX System Services Planning*, SC28-1890-09, Chapter 18, “Setting Up for the OS/390 UNIX and tcsh Shell Environments”
- *OS/390 V2R9.0 UNIX System Services User’s Guide*, SC28-1891-08, Chapter 5, “Customizing the tcsh Shell” and Chapter 9, “Writing tcsh Shell Scripts”

The SAP environment requires the C shell to be installed. IBM ships the enhanced but compatible tcsh (see *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B* for further information).

You need to set up a link to use tcsh as the C shell. A second link prevents ksh scripts from being executed by the current shell (otherwise, these scripts give error messages when called from tcsh). Figure 19 shows these links.

```
ln /bin/tcsh /bin/csh
ln /bin/sh /bin/ksh
```

Figure 19. Links for C shell (tcsh)

On startup, tcsh reads /etc/csh.cshrc instead of /etc/profile. Thus, you have to translate all statements from /etc/profile into C shell syntax and put them into /etc/csh.cshrc. This includes the environment variables mentioned in 2.2.5, “OS/390 UNIX System Services: basic setup” on page 22.

See Figure 20 for our /etc/csh.cshrc.

```
setenv TZ EST5EDT
setenv LANG C
setenv PATH /bin:/usr/lpp/java/J1.1/bin:.
setenv LIBPATH /lib:/usr/lib:.
setenv NLSPATH /usr/lib/nls/msg/%L/%N
setenv MANPATH /usr/man/%L
setenv MAIL /usr/mail/$LOGNAME
umask 022
setenv _BPXK_SETIBMOPT_TRANSPORT TCPIPOE
setenv _BPX_SPAWN_SCRIPT YES
setenv _BPX_SHAREAS NO
```

Figure 20. /etc/csh.cshrc

Important

Always try to keep /etc/profile and /etc/csh.cshrc in sync. Subsequent to the work for this redbook, a performance recommendation was made that _BPX_SHAREAS=YES should be specified in /etc/profile (an equivalent entry could be made in /etc/csh.cshrc) and a functional recommendation was made that in /etc/csh.cshrc setenv _BPX_SPAWN_SCRIPT YES should *not* be specified. The recommendation is to be in sync with the possible exception of _BPXSPAWN_SCRIPT.

The UNIX System Services tcsh (C shell) Kit Support Guide can be obtained from the IBM Web site:

`http://www.s390.ibm.com/unix/tcsh`

2.2.7 OS/390 NFS setup

References

- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966
- *Upgrade to Release 4.6B: OS/390 UNIX System Services*, material number: 51009018
- *R/3 Installation on UNIX - OS-Dependencies*, material number: 5100 8168
- OSS note 193208 (presently available in German only; will be available in English at a later date)
- *OS/390 Network File System Customization and Operation*, SC26-7253

NFS on OS/390 was set up as described in *OS/390 Network File System Customization and Operation*.

We had to decide whether to put the different filesystems on OS/390 or AIX. SAP recommends using OS/390 to host /usr/sap/put for performance reasons. /usr/sap/trans, /sapmnt/RED/global, and /sapmnt/RED/profile already exist on the AIX central instance and therefore have to be mounted on OS/390.

The central instance's /usr/sap/RED/DVEBMGS00 needs to be mounted on /sapmnt/RED/DVEBMGS00 for the time of the upgrade only. /sapmnt/RED/exe should not be mounted on OS/390, because the contents of that directory are platform-dependent.

You may decide to migrate /usr/sap/trans and /sapmnt/RED to OS/390 after the upgrade. See "Moving file systems to OS/390" on page 46 for details.

The export procedures on AIX do not differ from a dialog instance setup and are described in *R/3 Installation on UNIX - OS-Dependencies.* Remember to put the right interface addresses in the client access list. If you wish to mount that directory, e.g. via Gigabit Ethernet, use the address of the S/390's OSA Express adapter. Due to a bug in the NFS client software, we also had to include the S/390's primary TCP/IP address (the one that shows up when using the UNIX `hostname` command) in the client access list.

To mount /usr/sap/trans, /sapmnt/RED/profile, /sapmnt/RED/global, and /sapmnt/RED/DVEBMGS00 on OS/390, we first created the mount points as shown in Figure 21.

```
mkdir /sapmnt/RED/exe
mkdir /sapmnt/RED/global
mkdir /sapmnt/RED/profile
mkdir /sapmnt/RED/DVEBMGS00
mkdir /usr/sap/trans
chown redadm:SAPSYS /sapmnt/RED/*
chown redadm:SAPSYS /usr/sap/trans
chmod 750 /sapmnt/RED/*
```

Figure 21. Set up mount points

The commands from Figure 22 on page 27 were used to perform the NFS mount. These commands are specified in parmlib member BPXPRM8A.

```
MOUNT FILESYSTEM('NFS0001')                                          +
      MOUNTPOINT('/usr/sap/trans')                                   +
      TYPE(NFS)  MODE(RDWR)                                          +
      PARM('sap1en1:/usr/sap/trans,XLAT(Y)')                         +
      NOSECURITY
MOUNT FILESYSTEM('NFS0002')                                          +
      MOUNTPOINT('/sapmnt/RED/global')                               +
      TYPE(NFS)  MODE(RDWR)                                          +
      PARM('sap1en1:/usr/sap/RED/SYS/global,XLAT(Y)')                +
      NOSECURITY
MOUNT FILESYSTEM('NFS0003')                                          +
      MOUNTPOINT('/sapmnt/RED/profile')                              +
      TYPE(NFS)  MODE(RDWR)                                          +
      PARM('sap1en1:/usr/sap/RED/SYS/profile,XLAT(Y)')               +
      NOSECURITY
MOUNT FILESYSTEM('NFS0004')                                          +
      MOUNTPOINT('/sapmnt/RED/DVEBMGS00')                            +
      TYPE(NFS)  MODE(RDWR)                                          +
      PARM('sap1en1:/usr/sap/RED/DVEBMGS00,XLAT(Y)')                 +
      NOSECURITY
```

Figure 22. Mount commands

Exporting /usr/sap/put from OS/390 is trickier.

First we had to configure the NFS server to authenticate the OS/390 UNIX files using a UNIX style exports file. The security attributes in the NFS attributes dataset we used to export the HFS datasets to AIX are shown in Figure 23.

```
security(saf,exports,saf)
```

Figure 23. NFS security attributes for exporting datasets

Then we created the exports data set shown in Figure 24.

```
/hfs/usr/sap/put -access=sap1en1:sap1tr0
```

Figure 24. The OS/390 NFS export data set

To mount this file system on the AIX, we had to put the entry shown Figure 25 in the entry field **PATHNAME of remote directory** in smit's "Add a File System for Mounting" section, as shown in Figure 26 on page 28.

```
/HFS/usr/sap/put,text,xlat(oemvs311)
```

Figure 25. smit entry for NFS mount

```
                        Add a File System for Mounting


Type or select values in entry fields
Press Enter AFTER making all desired changes.

[TOP]                                                   [Entry Fields]
* PATHNAME of mount point                              []                          /
* PATHNAME of remote directory                         [HFS/usr/sap/put,text,...]
* HOST where remote directory resides                  []
  Mount type NAME                                      []
* Use SECURE mount option                              no                          +
   .
   .
F1=Help           F2=Refresh          F3=Cancel          F4=List
F5=Reset          F6=Command          F7=Edit            F8=Image
F9=Shell          F10=Exit            Enter=Do
```

Figure 26. smit screen for NFS mount

We completed that section according to SAP manual *R/3 Installation on UNIX - OS-Dependencies*.

Important

We strongly suggest using symbolic IP names instead of numeric IP addresses in the mount and export statements. Make sure they can be resolved using either DNS or /etc/hosts on all machines sharing these directories.

2.2.8 OS/390 settings for Workload Manager

Reference

- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966

Currently the application server on OS/390 does not exploit the Workload Manager (WLM). Application server processes can only be assigned to the same WLM service class. However, WLM exploitation such as workload balancing and classification and assignment of R/3 workloads to different WLM enclaves will be included in future SAP R/3 releases.

This section describes the steps to be done to assign a certain service class to the application server processes.

In addition to the Workload Manager (WLM) definitions necessary for the SAP R/3 database server as described in *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, we added a new OMVS classification rule to our WLM settings. This rule sets a service class of SAPAS based on the user ID the application server processes are running under, in our case REDADM. Figure 27 on page 29 shows the WLM settings to define this classification rule.

```
 Subsystem-Type  Xref  Notes  Options  Help
------------------------------------------------------------------------------
               Modify Rules for the Subsystem Type        Row 1 to 3 of 3
Command ===> _____________________________________________ SCROLL ===> PAGE

Subsystem Type . : OMVS        Fold qualifier names?   Y  (Y or N)
Description  . . . Use Modify to enter YOUR rules

Action codes:  A=After    C=Copy         M=Move     I=Insert rule
               B=Before   D=Delete row   R=Repeat   IS=Insert Sub-rule
                                                          More ===>
         -------Qualifier-------------              -------Class--------
Action    Type       Name     Start                 Service     Report
                                                DEFAULTS: OMVS        ________
 ____  1  UI         REDADM   ___                   SAPAS       SAPASREP
 ____  1  TN         MIKE*    ___                   SYSSTC      SAMBA
 ____  1  TN         DB2OL*   ___                   ________    DB2OLAP
****************************** BOTTOM OF DATA ******************************
```

Figure 27. Workload Manager classification rule settings for the application server

In our system we defined service class SAPAS with WLM settings as shown in Figure 28.

```
 Service-Class  Xref  Notes  Options  Help
------------------------------------------------------------------------------
                        Modify a Service Class              Row 1 to 2 of 2
Command ===> ____________________________________________________________

Service Class Name . . . . . : SAPAS
Description  . . . . . . . . . R/3 App Server OS/390
Workload Name  . . . . . . . . OMVS      (name or ?)
Base Resource Group  . . . . . ________  (name or ?)

Specify BASE GOAL information.  Action Codes: I=Insert new period,
E=Edit period, D=Delete period.

        ---Period---  ---------------------Goal---------------------
Action  #  Duration   Imp.  Description

  __
  __    1             2    Execution velocity of 70
****************************** Bottom of data ******************************
```

Figure 28. Workload Manager service class settings for the application server

For reporting purposes and for better transparency in the RMF reports, we included the application server workload in a new WLM report class SAPASREP, as shown in Figure 27. Workload related to the database server and ICLI was included in WLM report class DBK1.

2.2.9 ICLI server considerations

There is no need to establish a new ICLI server for the upgrade. Information about setting up a new ICLI server to connect to external applications server after the upgrade can be found in “ICLI server configuration (external application server)” on page 48.

2.2.10 SAPGUI considerations

SAPGUI must be upgraded to 4.6B in order to connect to the 4.6B system. This should be done before the upgrade.

2.2.11 DB2 UDB for OS/390 preparation

This section describes the customization we made to DB2 UDB for OS/390 in order to allow SAP R/3 to be installed and operated. Although we have tried to indicate where parameters are optional or required, you should recognize that the values we chose were to create a viable system in our environment. Your own choices may differ.

2.2.11.1 DB2 UDB for OS/390 Version 6.1

To run SAP R/3 with DB2 UDB for OS/390, the database must be at version 6.1. The required PTF level can be found in SAP R/3 note number 0081737, or it can be checked using the Automated PTF Check (see 2.2.3, “Automated PTF check” on page 17).

If you are not on version 6.1, you must migrate to that version first. Follow the instructions outlined in *DB2 UDB for OS/390 Installation Guide*. There is a dependency between the level of DB2 and the ICLI server: for DB2 UDB for OS/390 V6.1 and OS/390 V2.8, the required PTF is UW65680. The database upgrade is independent of the application server.

DB2 UDB for OS/390 V6.1 introduced some new DSNZPARM parameters. Table 2 lists those that are important for SAP R/3.

Table 2. New DSNZPARM settings

New DSNZPARM parameter	Recommended value
LBACKOUT	NO
NPGTHRSH	10
LOGAPSTG	10
PARTKEYU	NO
SEQCACH	SEQ
XLKUPDLT	YES

With DB2 UDB for OS/390 V6.1 you can move dynamic statements into a dataspace without using the EDM Pool; this controlled by EDMDSPAC. If you use this feature, you can make the EDM Pool smaller. There is no recommendation regarding this from IBM or SAP, so how you set it up depends on your system.

SAP R/3 4.6B makes use of some new bufferpools: BP8K0 and BP16K0. Use the DB2 alter bufferpool command to set them up for SAP R/3, with either a batch program like IKJEFT01, or by using the DB2I feature and issue the commands shown in Figure 29 on page 31.

```
ALTER BUFFERPOOL(BP8K0) VPSIZE(1000) VPSEQT(50) DWQT(30)     VDWQT(5)
HPSIZE(2000) HPSEQT(50) CASTOUT(YES)

ALTER BUFFERPOOL(BP16K0) VPSIZE(1000) VPSEQT(50) DWQT(30)     VDWQT(5)
HPSIZE(2000) HPSEQT(50) CASTOUT(YES)
```

Figure 29. DB2 command ALTER BUFFERPOOL

The setup of SAP R/3 splits the data in DB2 into many tablespaces (see Table 4 on page 54), which means that DB2 creates a large number of VSAM clusters. Most of the DB2 tablespaces are not very large, the average size of each is about 20 tracks. Having nearly 50000 tracks on one pack, there can be a lot of datasets placed on one pack. We therefore recommend that you initialize all volumes you use in DB2 for SAP with 400 tracks for the VTOC (based on a 3390 DASD unit).

For new features in DB2 UDB for OS/390 V6.1 and in SAP R/3 V4.6, more tablespace and indexes are necessary. Therefore we recommend you increase the number of databases in the installation panel DSNTIPD to 9000.

Note

All settings regarding performance, size, or usage are only snapshots, so you have to periodically review these settings, especially after a migration. Due to the fact that SAP R/3 4.6B has additional and enhanced functions, it uses more resources in DB2, e. g. more tables, indexes, and buffers. Refer to Table 4 on page 54 (comparison 4.5B to 4.6B).

2.2.11.2 Bind CLI packages

SAP R/3 makes use of the DB2 call level interface (CLI), therefore it is necessary to have the CLI packages bound. With DB2 UDB for OS/390 there is a sample job in the installation DSNTIJCL. Make sure this job has run; if it has not, you should run it now to prevent SQL code -805 (see SAP R/3 note number 0195524).

2.2.11.3 Setup for RRS

Since SAP R/3 4.5B, the ICLI server is attached to DB2 using the Recoverable Resource Manager Services Attachment Facility (RRSAF). So, if you are already at SAP R/3 4.5B, no extra setup for RRSAF is needed. However, if you want to migrate from an earlier release, you have to perform the RRSAF setup as described in *SAP R/3 on DB2 UDB for OS/390; Planning Guide SAP R/3 Release 4.6B*.

Note that if you run your DB2 in a data sharing environment, you have to use the Coupling Facility for RRSAF. Without data sharing, you can use a DASD-only logstream OS/390.

2.2.11.4 WLM-based stored procedures

SAP R/3 4.6B can run some DB2 utilities using a feature called DBA Planning Calendar, by using DB2 WLM-based stored procedures. To use this function, you have to set up the stored procedures environment.

If you are already using WLM-based stored procedures you can skip this section, But if you mean to install the DBA Planning Calendar, first create an application in

WLM and in it define the DB2 subsystem name and the procedure name of your stored procedure address (as you have in DSNZPARM, parameter STORPROC). Create the procedure in your proclib; a sample can be found in SDSNSAMP member DSNTIJSG.

2.2.11.5 DB2PM

DB2 UDB for OS/390 provides a tool for creating statistics reports called DB2PM. SAP R/3 can make use of this tool as well. While not a requirement for 4.6B, DB2PM is a prerequisite for version 4.6C. If you want to use the performance monitor from SAP R/3, it is recommended (by SAP and IBM) that you set up DB2PM. SAP R/3 note number 0192930 describes how to install it.

2.3 Performing the upgrade

Beginning with SAP R/3 4.6B, SAP supports upgrades on OS/390. This means that major steps of the upgrade are performed on OS/390. The advantage is a reduction of the total upgrade runtime since an upgrade performed on OS/390 eliminates network traffic. As a result, the runtime of many phases is reduced up to 60%.

Since our release is lower than 4.6A we have no Central Instance on OS/390 (the OS/390 CI Host). As a result, some upgrade steps are performed on the host running the Central Instance now (on AIX) while some other steps are performed within OS/390 UNIX.

For example, the upgrade programs R3up, the Upgrade Assistant server, and R3load all run on OS/390. Steps needing services provided by the AIX CI Host are executed remotely on the AIX CI Host via `rexec`. See Figure 30 on page 32.

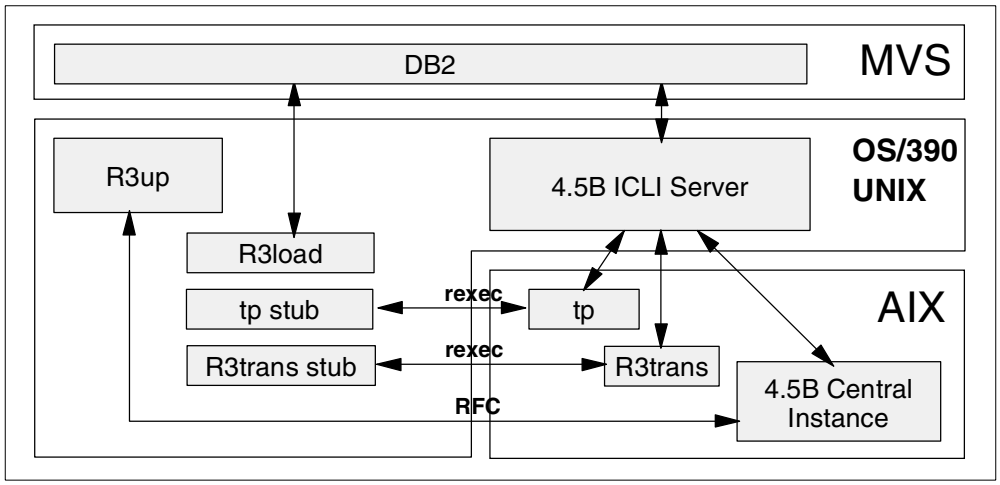

Figure 30. Upgrade components up to phase KX_SWITCH

This is remote performance occurs until the kernel switch in upgrade phase KX_SWITCH takes place. At this point, the Central Instance on AIX is shut down and a new Central Instance is started on OS/390. Now all steps are performed on OS/390. See Figure 31 on page 33.

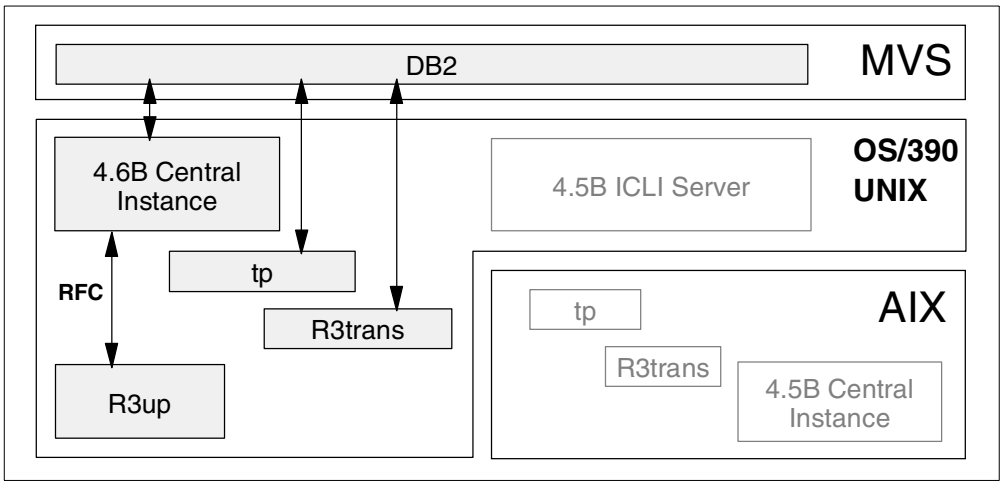

Figure 31. Upgrade components after phase KX_SWITCH

The result of the upgrade is an SAP R/3 Release 4.6B with a central instance running on OS/390.

Attention

Since our release is lower than 4.6B, we had to order a new license key. This is due to moving the central instance from a RISC/6000 to an S/390 processor.

2.3.1 Check necessary components

2.3.1.1 Verifying OS-dependent components

To avoid connection problems between AIX and OS/390 during the migration, check NFS and rexec.

For NFS, check that the following file systems are mounted and accessible from within OS/390 UNIX:

- sapmnt/RED/global
- sapmnt/RED/profile
- sapmnt/RED/DVEBMGS00
- usr/sap/trans

For remote command processing, use the following command on OS/390 UNIX to check that rexec is working properly. Perform this command as user redadm:

```
rexec sap1tr0 'uname -a'
```

The response should include the AIX CI Host name. A sample output follows:

```
AIX sap1tr0 3 4 000953294C00
```

As user redadm you should not be prompted for a username or password. If you are, check that the file .netrc exists with the right entry and that you are really logged on as redadm (no su).

Also check that your /etc/hosts contains the following entry:

```
127.0.0.1 localhost
```

2.3.1.2 Checking R/3 components

In order to run PREPARE we have to check the SAP programs. See *Upgrade to Release 4.6B: OS/390 UNIX System Services* for the required patch levels.

Since the version of our current kernel is 4.5B, we only have to check that the patch level of tp is at least 126. For R3trans there is no special requirement. Figure 32 shows that the version of our kernel is 4.5B Level 348, and that tp has version 331.

```
sap1tr0:redadm 9> tp -V | more
This is tp version 270.00.16 (release 45B) for DB2forOS/390 database

---------------------
tp information
---------------------
kernel release                45B
DBMS client library
DBSL shared library version   45B.01
compiled on                   AIX 2 4 004218294C00
compile time                  Jan 17 2000 03:47:08
update level                  0
patch number                  331
source id                     0.336
.
.
.

sap1tr0:redadm 4> disp+work -V | more

---------------------
disp+work information
---------------------
kernel release                45B
DBMS client library
DBSL shared library version   45B.01
compiled on                   AIX 2 4 004218294C00
compile time                  Feb  3 2000 04:20:21
update level                  0
patch number                  348
source id                     0.349
.
.
.
```

Figure 32. Commands to check the SAP programs

Note

If you run your SAP System with a kernel earlier than 4.6B, you have to check different requirements. See *Upgrade to Release 4.6B: OS/390 UNIX System Services*, “Substituting the SAP Kernel (source release 3.X)” and “Checking the SAP Programs (for source release 4.X)”.

2.3.1.3 Importing the necessary transports

Since our system was newly installed, we had to import the transports described in *Upgrade to Release 4.6B: OS/390 UNIX System Services*, “Upgrading the Operating System and Database System: Overview”.

2.3.2 Copying CDs

The SAP R/3 software is shipped on a few CDs. Due to the fact that there is no CD-ROM drive on the S/390, we copied the CDs to the host. (You can also mount the CD-ROM drive on AIX and NFS-mount it on OS/390 to access the data, but for performance reasons we recommend you do not use this method).

Table 3 lists the required CDs and the required space based on 3390 units:

Table 3. Required space for CD copies

Dataset	SAP CD	Required space
OMVS.SC42.SAP.CDKERNEL.HFS	SAP Kernel IBM DB2 Universal Database for OS/390 N 51008633	120 Cyl.
OMVS.SC42.SAP.CDUP1.HFS	Upgrade CD 1/4 N 51008760	800 Cyl.
OMVS.SC42.SAP.CDUP2.HFS	Upgrade CD 2/4 N 51008761	875 Cyl.
OMVS.SC42.SAP.CDUP3.HFS	Upgrade CD 3/4 N 51008762	925 Cyl.
OMVS.SC42.SAP.CDUP4.HFS	Upgrade CD 4/4 N 51008763	925 Cyl.
OMVS.SC42.SAP.CDLANG.HFS	Language Disc 1/3 N 51009131 (depending on your language)	820 Cyl.

To copy the CDs to the HFS file systems, perform the following steps:

1. Create a mountpoint for every CD.
2. Create an HFS file system for every CD.
3. Mount the HFS file system residing on OS/390 UNIX.
4. Export the file systems to AIX.
5. Create the same mount points on the AIX.
6. Change the permissions of these directories to 755, with redadm as owner.
7. Mount the file systems via NFS.
8. Mount a CD-ROM on AIX.
9. Copy the CD-ROM as user redadm to the appropriate filesystem.

For a sample procedure on how to perform these steps, refer to “System preparation” on page 16.

After copying the data, the names of all files and directories in the HFS have to be converted to uppercase. Table 33 on page 36 shows the script we ran in OS/390 UNIX:

```
#!/bin/sh
echo "Specify directory that contains a copy of the CD-ROM"
read DIR
if test ! -d $DIR
then
   echo "directory $DIR does not exist"; exit
fi

chmod -R 777 $DIR
for j in `find $DIR -type d -depth -print`
do
   cd $j
   for i in `ls`
   do
      mv $i `echo $i | tr "[a-z]" "[A-Z]"`
   done
done
```

Figure 33. Convert lowercase file names to uppercase

This script prompts you for the name of the directory to start from. You can either run it for every single directory or, if you have defined them as subdirectories with no directories other than the SAP CD directory, you can run it in one pass.

During the migration process, the language CD is also required on AIX, therefore we recommend you create a copy of this CD on AIX as well.

2.3.3 Preparing the OS/390 CI Host

Before we start PREPARE, we have to adapt the OS/390 UNIX environment of the OS/390 CI Host and install the main parts of the central instance:

1. Log on as user with UID 0.
2. Create the installation directory /usr/sap/put/install

Note

This directory should not be in the root filesystem. You should create a new filesystem either at /usr/sap/put or at /usr/sap/put/install. If you do not, it is almost certain that you will receive errors when your root filsystem is filled. To see how we did this, refer to Figure 15 on page 23.

3. cd to /usr/sap/put/install.
4. Start /sapcd/kernel/UNIX/INSTTOOL.SH.
5. Start /usr/sap/put/install/R3SETUP -f PRER3UP.R3S.

Since we have the SDSNLOAD not concatenated to the LINKLIST, we set the environment variable STEPLIB to DSN610.SDSNLOAD. To make the change permanent, we changed /u/redadm/.cshrc and /u/redadm/.profile. See “SAP R/3 configuration and profiles” on page 91.

Note

During the installation a problem with filesystem /usr/sap/trans may occur, which is related to NFS. SAP R/3 note number 193208 describes this problem and as a circumvention, suggests you log on to OS/390 UNIX using user redadm and start R3SETUP under this user ID.

During R3SETUP you are prompted for many input parameters. We recorded these parameters in “Input parameters for PRER3UP.R3S” on page 107.

In our environment we used an /etc/services file on OS/390, so R3SETUP created the necessary entries. Otherwise, you would have to add the entries from /etc/services.sap manually to your corresponding MVS data set <TCPIP>.ETC.SERVICES.

If the kernel directory on OS/390 is empty, don’t be confused; the kernel will be installed during the upgrade. R3SETUP only prepares the environment for R3up.

R3up does the following:

- Performs consistency checks.
- Creates the SAP R/3 directory structure including the links.
- Creates user profiles.
- Creates startsap and stopsap scripts.

2.3.4 Performing PREPARE

PREPARE is a program that automatically performs most preparations for your upgrade. It can run in parallel with your running system. Since it checks necessary requirements for your upgrade, we recommend you execute it *as early as possible*. You can rerun PREPARE any time before the upgrade to check your system again. PREPARE imports 500 MB of data during its first run into the database.

For details on running PREPARE refer to SAP manual *Upgrade to Release 4.6B: OS/390 UNIX System Services, “*Starting Prepare”.

The sequence of steps includes:

1. Running script PREPARE from OS/390 UNIX.
2. Starting the Upgrade Assistant Server.
3. Starting the Upgrade Assistant.

2.3.4.1 Running the PREPARE script

For the first step you have to logon to the host using the SAP administrator ID (in our case, redadm). You can either log on to OS/390 UNIX using a communication program like telnet or rlogin, or use an OS/390 tool like OMVS. If you use the OMVS interface, you need to define a TSO segment in RACF for the redadm user ID.

Note

We recommend you do not use the `su` command to switch to user redadm, because this does not create the proper environment for redadm. Logon as user redadm instead.

To start PREPARE the first time, we issued the following commands, which extracts the data for PREPARE:

```
cd /usr/sap/put
/sapcd/kernel/UNIX/PREPARE
```

After the extraction we were prompted whether or not to use the Upgrade Assistant. Using the Upgrade Assistant is recommended by SAP. Consequently we used the Upgrade Assistant.

2.3.4.2 Starting the Upgrade Assistant server

Before running the Upgrade Assistant server the first time, we converted the Java archive from EBCDIC to ASCII once, by issuing the following commands:

```
cd /usr/sap/put/ua
mv ua.jar ua.jar.ebc
iconv -f IBM-1047 -t ISO8859-1 ua.jar.ebc > ua.jar
```

We set the CLASSPATH variable and started the Upgrade Assistant Server as follows:

```
setenv CLASSPATH /usr/sap/put/ua/ua.jar
java UaServer -upgdir /usr/sap/put
```

2.3.4.3 Starting the Upgrade Assistant

We decided to use the Netscape Navigator browser to start the Upgrade Assistant from our local PC. Therefore we entered the following URL:

```
http://wtsc42oe.itso.ibm.com:4239/ua/UaGui.html
```

For details see *Upgrade to Release 4.6B: OS/390 UNIX System Services,* “Starting the GUI of the Upgrade Assistant” and “Starting the Upgrade Assistant”.

2.3.4.4 Running PREPARE

“PREPARE phases from UpgDialog.log” on page 108 shows the user input that is required during PREPARE. We decided to run all check modules. Since our release is lower than 4.6A, many steps were performed on AIX. Therefore, we often had to specify parameters related to the RS/6000 instead of OS/390.

For details see *Upgrade to Release 4.6B: OS/390 UNIX System Services* “User Action During PREPARE”.

When PREPARE was finished, we checked the /usr/sap/put/log/CHECKS.LOG. It contains all tasks that have to be performed before we could proceed with our upgrade.

PREPARE should be rerun until the CHECKS.LOG shows no more errors.

2.3.5 Special notes concerning PREPARE

In this section we describe problems that we encountered in our environment:

2.3.5.1 Phase VALCHK_INI: Stored procedures

Because of problems with stored procedures in connection with OS/390 UNIX, the RUNSTATS jobs failed. R3up prompted us to transmit and execute the job via ftp.

2.3.5.2 Phase SPACECHK_INI: Volumes.pfl

We copied file volumes.smp in /usr/sap/put/bin using volumes.pfl which reside in the same directory and adapted it according to our environment. See *Upgrade to Release 4.6B: OS/390 UNIX System Services*, “Making Entries for the Initialization Module” for further description.

This file is used by DB2 for allocation of new VSAM datasets for substitution tables. R3up checks whether the space on the provided volumes is enough for these new substitution tables. However, there is no space checking done on the existing datasets and volumes, if there is enough left for the expected growth of the database.

2.3.5.3 Phase INITPUT_PRE: db2jcllib

We had problems with the automatic JCL job submission. Therefore, we downloaded the latest version from sapserv3 and moved it to /usr/sap/put/exe.

2.3.5.4 Phase BIND_PATCH: Running Report RSSPDASS

We used a workaround to disassemble the support packages which are supposed to be included in the upgrade. SAP note 193208 now contains this workaround so you should follow the instructions there. Our procedure was the following:

- Since we had to run this report on AIX, we had to rename the tp in /usr/sap/put/exe and then we created a link called tp to point to /sapmnt/RED/exe/tp. This is because the tp in /usr/sap/put/exe is not an AIX executable, but an OS/390 UNIX executable.
- After running the report, we deleted the tp link and restored the OS/390 UNIX executable tp in /usr/sap/put/exe.

2.3.5.5 After PREPARE: DB2BIND.TPL

We modified the file /usr/sap/put/bin/DB2BIND.TPL, according to SAP R/3 note number 0193208. It must be modified so that ISOLCATION(CS) is replaced by ISOLATION(UR). We let the upgrade perform the new bind during the run of R3up.

2.3.6 Actions before starting R3up

For the purpose of documenting this redbook, we carried out the steps that are needed, from a technical point of view, before starting R3up. For the preparation steps needed on a production system, refer to *Upgrade to Release 4.6B: OS/390 UNIX System Services.*

2.3.6.1 Preparing and backing up the SAP environment

In R/3, we created operation modes and checked the users that are used during the upgrade (DDIC, SAP*, and a user performing transaction SPDD).

Then we backed up our kernel on AIX, saved our start and stop scripts, and checked that we could restore our database.

For details see *Upgrade to Release 4.6B: OS/390 UNIX System Services,* “User Actions Before Starting the Upgrade”.

2.3.6.2 Removing rfcoscol

rfcoscol provides a communication path from saposcol to an SAP R/3 instance on another machine. See Figure 34 on page 40 for the 4.5B setup.

.

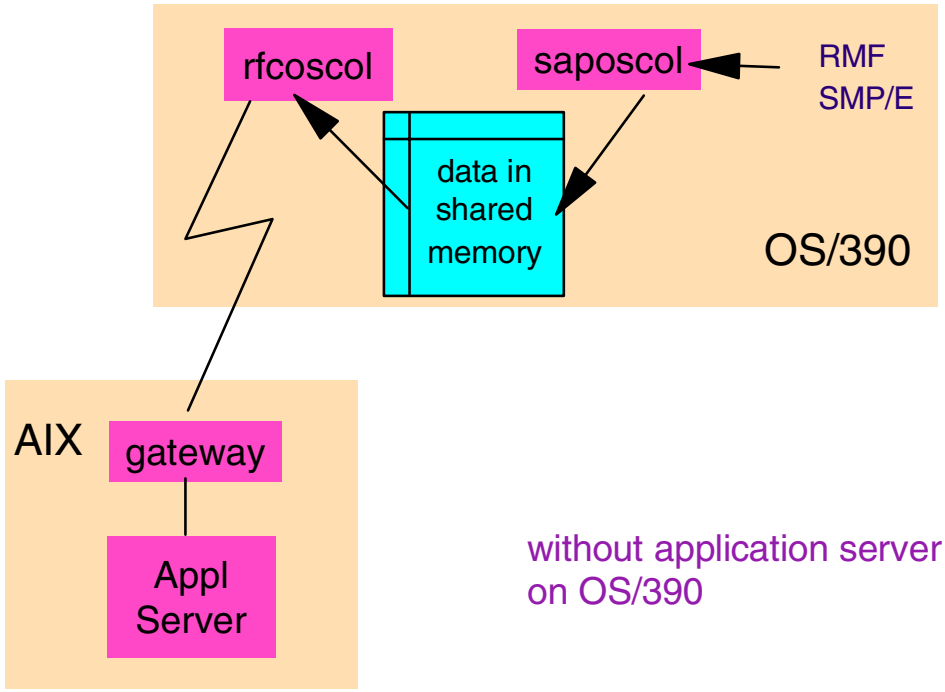

Figure 34. saposcol without SAP instance on OS/390

With an application server on OS/390, direct access to saposcol is possible. When any other application server requests data from saposcol, it uses a direct connection to the SAP R/3 instance on OS/390; see Figure 35.

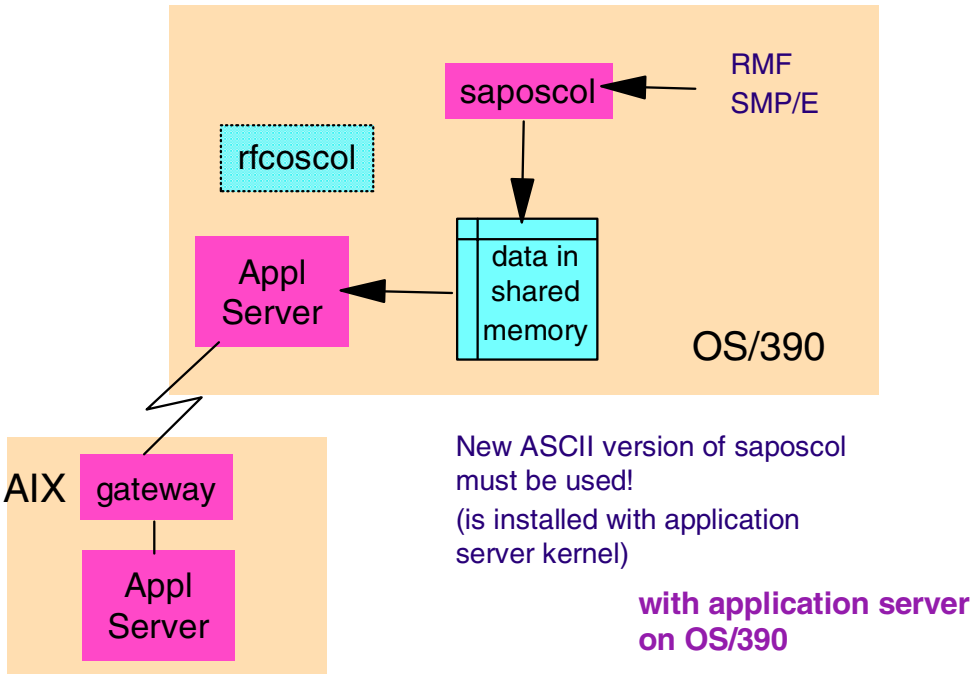

Figure 35. Data flow without rfcoscol

When R3up switches to the central instance running on OS/390, it starts the new ASCII version of saposcol. This will fail if rfcoscol is still running. You cannot run an SAP R/3 instance and rfcoscol on the same machine, as mentioned in OSS note 145015.

You have to deinstall rfcoscol. Make sure you also delete the files /tmp/coll.put and /usr/sap/tmp/coll.put.

Note that the saposcol packaged with the application server is incompatible with the saposcol that comes with rfcoscol, although they report the same version number when called with saposcol -v.

2.3.7 Running R3up

The upgrade process on OS/390 offers a choice of three different upgrade strategies. They are called A_switch, A_on, and A_off. These strategies differ in the total runtime of the upgrade and the downtime on production processing.

With DB2 UDB for OS/390 as your database server, the changes to the database are logged during the whole upgrade process on OS/390, so there is no difference between the strategies A_switch and A_on. If you use a database other than DB2, there is a difference between these strategies; an example is the number of archives used.

It was our aim to get a fast upgrade, and we did not use the SAP system during the upgrade, therefore we chose the A_off strategy.

For more detail refer to *Upgrade to Release 4.6B: OS/390 UNIX System Services,* “Planning the Upgrade Strategy”.

2.3.7.1 Starting the upgrade

The handling of the upgrade is similar to that of PREPARE. To start the upgrade, start the Upgrade Assistant server and your Upgrade Assistant (refer to “Starting the Upgrade Assistant server” on page 38 and to “Starting the Upgrade Assistant” on page 38).

To start R3up choose, select **Administrator --> Start R3up** from your browser.

2.3.7.2 User actions of specific phases during the upgrade

In this section, we only mention user actions that differ from those performed for PREPARE (See “Starting the Upgrade Assistant” on page 38) and that are specific to the OS/390 platform. For a table containing the user input, see Appendix C.3, “UPGRADE phases of UpgDialog.log” on page 115.

For details on performing the upgrade and a description of single upgrade phases, refer to *Upgrade to Release 4.6B: OS/390 UNIX System Services*.

In the INITSUBST phase (during R3up), you are asked whether you would like the upgrade process during the final R3up phases to stop as soon as it is possible to start production operation. We choose **do not stop** in our case.

Since we chose the A_off strategy, R3up allows us to start multiple R3load processes to import the substitution set. We chose the number of table importers to be six (TABLE IMPORTERS = 6).

As mentioned in *Upgrade to Release 4.6B: OS/390 UNIX System Services,* “Monitoring the Upgrade”, SAP recommends two background processes for machines with up to 128 MB memory, three for machines with up to 256 MB memory, and four for machines with more than 256 MB memory. We chose the maximum number of batch processes during the upgrade to be five (BATCH PROCESSES = 5).

During phase INITSUBST, you can either choose to run single or parallel tp processes in phase PCON and NEWTAB_CRE. We chose to run the tp processes in parallel for both phases.

We choose six as the number of tp processes in phase PCON to alter tables that are larger than 1 MB with DDL statements (TP PROCESSES with DDL = 6).

We choose a value of 10 for the number of processes to tables and tablespaces with DDL statements (TP PROCESSES with DDL = 10). During phase NEWTAB_CRE, these TP processes will run in parallel creating tables and tablespaces using DDL statements to optimize your system load.

Note

Increasing the number of parallel tp processes may result in a number of deadlocks. You can spot them in the MVS system log or in the ICLI error log.

In any case, the upgrade process keeps track of deadlocks and repeats the aborted units of work as required.

In phase PATCH_CHK3, R3up checks the support packages (the former hot packages) you already included in your system. If they are more recent than

those included in the upgrade data, you have to obtain the 4.6B support packages from SAP and integrate them into the upgrade in phase BIND_PATCH. For start release 4.5B, this happens if your support package level exceeds 10; for release 4.0B, the corresponding level is 28 (there is no SAP note mentioning those numbers; ask SAP for other start releases).

SAP recommends that you include all available support packages in this case, with the exception of Basis Support Packages, which are not approved in SAP note 119738 (we had to refer to the German version of that note, as the English one was outdated).

The general procedure is described in *Upgrade to Release 4.6B: OS/390 UNIX System Services, Making Entries for the Read CD Module*. When disassembling the packages with the program RSSPDASS, we ran into the problem that this report called the wrong tp version. A possible workaround is mentioned in SAP note 193208.

In phase MODPROFP_46B, there is a note stating that all secondary application servers can be restarted; however, this is not possible at that stage since those application servers have not been upgraded to 4.6B yet.

Note

After the upgrade, the central instance is “moved” to OS/390. Any previous SAP instances (on AIX or NT) that formed part of the SAP R/3 system before the upgrade are not upgraded to 4.6B.

Those secondary application servers will have to be re-installed with SAP R/3 4.6B in order to use them as application servers supporting the 4.6B central instance on OS/390. Refer to “Installing a new dialog instance on the AIX host” on page 51 for information about how to install a new dialog instance.

2.3.7.3 Monitoring the upgrade

The upgrade monitor can be invoked from the Upgrade Assistant by selecting **Administrator --> Start Upgrade Monitor.**

2.3.8 Special notes concerning R3up

Phase SHADOW_IMPORT: R3trans

We downloaded the newest R3trans, according to SAP R/3 note number 179373, since we had to include Support Packages. We put it into /usr/sap/put/exe.

Phase REQJOBRES: Rescheduling batch jobs

After the upgrade we ran report BTCTRNS2 as user DDIC using transaction SE38. This reschedules the batch jobs that have been removed for the upgrade. When you perform this step, ensure that the file REPLIST exists in the work directory of the application server where you are logged on. If you want to run it from OS/390, you have to copy the file REPLIST from AIX:

1. Logon to AIX.
2. cd /usr/sap/RED/DVEBMGS00/work
3. cp -p REPLIST /usr/sap/trans

4. Logon to OS/390.
5. cd /usr/sap/trans
6. mv REPLIST /usr/sap/RED/DVEBMGS00/work
7. Start report BTCTRNS2.

Phase REQGENLD: generating the ABAP programs
Because we wanted to increase the performance of our system, we chose to run transaction SGEN after the upgrade. We ran this transaction twice, once for each platform: once when logged on to SAP using the OS/390 CI Host, and the other time when logged on the AIX host. The reason for running this report twice is because different ABAP/4 loads exist in the database for the same ABAP/4 program on different platforms.

2.4 Post-upgrade steps

After upgrading to 4.6B, there are some post-upgrade steps which have to be performed, most are mandatory, some are optional.

2.4.1 Executing saproot.sh

To perform some adaptations, execute the following commands:

1. Logon as a user redadm.
2. su root
3. cd /usr/sap/put/exe
4. ./saproot.sh RED
5. Restart your SAP.

2.4.2 Reconfiguring the Transport Management System (TMS)

We moved the central instance to another machine. To reflect this in the TMS configuration, you have to perform two steps prior to distributing the configuration as mentioned in *Upgrade to Release 4.6B: OS/390 UNIX System Services, Post-Upgrade Activities*:

- Change the RFC destination for system RED:
  SM59: RFC-destinations -> R/3 connections -> RED,
  change sap1tr0 to wtsc42oe
- Change the TMS communication parameters:
  STMS: Overview -> Systems, doubleclick on system RED, change field Target host in Communications data: RFC address from sap1tr0 to wtsc42oe

2.4.3 Importing required SAP transports

SAP R/3 note number 0191215 lists several transports that need to be imported into your new 4.6B system. Make sure to also check the German version if you get the warning translation not current.

These transports include last-minute DDIC corrections, new CCMS functionality, and some performance-related enhancements.

2.4.4 Performing DB2 RUNSTATS, REORG and backup

Although it is an optional task, we strongly recommend that you back up your database after the upgrade. It is your responsibility to generate the image copy jobs and you have to include all new defined tablespaces during the upgrade process.

An alternative is to use transaction DB13, where you have the option of backing up all SAP R/3 tablespaces. Due to the high number of tablespaces, this job takes a long time to run.

Another recommended step is to reorganize all R3 tablespaces. During the upgrade process, there is no job created by SAP for RUNSTATS, so you have to write your own job for doing so. But you may not have the resources to do that. Instead, you can determine the most necessary tablespaces by running the query shown in Figure 36.

```
SELECT DBNAME, TSNAME, CARD, (NEARINDREF + FARINDREF) * 100 / CARD,
       PERCDROP
  FROM SYSIBM.SYSTABLEPART
 WHERE ((CARD > 0 AND (NEARINDREF + FARINDREF) * 100 / CARD > 10)
        OR PERCDROP > 10)

SELECT IXNAME, IXCREATOR, CARD, (NEAROFFPOS + FAROFFPOS) * 100 / CARD
  FROM SYSIBM.SYSINDEXPART
 WHERE (CARD > 0 AND (NEAROFFPOS + FAROFFPOS) * 100 / CARD > 10)

SELECT IXNAME, IXCREATOR
  FROM SYSIBM.SYSINDEXPART
 WHERE LEAFDIST > 200
```

Figure 36. SQL statements to find necessary tablespaces for REORG

The last utility you should run is RUNSTATS, for performance reasons, you should run it on all tablespaces. Here you have the choice of either using DB13 to generate this job, or using your own mechanism to code the JCL.

We performed a full image copy of the database as well as a full backup of the SAP file systems on OS/390 and AIX after generating the ABAP/4 loads using transaction SGEN.

After the upgrade process, there may be empty tablespaces, databases or storage groups which can be dropped. SAP provides a program called RSDB2CLN to find and drop them, if you decide to do so.

2.4.5 Moving file systems to OS/390

Figure 37 shows the layout of the filesystems after the upgrade. The solid arrows denote symbolic links and the dotted arrows denote NFS mounts. Directories outside the disk symbols are NFS mountpoints.

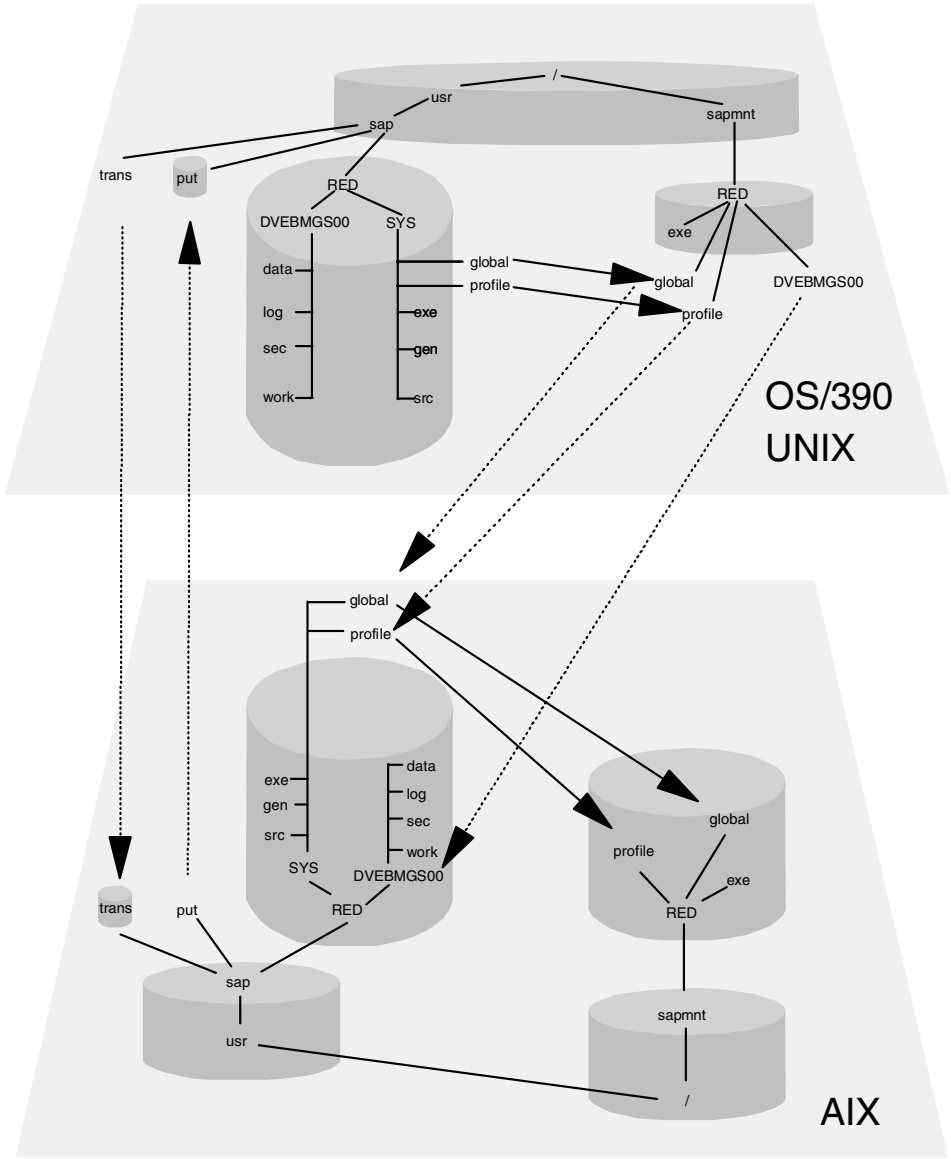

Figure 37. Directory structures in OS/390 UNIX and AIX after the upgrade process

We decided to leave the central instance on the S/390 host. For high availability reasons, we chose to move the remaining shared file systems to the central instance.

To migrate the filesystems to the S/390, we used the following process flow:

1. We shut down the SAP system.
2. We created a new HFS in OS/390 with /usr/sap/trans2 as the mountpoint. The size had to be at least the size of /usr/sap/trans on AIX.
3. We logged on as user redadm and created directories using the following commands:
   a. mkdir profile2
   b. mkdir global2
4. We copied contents of the directories /usr/sap/trans, /sapmnt/RED/global, and /sapmnt/RED/profile to the corresponding new directories (e.g. cp -Rp /usr/sap/trans/* /usr/sap/trans2).
5. We unmounted the old NFS mounts /usr/sap/trans, /sapmnt/RED/global, /sapmnt/RED/profile, and /sapmnt/RED/DVEBMGS00.
6. We removed the mount points /sapmnt/RED/global, /sapmnt/RED/profile, and /sapmnt/RED/DVEBMGS00.
7. We renamed the directories profile2, global2 to profile and global (e.g. mv /sapmnt/RED/profile2 /sapmnt/RED/profile).
8. We unmounted the filesystem /usr/sap/trans2 and mounted it again using the mountpoint /usr/sap/trans.
9. We removed old mountpoint /usr/sap/trans.
10. We removed the NFS exports from AIX.
11. We restarted the SAP R/3 system.

Figure 38 on page 48 shows the layout of the filesystems after the filesystem migration.

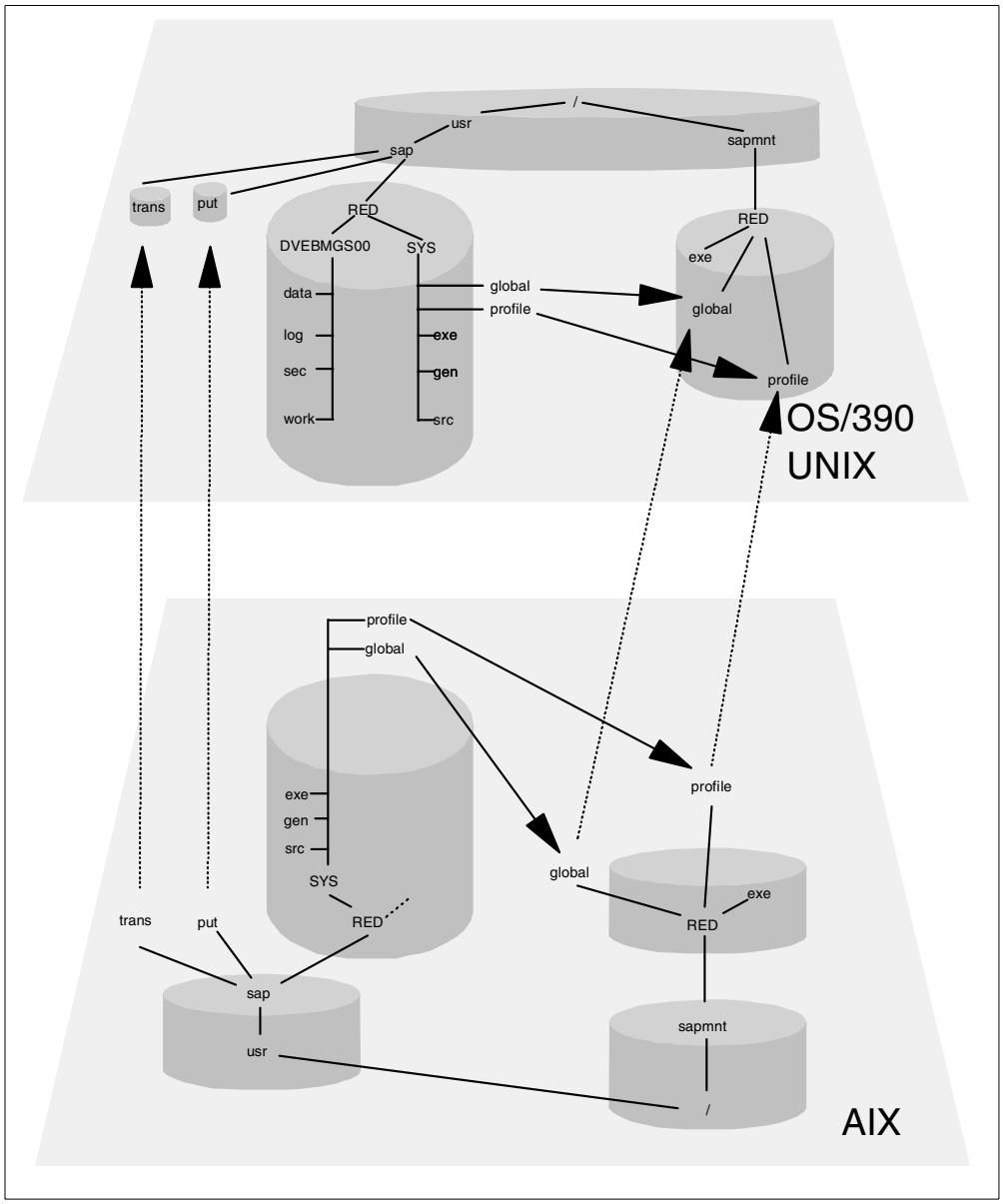

Figure 38. Directory structures in OS/390 UNIX and AIX after the move

2.4.6 Installing a new license

Because we moved our central instance to the S/390, the message server then ran on a different machine. This resulted in a changed customer key and made the old license invalid. Currently the system runs with a temporary license. Since this license expires after four weeks, we will have to install a new license.

2.4.7 ICLI server configuration (external application server)

Beginning with SAP R/3 4.6A, TCP/IP is the only supported communication protocol for the database connection. Make sure that all required IP definitions are made in order to establish a successful connection between the application server and the database server. The IP profile definitions we used in our scenario are shown in “Network configuration” on page 87 and in Figure 81 on page 91.

You also have to make sure that the **-**TCP parameter is specified in the startup procedure of the ICLI server, as shown in Figure 41.

We created a new ICLI server for the connection between the database server and any external application server. Figure 39 shows the OS/390 UNIX commands which created the new directory and files necessary for the ICLI server.

```
cd /usr/lpp/icli/samples
./fome46bi /u/iclirun/red1 DSN610.SDSNLOAD ICLIRUN FOMEP46B 6531
```

Figure 39. Setting up the ICLI server instance

We did not use passticket signon verification, therefore the file iclienv located in the ICLI directory /u/iclirun/red1 had to be modified to reflect this. Figure 40 shows the contents of the iclienv file.

```
ICLI_TRACE_LEVEL=0
ICLI_TRUSTED_CONNECTIONS=1
NLSPATH=/usr/lib/nls/msg/%L/%N
STEPLIB=DSN610.SDSNLOAD
```

Figure 40. iclienv file

After setting up the ICLI server, we used the JCL from SYS1.SAMPLIB member FOME46BB to bind the new plan for 4.6B. We also used the JCL located in SYS1.SAMPLIB(FOME46BG) to grant the necessary DB2 access.

To create the started task for the ICLI server, we copied the JCL from OS/390 UNIX file /u/iclirun/red1/iclitask.jcl to SYS1.PROCLIB(ICLIRED). We also added the TCP parameter in the PARM field of the EXEC statement. The JCL can be seen in Figure 41.

```
//* ICLI server started task JCL
//ICLI    EXEC PGM=BPXBATCH,TIME=NOLIMIT,REGION=200M,
//        PARM='PGM /usr/sbin/fome46bs -PLAN FOMEP46B -LOGDIR /u/icliru-
//             n/red1 -PORT 6531 -TCP'
//STDENV  DD PATH='/u/iclirun/red1/iclienv'
//STEPLIB DD DISP=SHR,DSN=DSN610.SDSNLOAD
//STDERR  DD PATH='/u/iclirun/red1/icliserv.err',
//        PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//        PATHMODE=(SIRWXU)
//STDOUT  DD PATH='/u/iclirun/red1/icliserv.out',
//        PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//        PATHMODE=(SIRWXU)
//SYSUDUMP DD SYSOUT=*
```

Figure 41. JCL to start the ICLI server

2.4.8 Configuring the ICLI Alert Router

The ICLI alert router transfers DB2 exception events to the SAP system. After upgrading to 4.6B, a new version has to be installed using the OS/390 UNIX commands shown in Figure 42.

```
cd /usr/lpp/icli/samples
fome46bj /u/iclialrt DSN610.SDSNLOAD FOMEP46B RED DBK1 /usr/lib
```

Figure 42. Setting up the ICLI alert router

We copied the JCL from OS/390 UNIX file /u/iclialrt/alrttask.jcl to SYS1.PROCLIB(ALRTRED). See Figure 43 for this JCL.

```
//* ICLI alert router started task JCL
//ICLI    EXEC PGM=BPXBATCH,TIME=NOLIMIT,REGION=20M,
//        PARM='PGM /usr/sbin/fome46br -DEST RED -DBAN DBK1 -PLAN FOMEP-
//             46B -LOGDIR /u/iclialrt'
//STDENV  DD PATH='/u/iclialrt/alrtenv'
//STEPLIB DD DISP=SHR,DSN=DSN610.SDSNLOAD
//STDERR  DD PATH='/u/iclialrt/iclialrt.err',
//        PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//        PATHMODE=(SIRWXU)
//STDOUT  DD PATH='/u/iclialrt/iclialrt.out',
//        PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//        PATHMODE=(SIRWXU)
//SYSUDUMP DD SYSOUT=*
//SYSMDUMP DD SYSOUT=*
```

Figure 43. JCL to start the ICLI Alert Router

You need to import the CCMS transport mentioned in note 191215 to be able to use the ICLI Alert Router. See “Importing required SAP transports” on page 44.

Before starting the ICLI Alert Router, the configuration table in SAP R/3 has to be recreated:

- Call transaction ST04 and click the button **ICLI Alert Router settings**.
- Select **Alert Router setting -> Change**.
- Set Application server and System number according to your new central instance on OS/390.
- Select **Alert Router setting -> Create**.

You can check from within SAP R/3 if the ICLI Alert Router is running. From transaction ST04, choose **Thread activity**. The resulting table should contain an “Alert Router” entry.

2.4.9 Installing a new dialog instance on the AIX host

Attention

To avoid data corruption see SAP R/3 note number 0204662. This affects all application servers not running on OS/390. Follow the instructions in this note after installing the new kernel for your new dialog server.

Since we decided to leave our central instance on OS/390, we installed a new dialog instance on sap1tr0. Therefore we deinstalled our old central instance on AIX first. Afterwards we installed a new dialog instance on sap1tr0 using R3SETUP -f DIALOG.R3S.

For more details see the chapter “Installation a Dialog Instance*”* in *R/3 Installation on OS/390 UNIX System Services: DB2 UDB for OS/390.*

Note

If you want to shift your central instance back to AIX, perform R3SETUP -f CENTRAL.R3S. But you should not delete filesystems /usr/sap/trans, /sapmnt/RED/exe, and /sapmnt/RED/profile when you deinstall your old central instance.

The following filesystems reside on OS/390 and were NFS-mounted from OS/390 for the installation of the dialog instance:

- /sapmnt/RED/global
- /sapmnt/RED/profile
- /usr/sap/trans

To export these filesystems from OS/390, we modified the exports data set in the NFS configuration to the values shown in Figure 44:

```
/hfs/sapmnt/RED/profile -access=sap1en1:sap1tr0
/hfs/sapmnt/RED/global -access=sap1en1:sap1tr0
/hfs/usr/sap/trans -access=sap1en1:sap1tr0
```

Figure 44. NFS export dataset on OS/390

These NFS mounts should be permanently mounted on AIX for the dialog instance operation.

Note

Because this is a heterogeneous environment, you must not mount /sapmnt/SID/exe from OS/390. Instead, create a separate filesystem /sapmnt/SID/exe with at least 240 MB of free space on AIX.

After the installation of our dialog instance, we adapted its profile appropriately and synchronized the time between the application server and the central instance on OS/390.

2.4.10 Adapting the profiles

Directly after the dialog instance installation, the central instance on OS/390 runs with generated SAP R/3 profiles. Therefore, you have to adapt the new instance profiles according to your former environment. The old profiles are stored in /sapmnt/RED/profile with the following names:

- DEFAULT.PFL_sap1tr0
- RED_DVEBMGS00_sap1tr0

To adapt the profiles, we recommend that you use the transaction rz10. You have to import the newly generated profiles first.

2.5 Summary

This section shows our final system configuration after performing the upgrade. It also shows some information about resource usage in DB2.

2.5.1 Final configuration

Figure 45 on page 53 shows the final system configuration after the upgrade. For simplicity, we did not include the RS/6000 F50 in this diagram.

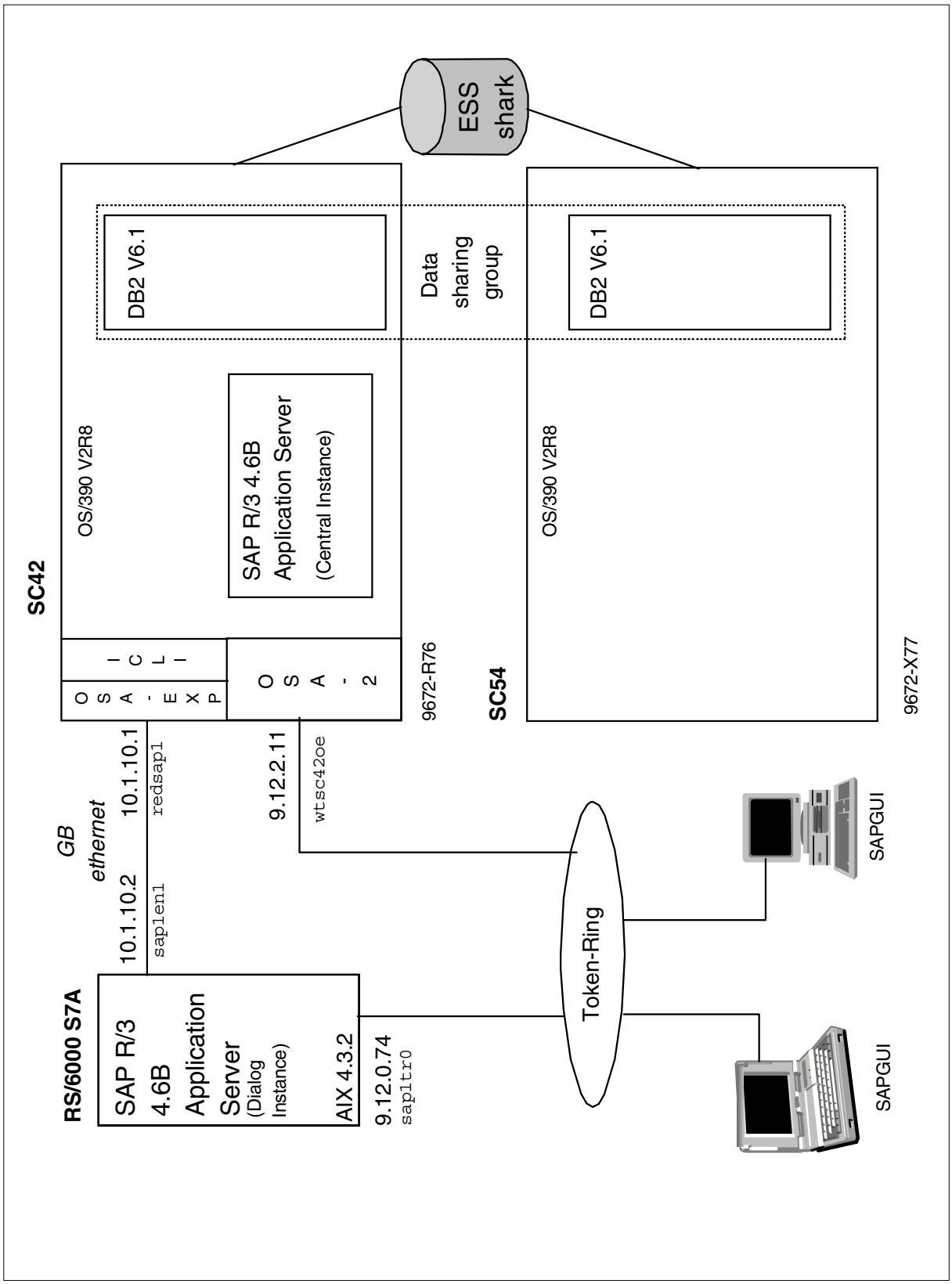

Figure 45. Final system configuration

2.5.2 Resource usage in DB2

Table 4 provides information on the number of resources you need for the migration from 4.5B to 4.6B.

Table 4. Resource usage in DB2

	SAP R/3 4.5B	SAP R/3 4.6B	Growth in %
Storage groups	24	24	0
Databases	7,378	9,052	22.7
Tablespaces	7,378	9,052	22.7
Tables	16,711	19,887	19
Indexes	19,180	23,128	20.6
Views	3,471	4,102	18.2
Space in GB	12.8	24.5	91.4

The calculated space is based on the sample data downloaded from the CD during the installation of 4.5B. Keep in mind that you will have a different amount, depending on the data of your SAP system.

The growth in space (91.4%) is mainly due to tables being populated that were empty in earlier releases. Since most users have the majority of space in their data tables, this percentage increase is not expected for an existing user. However, new users and users who intend to install 4.6B in a test-only system should plan for this space increase of a database that only contains SAP R/3 tables.

The total amount of space was calculated using the DB2 STOSPACE utility on all storage groups belonging to SAPR3 and running the following SQL run under QMF.

```
SELECT SUM(SPACE) FROM SYSIBM.SYSSTOGROUP WHERE CREATOR='SAPR3';
```

Figure 46. SQL statement for gathering space values

Chapter 3. Operating SAP R/3 on OS/390

This chapter contains information about operating SAP R/3 instances on OS/390 such as procedures to start and stop SAP, process overview, and R/3 configuration.

Since the application server on OS/390 is a UNIX port, the handling of the R/3 instance is quite similar to that on other UNIX systems. As a result, we mainly focus on aspects specific to OS/390 UNIX System Services.

3.1 Starting and stopping SAP on OS/390

On OS/390, all processes for the SAP R/3 application server run as OS/390 UNIX processes under the SAP system ID <sid>ADM; in our case, this is REDADM. The handling of these processes is similar to other UNIX systems. Starting and stopping the application server instance on OS/390 can be performed either by using OS/390 UNIX commands and scripts or by using an OS/390 started task.

Under OS/390 UNIX, the commands startsap and stopsap can be used. These commands have to be issued by user redadm.

In our scenario we created two started tasks to start and stop the SAP R/3 instance. The JCL used in these started tasks executes an OS/390 UNIX batch program, which itself executes the startsap or stopsap script. The started tasks can be incorporated into any OS/390 automation product. The JCL we used to start the SAP R/3 instance is shown in Figure 47.

```
//STARTRED EXEC PGM=BPXBATCH,REGION=0M,PARM='SH startsap'
//STDOUT   DD PATH='/u/redadm/std.out',PATHOPTS=(OWRONLY,OCREAT),
//         PATHMODE=SIRWXU
//STDERR   DD PATH='/u/redadm/std.err',PATHOPTS=(OWRONLY,OCREAT),
//         PATHMODE=SIRWXU
```

Figure 47. STC JCL to start SAP R/3

The STC JCL to stop SAP R/3 can be seen in Figure 48.

```
//STARTRED EXEC PGM=BPXBATCH,REGION=0M,PARM='SH stopsap'
//STDOUT   DD PATH='/u/redadm/std.out',PATHOPTS=(OWRONLY,OCREAT),
//         PATHMODE=SIRWXU
//STDERR   DD PATH='/u/redadm/std.err',PATHOPTS=(OWRONLY,OCREAT),
//         PATHMODE=SIRWXU
```

Figure 48. STC JCL to stop SAP R/3

Both STCs have to run under the user ID of redadm in order to pick up the correct environment variables necessary to start and stop SAP R/3. Therefore, we added new RACF STARTED class profiles. The RACF commands to define these profiles and to associate redadm with them are shown in Figure 49 on page 56. Note that user redadm has to be connected to group OMVSGRP before you create the profiles.

```
CONNECT REDADM GROUP(OMVSGRP)
RDEFINE STARTED (STARTRED.*) STDATA(USER(REDADM) GROUP(OMVSGRP))
RDEFINE STARTED (STOPRED.*) STDATA(USER(REDADM) GROUP(OMVSGRP))
SETROPTS RACLIST(STARTED) REFRESH
```

Figure 49. RACF definitions for STARTED profiles

Note

Neither the command stopsap nor the corresponding started task stops saposcol. This has to be done manually if needed.

The sequence to bring up an SAP R/3 system is:

1. Start DB2.
2. Start the ICLI server (if external application servers are used.)
3. Start the central instance.
4. Start the ICLI alert router.
5. Start any additional dialog instances.

To stop an SAP R/3 system, the above sequence can be used in reverse order.

3.2 Process overview on OS/390

On OS/390, SAP R/3 creates different processes in OS/390 UNIX. Each process is represented by its own address space. Depending on how you start the SAP R/3 instance on OS/390, the name of the address spaces will either include the started task name or the <sid>ADM user ID.

Normally a digit is appended at the end of the address space name. In our scenario we used a started task name of 8 characters, therefore the address space names were all equal.

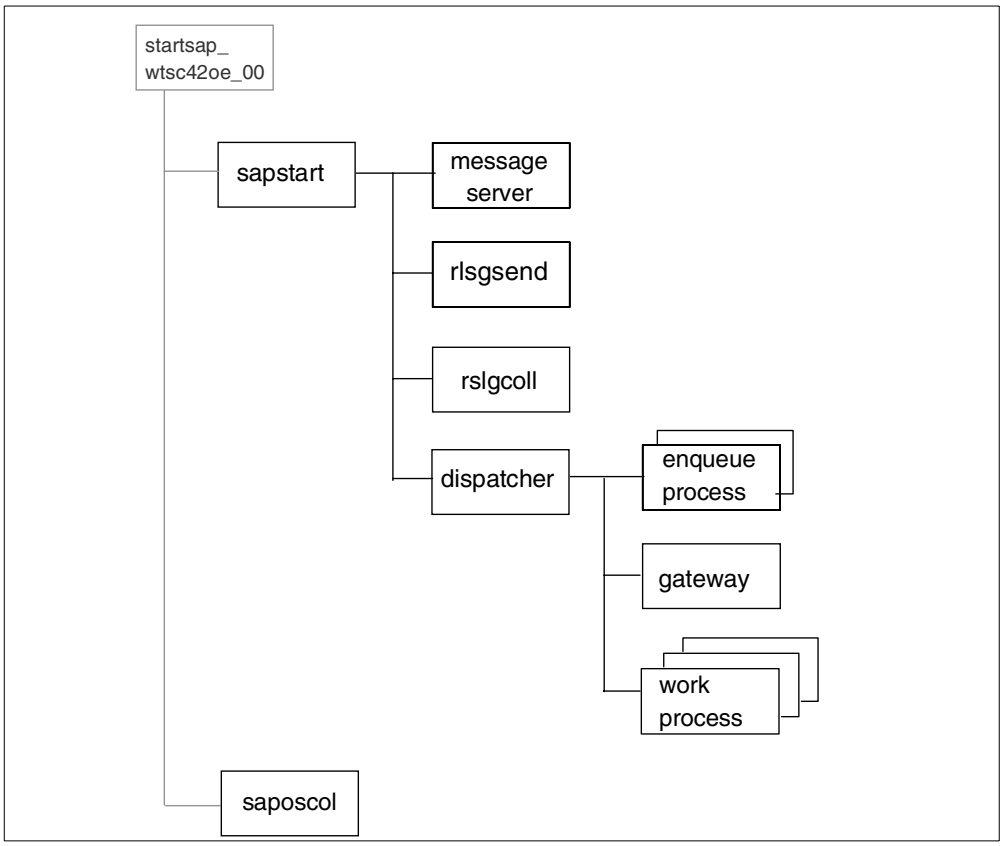

Figure 50. Process overview

As shown in Figure 50, the first process started by the startsap script is saposcol, which has the init process as parent. The next process is the sapstart process, which also has the init process as parent. sapstart then becomes parent for all other processes started by SAP R/3. Under this process the following processes were created: msg_server, rslgsend (remote system log sender), rslgcoll (remote system log collector), saposcol and dispatcher.

The dispatcher becomes a parent process, and all the remaining processes run under this process. Examples of these child processes are enq server, spool, gateway, and work processes.

The OS/390 system command `D OMVS,U=<sapid>ADM` (in our case, REDADM) can be used to view all SAP R/3 instance processes. Note also that the OS/390 UNIX command `ps -ef | grep <sapid>adm` will achieve the same results. Figure 51 on page 58 shows sample output from the OS/390 system command `D OMVS,U=REDADM`.

```
-D OMVS,U=REDADM
 BPXO040I 14.11.33 DISPLAY OMVS 832
 OMVS     000F ACTIVE          OMVS=(8A)
 USER     JOBNAME  ASID        PID       PPID STATE   START     CT_SECS
 REDADM   REDADM4  005D   67109459          1 1WI   11.31.32       .194 [1]
   LATCHWAITPID=         0 CMD=/usr/sap/RED/SYS/exe/run/sapstart pf=/us
 REDADM   REDADM6  0081   83886686          1 1S    11.31.24      4.729 [2]
   LATCHWAITPID=         0 CMD=/usr/sap/RED/SYS/exe/run/saposcol
 REDADM   REDADM1  005B   83886693   67109459 1F    11.31.33       .254 [3]
   LATCHWAITPID=         0 CMD=ms.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM2  0071       3435   67109459 1FI   11.31.33      8.891 [4]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM3  0082       3436   67109459 1FI   11.31.33       .201 [5]
   LATCHWAITPID=         0 CMD=co.sapRED_DVEBMGS00 -F pf=/usr/sap/RED/S
 REDADM   REDADM4  0084       3437   67109459 1FI   11.31.33       .135 [6]
   LATCHWAITPID=         0 CMD=se.sapRED_DVEBMGS00 -F pf=/usr/sap/RED/S
 REDADM   REDADM3  0067   16777835       3435 1FI   11.31.41       .821 [7]
   LATCHWAITPID=         0 CMD=gwrd -dp pf=/usr/sap/RED/SYS/profile/RED
 REDADM   REDADM4  004C       3438       3435 1DI   11.31.41    213.583 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM5  006B       3439       3435 1DI   11.31.42     35.747 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM6  0074       3440       3435 1DI   11.31.42     21.477 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM7  0075       3441       3435 1DI   11.31.42     18.027 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM8  0077       3442       3435 1DI   11.31.42       .397 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM9  006A       3443       3435 1DI   11.31.42      2.512 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM1  0055       3444       3435 1DI   11.31.42       .300 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM2  006D       3445       3435 1DI   11.31.43       .216 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM3  0062       3446       3435 1DI   11.31.43      6.070 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM4  006E       3447       3435 1DI   11.31.43      4.453 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
 REDADM   REDADM5  0068       2448       3435 1R    11.31.43      2.731 [8]
   LATCHWAITPID=         0 CMD=dw.sapRED_DVEBMGS00 pf=/usr/sap/RED/SYS/
```

Figure 51. System command D OMVS,U=REDADM

The following references explain items of interest in Figure 51:

[1] The sapstart process, which has the eyecatcher sapstart in it and belongs to PPID 1.

[2] The saposcol process, which has the earliest start time and belongs to PPID 1 also.

[3] The msg_server process, which can be recognized by the initial characters ms following “CMD=”. It belongs to the sapstart process.

[4]i The dispatcher, which can be recognized by the initial characters dw following “CMD=”; the parent process ID must be the one from the sapstart, (otherwise see [8]).

[5] The remote syslog collector, which is a child of the sapstart process and contains the eyecatcher co following “CMD=”.

[6] The remote syslog sender, which is a child of the sapstart process and contains the eyecatcher se following “CMD=”.

[7] A gateway process, which is a child of the sapstart process and contains the eyecatcher gwrd following “CMD=”.

[8] All work processes which contain eyecatcher dw following “CMD=” (as in **[4]**). However the parent process in this case is the dispatcher. These work processes can be batch, dialog, enq server, spool or update processes. There is no identifier in the OS/390 command output that distinguishes between the process types. You must use SAP R/3 transaction SM50 (whose output is shown in Figure 52) to determine the type of work process.

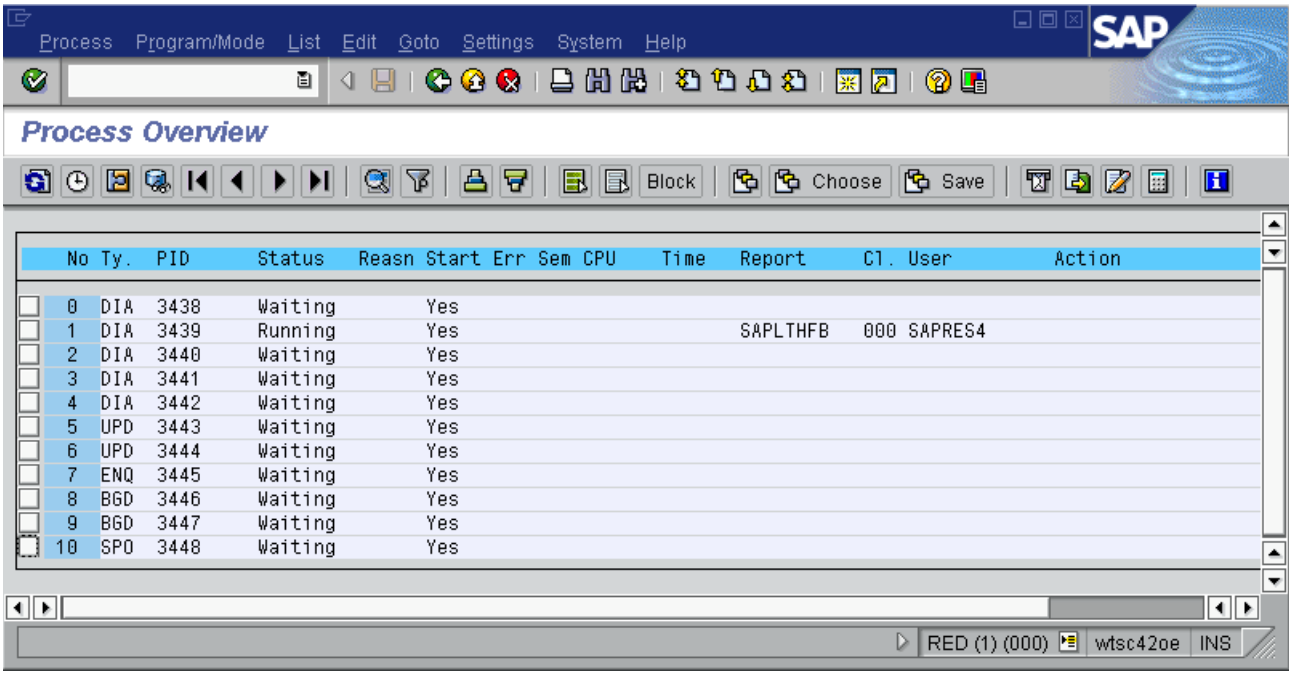

Figure 52. Process overview SM50

3.3 Profile settings for memory management

Since the SAP R/3 application server on OS/390 is a UNIX port, the configuration of the SAP R/3 instance is almost the same as for other platforms. You maintain your profiles as usual with transaction rz10**.** In “SAP R/3 configuration and profiles” on page 91 you can see the profiles of our SAP R/3 System RED.

Of course, there are some special parameters that are related to memory management as shown in Table 5.

Table 5. SAP R/3 profile parameters

Parameter	Suggested Value	Meaning
ES/TABLE	SHM_SEGS	This enables usage of the map service for extended memory. This parameter is required.
em/address_space_MB	512	The size of address space (in MB) that is reserved in the work process for extended memory.
ES/SHM_SEG_SIZE	256	The size of each shared memory segment in MB.
ES/SHM_USER_COUNT	1024	The maximum number of user contexts.
em/initial_size_MB	....	This value is ignored, but must be set. The size of extended memory is limited by (ES/SHM_SEG_SIZE)*(ES/SHM_USER_COUNT).

Besides other types of memory, SAP R/3 distinguishes between two different types of memory used by its work processes. The first one is used for R/3 buffer pools. These pools are implemented as shared memory, so that R/3 processes can share the contents of this huge buffer.

The second type of memory that is used by R/3 is R/3 extended memory. It contains the major parts of user contexts of the ABAP/4 program that is actually performed by a work process. Similar to AIX, this type of memory is implemented on OMVS as shared memory. With each context change, the user context is assigned a different work process by a mapping function that guarantees a fast context switch.

On OS/390, the limit for these shared memory segments is 2 GB. Since the application server on OS/390 utilizes a new map service, the total amount of extended memory (sum of all shared memory segments) is no longer restricted to 2 GB, but for a single address space the limit remains at 2 GB. The total amount of shared memory for all address spaces is limited only by system performance considerations, such as an installation's tolerance for paging.

To visualize the memory layout refer to Figure 53.

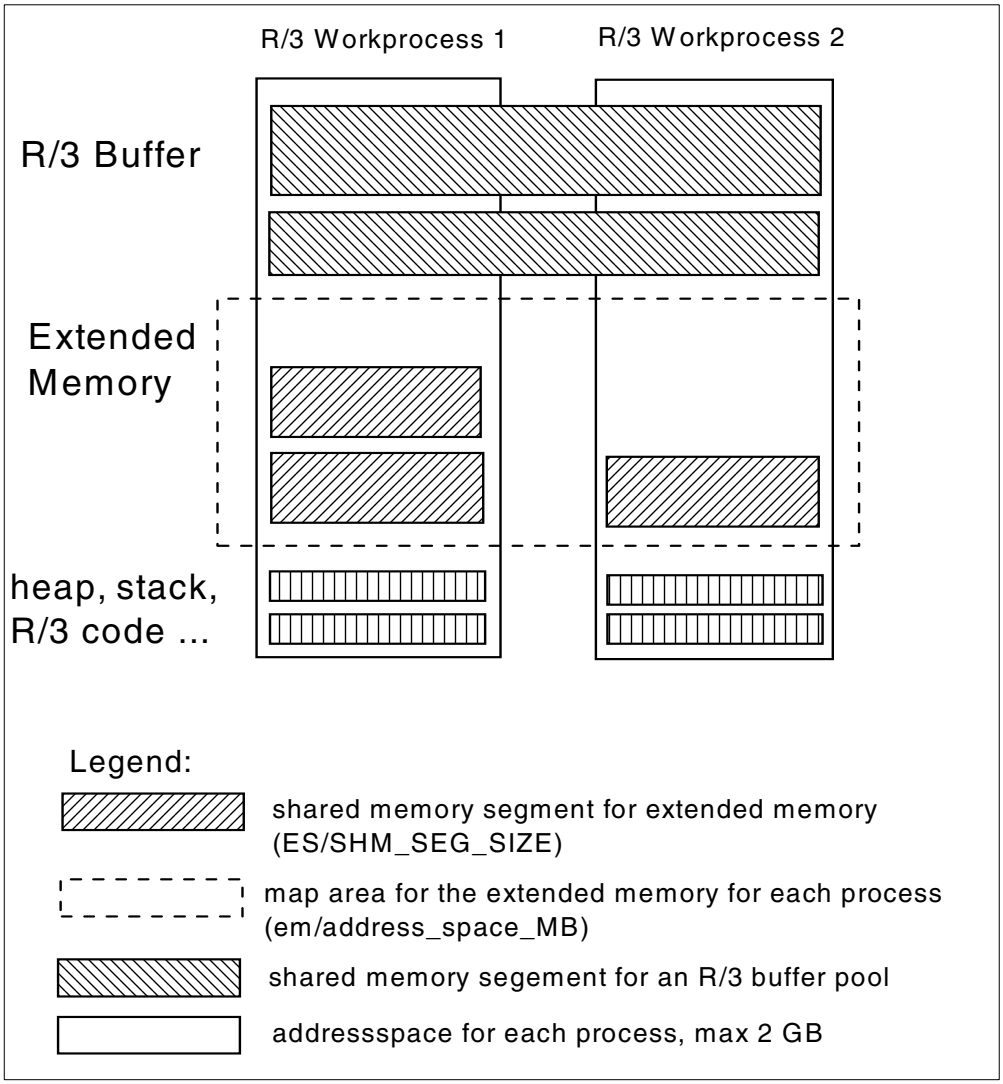

Figure 53. Memory layout for application server on OS/390

Information

Shared memory segments for the buffer pools and the extended memory are located in dataspaces of the OMVS Kernel.

Note

SAP AG is developing common memory management routines that apply to various platforms, so watch for information regarding this topic.

3.4 Performance monitoring

In our scenario the Workload Manager (WLM) associates service class SAPAS and report class SAPASREP with the SAP R/3 application server processes according to WLM's classification rule. Information about WLM settings can be found in “OS/390 settings for Workload Manager” on page 28.

On OS/390, the usual monitoring tools like RMF can be used to gather information about performance values for the application server on OS/390, the ICLI server, and DB2 UDB for OS/390. To monitor DB2 performance in more detail, DB2PM can be used.

SAP R/3 itself provides a collection of performance monitoring transactions like ST02 “Tune summary”, ST03 “Workload Analysis”, ST04 “Database Performance Analysis”, and ST06 “Operating System Monitor”, that can be used to evaluate your system.

3.5 Installing R/3 kernel patches

In a heterogeneous environment, different platform-dependent SAP executables are used by SAP R/3 on different platforms. When applying SAP kernel patches, make sure that you download the appropriate kernel patch related to your platform(s) and apply them separately. After applying the kernel patch, all application servers running on the same platform must be at the same patch level. To obtain fixes from sapserv, you might consider using the procedure we used; it is detailed in Appendix E, “Getting files from sapserv” on page 125.

To find out about your SAP kernel patch level, run transaction SM51, select an application server, and click **Release Notes**.

3.6 Useful hints and tips for problem determination

Problem determination for application servers on OS/390 should be done using the normal debugging procedures for SAP, OS/390, and AIX.

3.6.1 Log files

With the central instance on OS/390, new SAP logs now reside on the OS/390 UNIX filesystems; for instance, the logs for startsap and stopsap are available in <sapid>adm’s home directory (in our scenario this was /u/redadm).

The most valuable log files can be found in SAP R/3’s work directory, /usr/sap/RED/DVEBMGS00/work in our case. Every process writes a log file in that directory, called a “developer trace”. Examples are the dispatcher’s log, dev_disp, the message server’s log, dev_ms, or the work processes’ log dev_w<work process number>. The work process logs are also accessible from within SAP R/3 by using transaction SM50.

3.6.2 Database connectivity

SAP R/3 programs running on OS/390 no longer use ICLI to connect to the database; instead the connection is made using cross-memory services (XMS). To successfully connect, these programs (including the R/3 kernel, R3trans, tp) need to know the DB2 plan name. The R/3 kernel gets this information from the

dbs/db2/planname parameter in its instance profile. All other programs need the environment variable DBS_DB2_PLANNAME to be set accordingly. For example, a plan name could be SAPR346B.

The database connection can be tested under user <sapsid>adm using the command:

```
R3trans -d
```

If this command completes with a return code of 8 or higher, the connection was not established. For more information, browse the trans.log file in the directory where R3trans -d is run to determine why the connection failed. (This assumes the environment variable TRACE is set to 1, as it should automatically be with the -d parameter.)

3.6.3 Shared Memory pitfalls

SAP R/3 allocates considerable amounts of shared memory. In case of a crash, the system may no longer be able to deallocate these memory segments. Restarting the system will fail, unless these memory segments are freed.

SAP R/3 provides a procedure, cleanipc, that frees the segments. The procedure is optionally included in the startsap script. (It is not the default; many test installations do include it. Most production installations do not include it) To run cleanipc, first stop all running SAP R/3 processes, including saposcol (the ICLI server and ICLI Alert Router are not affected). Login as <sapsid>adm and issue the command: `/sapmnt/<SAPSID>/exe/cleanipc <INSTANCE> remove`
where INSTANCE is the two-digit instance number.

Certain system errors may occur that make it impossible to run cleanipc. Some of the possible causes are:

- A process is running and holds the memory.
- The application server was started under a different user ID not accessible to cleanipc.
- OS/390 is not operating correctly due to a bug.

For any of these cases, the following alternative to cleanipc is provided, although we believe the use of such a procedure should rarely be necessary.

Logging on with UID 0, you can issue the OS/390 UNIX command `ipcs` to get a list of all allocated shared memory segments and semaphores. A sample of the output can be found in Figure 54 on page 64.

```
wtsc42oe:/usr/sap/trans/bin (11)>ipcs

Message Queues:
T         ID     KEY        MODE       OWNER    GROUP
q          4 0x00000000 ------------  AAAAAAA     SYS1
q          5 0x00000000 ------------  AAAAAAA     SYS1
q          6 0x00000000 ------------  AAAAAAA     SYS1
q          7 0x00000000 ------------  AAAAAAA     SYS1
q          8 0x00000000 ------------  AAAAAAA     SYS1
Shared Memory:
T         ID     KEY        MODE       OWNER    GROUP
m      40004 0x00000000 --rw-------  AAAAAAA     SYS1
m    4234394 0x00004dbe --rw-rw-rw-  AAAAAAA   SAPSYS
m     498843 0x0382be84 --rw-rw-rw-    redadm   SAPSYS
m    1155002 0x00002743 --rw-r-----    redadm   SAPSYS
m    1155003 0x0000272f --rw-r-----    redadm   SAPSYS
[...]
m    3055637 0x00002738 --rw-r-----    redadm   SAPSYS
m    2990107 0x00002717 --rw-r-----    redadm   SAPSYS
m    5480476 0x00002731 --rw-r-----    redadm   SAPSYS
m    5546023 0x0000272e --rw-r-----    redadm   SAPSYS
m    5677100 0x00002732 --rw-r-----    redadm   SAPSYS
Semaphores:
T         ID     KEY        MODE       OWNER    GROUP
s      20004 0x00000000 --ra-------  AAAAAAA     SYS1
s     478757 0x00004e22 --ra-ra-ra-    redadm   SAPSYS
s    1723945 0x00004e20 --ra-ra-ra-    redadm   SAPSYS
s    1723946 0x000497bd --ra-r-----    redadm   SAPSYS
[...]
s    1723955 0x000497c3 --ra-r-----    redadm   SAPSYS
s    1789492 0x000497c6 --ra-r-----    redadm   SAPSYS
s     478773 0x0382bee8 --ra-ra-ra-    redadm   SAPSYS
s     806454 0x000497c7 --ra-r-----    redadm   SAPSYS
```

Figure 54. Shared memory usage reported by ipcs

If there are entries belonging to <sapsid>adm, and no SAP R/3 processes are running, these entries must be freed using either the OS/390 UNIX command `ipcrm` on every single entry, or the SAP R/3 command cleanipc (which may now function, since it is called by user root, UID 0).

3.6.4 Troubleshooting the JCL submission service

While performing the upgrade, we had some problems getting the JCL submission service to work. If you experience similar problems, first check OSS note 151289 for known problems with JCL submission. To avoid restarting R3up over and over again, you can test JCL submission using the SAP-supplied command `db2jclsub`.

This program is obviously not intended for productive usage, since it provides poor error reporting. Nevertheless, it works when used correctly.

You need to log in as <sapsid>adm to operate in the right environment. On OS/390, this environment is not available while the upgrade is running, so you need to set or augment some environment variables as shown in Figure 55 on page 65. An incorrect environment leads to the following error message:

```
Encrypting userid fails
```

```
setenv PATH /usr/sap/put/exe:$PATH
setenv LIBPATH /usr/sap/put/exe:$LIBPATH
setenv RSDB_DB2JCLLIBRARY /usr/sap/put/exe/db2jcllib.dll
setenv DIR_LIBRARY /usr/sap/put/exe
```

Figure 55. Environment for db2jclsub on OS/390 while upgrading SAP

The db2jclsub command uses a configuration file which contains the JCL submission host, the TSO user ID and the associated password. You can create that file by issuing the command:

```
db2jclsub -m enc -f <config file> -s <submission host> -u <userid> -p <passwd>
```

To test the JCL submission, create a file containing JCL. Then call db2jclsub, providing the configuration file, the JCL file, and a file name to receive the job output:

```
db2jclsub -m exe -f <config file> -i <JCL file> -o <result file>
```

To track down problems, set the environment variable TRACE to the value 3. This causes a detailed trace to be written to the screen, including communications with the ftp utility.

Submitting JCL jobs from within SAP R/3 uses another approach. OSS note 189762 contains more information for that case.

3.6.5 DB2 checks

In DB2 you can see whether there is a connection to the SAP processes by using the DB2 command shown in Figure 56.

```
-DIS THREAD(RRSAF)
```

Figure 56. DB2 display thread command

You will find one thread for every dialog, batch, enqueue, update, and spool process; see Figure 57 on page 66 for a sample of output from the command.

```
=DBK1 DIS THREAD(*)
DSNV401I =DBK1 DISPLAY THREAD REPORT FOLLOWS -
DSNV402I =DBK1 ACTIVE THREADS -
NAME     ST A   REQ ID           AUTHID   PLAN     ASID TOKEN
RRSAF    T    25941 rrs_correlid REDADM   SAPR346B 00B6    39
 V437-WORKSTATION=5 00000 0000003448, USERID=rrs_user_identif,
      APPLICATION NAME=wtsc42oe
RRSAF    T     7288 rrs_correlid REDADM   SAPR346B 008A    38
 V437-WORKSTATION=2 00000 0000003447, USERID=rrs_user_identif,
      APPLICATION NAME=wtsc42oe
                            ...

                            ...
RRSAF    T    29975 rrs_correlid REDADM   SAPR346B 00B3    30
 V437-WORKSTATION=1 00000 0000003438, USERID=rrs_user_identif,
      APPLICATION NAME=wtsc42oe
RRSAF    T     8778 rrs_correlid REDADM   SAPR346B 00B4    29
 V437-WORKSTATION=1 00000 0000003437, USERID=rrs_user_identif,
      APPLICATION NAME=wtsc42oe
DISPLAY ACTIVE REPORT COMPLETE
DSN9022I =DBK1 DSNVDT '-DIS THREAD' NORMAL COMPLETION
```

Figure 57. Sample output from -DIS THREAD

If no problems are found using the preceding procedures, but you are still getting SQL errors in an SAP R/3 application, check for restricted objects in DB2. Use the DB2 command shown in Figure 58.

```
--DIS DB(*) SPACE(*) RESTRICT LIMIT(*)
```

Figure 58. DB2 display database command

This command scans all databases and tablespaces in the DB2 catalog, so it may take a few minutes to get the result. Figure 59 on page 67 shows a sample of the output from this command.

```
DSNT360I =DBK1 **********************************
DSNT361I =DBK1 *  DISPLAY DATABASE SUMMARY
               *    RESTRICTED
DSNT360I =DBK1 **********************************
DSNT362I =DBK1     DATABASE = PR30#000  STATUS = RW
                   DBD LENGTH = 4028
DSNT397I =DBK1
NAME     TYPE PART STATUS              PHYERRLO PHYERRHI CATAL
-------- ---- ---- ------------------ -------- -------- -----
TSP02    TS        STOP
TSP02H0  IX        STOP
TSP02H1  IX        STOP
TSP02H3  IX        STOP
******* DISPLAY OF DATABASE PR30#000 ENDED      *************
DSN9022I =DBK1 DSNTDDIS 'DISPLAY DATABASE' NORMAL COMPLETION
```

Figure 59. Sample output from -DIS THREAD

3.7 Operating summary

In this chapter we tried to explain operational details of SAP R/3 when using application server processes on OS/390. In most cases, the operational aspects are the same as when SAP R/3 is on any other platform; we concentrated on those items that might be different when this platform is used.

Obviously, many other operational details of OS/390 running on S/390 will be different from other application server platforms. Examples of these differences are input/output device allocation, scheduling of work, internal representation of data, filesystem organization, and so on. Most installations with DB2 UDB for OS/390 will be familiar with such aspects; so we did not try to explain them (and our scope of effort and available time would not have allowed it).

Chapter 4. SAP R/3 work processes on OS/390

This chapter describes our findings and experiences from moving SAP R/3 processes from AIX to OS/390 and vice versa.

Theoretical information about SAP work processes and why they should be placed on OS/390 can be found in Chapter 1, “Introduction” on page 1.

Due to the fact that we used the Controlled Availability (CA) version of the SAP R/3 code which was not yet completely optimized for operation on OS/390, we could not perform detailed comparison tests, therefore we do not provide explicit performance values.

Some tests were carried out with all work processes on the OS/390 central instance and then on an AIX central instance using the same DB2 database on OS/390. We then moved different work processes depending on their type (batch, update, spool, etc.) from OS/390 to an AIX instance and vice versa but kept the message and enqueue server on OS/390. We created a test scenario that produced a heavy load on the system, performing tasks that made use of the message, enqueue, dialog, and update services. For the batch tests, we carried out a local client copy. This test was not designed to simulate a real workload.

The placement of all types of work processes on OS/390 had no impact on the functionality on an application server on OS/390; we had no scenarios that failed because a process was placed on OS/390.

4.1 Moving work processes from OS/390 to AIX

To perform our tests, we have to move some of the services from the OS/390 to AIX. Therefore, we describe the moving of different types of work processes first.

In order to move a central instance from OS/390 to AIX, we recommend that you deinstall the dialog instance on AIX and install a new central instance on the AIX using `R3SETUP -f CENTRAL.R3S` as described in *R/3 Installation on OS/390 UNIX System Services: DB2 UDB for OS/390,* “Installing a Central Instance”. It is also possible to modify the configuration files from the profile directory /sapmnt/RED/profile, including the start profiles. However, we do not recommend this because the directory structure and several filenames would not meet the naming conventions for a central instance.

To move other SAP R/3 services or single processes to AIX, we followed the method shown in Table 6 on page 70. For example, if we wanted to move all batch processes from OS/390 to AIX, we would change the value rdisp/wp_no_btc to the appropriate number of batch processes we wanted to run. If the AIX machine is the primary batch server or if it is the only instance that offers that service afterwards, we would have to modify the appropriate parameter in the DEFAULT.PFL as well.

Task	DEFAULT.PFL	RED_D00_sap1tr0 RED_DVEBMGS00_wtsc42oe
Moving Batch	**rdisp/btcname** = sap1tr0_RED_00 if sap1tr0 is your primary batch server	**rdisp/wp_no_btc**
Moving Update	**rdisp/vbname** = sap1tr0_RED_00 if sap1tr0 is your primary update server	**rdisp/wp_no_vb** for V1 updates **rdisp/wp_no_vb2** for V2 updates
Moving Dialog	-	**rdisp/wp_no_dia**
Moving Spool	-	**rdisp/wp_no_spo**

Table 6. Profile changes for process movement

Note

When changing the distribution of work processes for your system, you should check SAP R/3 note number 39412. This note describes the minimum number of work processes by type, both for an instance and system-wide.

4.2 Placement of work processes on OS/390 - findings

This section describes our findings when placing work processes on OS/390.

4.2.1 Message and enqueue server

Placing the central instance (message server and enqueue server) on OS/390 resulted in a fully functional system, as expected. We did not observe any performance impact by having such a setup.

4.2.2 Update work process

In our test scenario we ran several transactions in parallel. These transactions were processed by dialog work processes and used the update service for asynchronous updates of the database. As a consequence, the update process gets continuous input from the update tables (VBHDR, VBMOD, VBDATA) that are filled by many dialog processes in parallel. These update requests are database-intensive. In fact, we saw a good utilization of the update process. We also observed a shorter average database request time when the update processes were placed on OS/390.

4.2.3 Batch work process

We performed a local client copy on the OS/390 central instance with no secondary application servers and on an AIX central instance with no secondary application servers as well.

We found that the local client copy performed on the OS/390 central instance was about 30% faster than the one performed on the AIX central instance.

4.2.4 Dialog work process

The average database request time achieved using dialog work processes on OS/390 central instance was much lower than that achieved when using dialog work processes on an AIX central instance.

The total response time is very much affected by the CPU processing time, which itself is affected by the processor speed. Therefore, this processing time can vary for different processor types.

4.2.5 Work process distribution planning

The experience that we had with placing services on OS/390 is that the functionality in general is not affected.

Since we observed that the performance impacts were very dependent on the types of workload, we cannot provide a general guideline on moving services to OS/390. To find a suitable configuration for your environment, we suggest the following procedure:

1. Start with only two dialog processes on the central instance for administration tasks. Using this setup, you gain experience in operating an R/3 instance on OS/390.
2. Move another type of service to OS/390, depending on the needs of your production system. For example, the next step might be to move some batch processes to OS/390 if you have some time-critical or database-intensive batch jobs.

In this way, you can evaluate the benefits to your system step by step.

Chapter 5. Printing

There are several ways to print output on SAP R/3 systems. Depending on whether you have high volume printing or desktop printing, for example, you might choose between local output to a host spool or output to SAPLPD on your desktop machine.

The local host spool access methods relevant to our configuration are:

- **L**
  The SAP spool process uses host commands to print output that it saved in the host filesystem before. The host commands for printing and status report are saved in the instance parameters rspo/host_spool/print and rspo/host_spool/query.
- **E**
  This mode can be used for printers defined in an Output Management System (OMS) that are suitable for connection to the SAP R/3 system. OMS then allows the user to track and manage print jobs that are already released from the SAP R/3 spool.
- **P**
  This mode is used to define device pools that allow printing to be done to several devices at the same time.
- **F**
  This mode is used to spool output to a spool program on the user's workstation via the dialog process the user is connected to. This spool program can be, for example, SAPLPD on Windows or `lpd` on UNIX workstations.

With a spool process on the S/390 host, you can take advantage of the printing capabilities of Infoprint Server for OS/390 by either defining your printers in mode L or mode E. We followed both approaches in order to document the installation process.

5.1 Implementing printers in OS/390 Infoprint Server

OS/390 Infoprint Server is an optional (orderable) feature of OS/390.

A printer can be defined in OS/390 Infoprint Server as an IP PrintWay printer or a Print Services Facility (PSF) printer or as any printer attached to System/390 controlled by JES. If you define a printer as an IP PrintWay printer, its output will be spooled to JES, and from there transferred by IP PrintWay to a printer supporting one of the following protocols: LPR to LPD, IPP, or direct-socket printing.

PSF printers write output in Advanced Function Printer (AFP) format to JES spool; from there the output is sent to an AFP printer device. If the output you want to print happens to be in a format other than AFP, the PSF printer definition allows you to name transform filters. IBM Infoprint Server Transforms for OS/390 provides filters that allow your data format to be Printer Control Language (PCL), PostScript (PS), Portable Document Format (PDF), or SAP Output Text Format (OTF).

For details on setting up Infoprint Server, refer to the documentation that comes with the product.

5.1.1 Implementing the PSF printer

The PSF printer we used in our installation to test printing from SAP R/3 is configured to support plain text format, AFP, PCL, PS, PDF, and OTF. The physical printer that is the ultimate destination of the output is an IBM 3130.

In order to configure the printer, we start the Infoprint Server Printer Inventory Manager, select **Add** on the first panel and **PSF for OS/390** in the following dialog. On the printer definition panel, which you can see in Figure 60, we entered the printer definition name. In this panel, custom values for allocation and processing can be set by moving the cursor to the appropriate row in the custom values column and pressing Enter.

```
 AddPSF for OS/390 Printer Definition
Command ==>

Printer definition name . pokeall
Description .                                                    (extend)
Location. . .                                                    (extend)

                         Component name        Custom values
Section                  (enter to list)       (enter to customize)
Allocation           =>                          => *
Processing           =>                          => *
NetSpool options     =>                          =>
NetSpool end-of-file =>                          =>

NetSpool LU name .           LU classes . .                       (extend)
```

Figure 60. PSF printer definition panel

In the allocation panel (not shown here), we set the CLASS parameter to U and the DEST parameter to POK3130E; these are the appropriate values for our installation. Our settings for the processing options are shown in Figure 61 on page 75. We selected all input formats and inserted the appropriate transform filters. For all other settings, we used the defaults.

```
Add Processing                        Top of data
Command ==>

Printer definition name . pokeall

                                                                    More:     +
Document code page . .
Printer code page. . . IBM-1047

Print Interface supported data formats and associated filters:
Data format:  Filter:
/ Line data                                                          (extend)
/ MO:DCA-P                                                           (extend)
/ PostScript   ps2afp.dll                                            (extend)
/ Text                                                               (extend)
/ PCL          pcl2afp.dll                                           (extend)
/ PDF          ps2afp.dll                                            (extend)
/ SAP          sap2afp.dll                                           (extend)
  Other                                                              (extend)

NetSpool SCS-to-Line Conversion:
   Margins:  Top . . .       Bottom . .       Left . .       Right . .
```

Figure 61. PSF printer definition: part of Custom Values/Processing panel

5.1.2 Implementing the IP PrintWay printer

The physical printer we used was an IBM 3130. In this case, it provided a queue named afccu2 which was configured to accept input in plain text, PCL, and PS. It communicates with hosts using the LPR/LPD protocol.

In Figure 62, the entry panel to the IP PrintWay definition is displayed. It differs from the PSF panel in Figure 60 on page 74 by offering additional options.

```
Edit                    IP PrintWay Printer Definition
Command ==>

Printer definition name . pokelp
Description . IBM3130                                              (extend)
Location. . .                                                      (extend)

                        Component name        Custom values
Section                 (enter to list)       (enter to customize)
Allocation           =>                         => *
Processing           =>                         => *
NetSpool options     =>                         =>
NetSpool end-of-file =>                         =>
IP PrintWay options  =>                         => *
Protocol             =>                         => *

/ Use DEST, CLASS, and FORMS for IP PrintWay printer selection
NetSpool LU name .            LU classes . .                       (extend)
```

Figure 62. IP PrintWay printer definition table

The only values we set in the Allocation/Custom values-panel (which is not displayed here) were CLASS = J and FORMS = STD. Note that these parameters link to JES definitions for the CLASS and could be different in other installations.

The class used must be one specified for IP PrintWay printing in JES initialization. For more detail see *OS/390 V2R8 Infoprint Server Customization,* G544-5694.

The changes we made to the IP PrintWay processing panel are displayed in Figure 63. We selected only the data formats that were defined in the queue afccu2. The filter aopfiltr.so is only used to prepare text for output on an ASCII printer.

```
 Edit                                Processing
Command ==>

Printer definition name . pokelp

                                                                      More:     +
Document code page . .
Printer code page. . .

Print Interface supported data formats and associated filters:
Data format:  Filter:
  Line data                                                           (extend)
  MO:DCA-P                                                            (extend)
/ PostScript                                                          (extend)
/ Text         aopfiltr.so                                            (extend)
/ PCL                                                                 (extend)
  PDF                                                                 (extend)
  SAP                                                                 (extend)
  Other                                                               (extend)
```

Figure 63. IP PrintWay: part of the Processing panel

The panel shown in Figure 64 is used for protocol settings. The protocol is lpr by default; we inserted the printer IP address and the queue name and selected to restrict the ports used to 721-731. OS/390 uses these ports when communicating with the remote printer.

```
Edit                                Protocol
Command ==>

Printer definition name . pokelp

                                                                    More:     +
Protocol . . . . . .    1. lpr  2. IPP  3. Direct sockets
Printer IP address . 9.12.2.4                                        (extend)
Print queue name . . afccu2                                          (extend)
Port number. . . . .
URL. . . . . .                                                       (extend)

User options . . . .                                                 (extend)

lpr Processing Options:
   Mode . . . . . . . . 2  1. Control file first  2. Control file last
                           3. Stream              4. Remote PSF
   / Restrict ports
   / Print banner page
        Banner class. .
        Banner job name                                              (extend)
   Filename . . . . . .
   Indent . . . . . .
   Owner. . . . . .
   Print function . . . f
```

Figure 64. IP PrintWay: part of the Protocol panel

With these settings and a properly set up Infoprint Server, we were able to print files from within OMVS, issuing commands such as:

```
lp -d pokelp <filename>
```

5.2 Setting up printing in SAP R/3

At the time of writing this redbook, only one of the two printing options we implemented is generally available. To be able to use Infoprint Server with OMS, we obtained a fix for APAR OW43022. (Subsequent to the work on this redbook the APAR has been closed.)

Note

The fix for APAR OW43022 is now on the Internet at:

`http://www.printers.ibm.com/R5PSC.NSF/Web/ipserv_sapoms`

We first describe some changes made to the system by applying the APAR fix, then we describe the setup for R/3 to be able to print using host spool access methods **L** and **E**.

5.2.1 Setting up Infoprint Server as an OMS

After applying the PTF to the system, we found two new executables in /usr/lpp/Printsrv/bin. These are aopsapd and aopoms.

aopsapd is the callback daemon responsible for updating job status in the SAP R/3 system. It expects to find a configuration file called aopsapd.conf in /etc/Printsrv, for which a model can be found in /usr/lpp/Printsrv/samples. Figure 65 shows our adaptation of this file. The daemon can connect to several SAP R/3 systems, which then all have to be defined in the configuration file. See Figure 65 for a sample of this file.

```
#-------------------------
# aopsapd.conf
#-------------------------
server wtsc42oe_RED_00
client = 000
userid = sapres6
password = basis
language = english
;
```

Figure 65. /etc/Printsrv/aopsapd.conf

For Logical Output Management System (LOMS) using callback, a dialog user logs on to the R/3 System. This user updates the status of print requests directed to printers managed by an external output management system (i.e. using the host spool access method E). The dialog user defined for the client that uses callback need only have SAP R/3 authorization S_XMI_XOM_A. The user must be defined in aopsapd.conf.

As aopsapd.conf contains a nonencrypted password, the file should be made readable only to OS/390 UNIX user redadm, who issues the `aopsapd` command.

Note also that aopsapd is stopped by the command `aopstop`, but not started by `aopstart`. It can be started in one of the following ways:

- Manually.
- Automatically by the SAP R/3 system as configured in the ROMS.
- It will be started whenever status updates occur for a job and aopsapds is not yet started.

The aopoms command is the interface which the R/3 system uses to communicate with the OMS in Infoprint Server in order to:

- Submit output requests
- Cancel output requests
- Synchronously get status of output requests
- Synchronously get status of output devices

It is also used when the job status is tracked using polling rather than callback.

Another step in this process is to make an EBCDIC version of librfc available, either by putting it in /usr/lpp/Printsrv/lib, or by setting up LIBPATH to contain the location of librfc that comes with R/3 4.6B. We chose the first approach.

5.2.2 Host spool access method L

Configuration of a printer in SAP R/3 using host spool access method L is straightforward and does not need the implementation of an OMS.

We used transaction *spad* and, after changing to edit mode, clicked **Output Devices**. This led to a list of already configured devices. We chose **Output Device -> Create** from the menu and entered into the following panels the values that are displayed in Figure 66 on page 79 to Figure 68 on page 80.

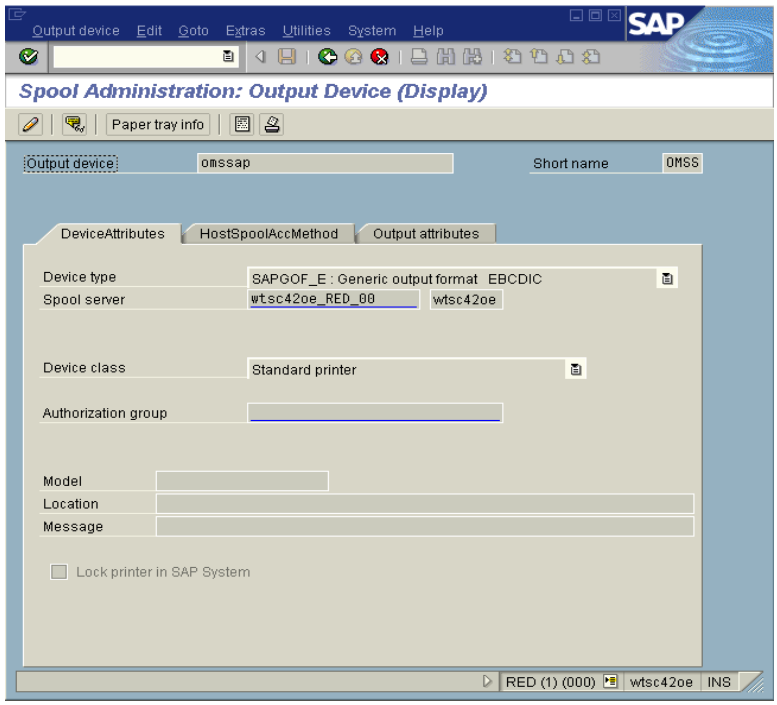

Figure 66. SAP printer definition: Device Attribute

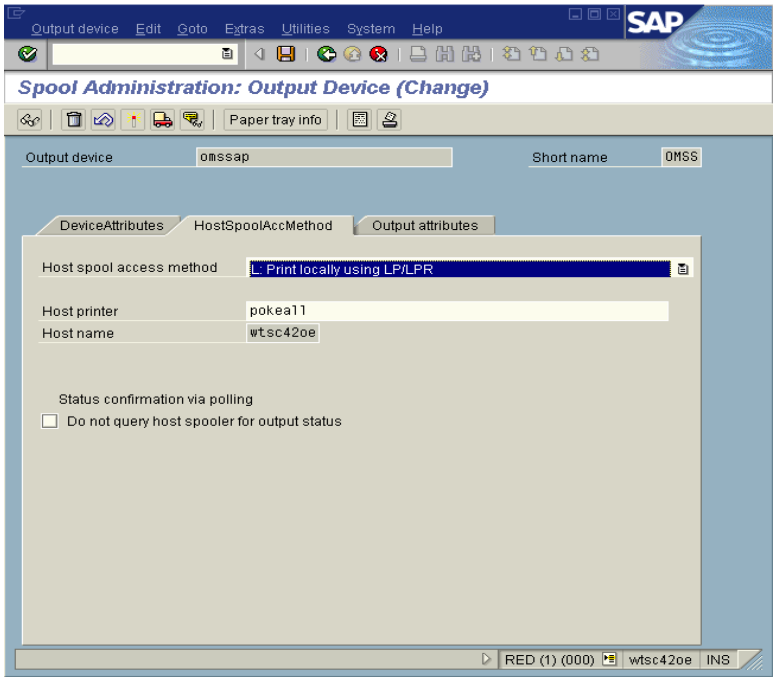

Figure 67. SAP printer definition: Host Spool Access Method

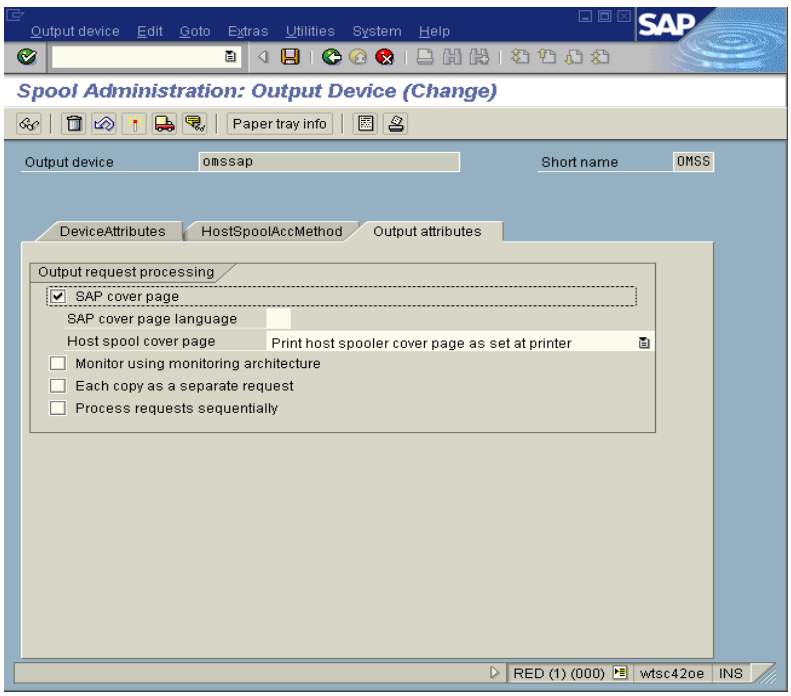

Figure 68. SAP printer definition: Output attributes

Specifying the device type SAPGOF_E tells SAP R/3 to create output in Output Text Format (OTF). In this case, we choose L for the Host Spool Access Method and the PSF-defined printer pokeall.

Having the system create both SAP R/3 and host spool cover pages turns out to be useful when you test printing, since the SAP R/3 page has the job ID reported in transaction sp01 on it, and the host spool banner page has the JES spool job ID printed on it.

Table 7 shows a list of the device types you can select in your definition of an SAP R/3 printer. We tested these on the printers we defined on the host. Only printing of the SAP R/3 generic output format (SAPGOF) was not successful on pokelp due to the lack of an appropriate driver.

Table 7. SAP device types tested on our printers

SAP device type	pokeall	pokelp
POST2	X	X
HPLJ4	X	X
SAPGOF_E	X	-

5.2.3 Host spool access method E

After applying the APAR fix OW43022 to the host system and performing the tasks described in 5.2.1, “Setting up Infoprint Server as an OMS” on page 78, the next thing we do in order to use our printers with access method E is to set up both an ROMS and an LOMS within SAP R/3.

The APAR fix comes with a model configuration called infoprint.oms you can find in /usr/lpp/Printsrv/samples. This file should be checked to be certain the settings reflect your configuration and that the paths for the binaries are correct. Edit the file to make any changes appropriate to your installation.

Then, we call transaction spad and choose from the menu **Utilities** -> **For output management system** -> **Import**. Enter the configuration file and select **Execute import** as shown in Figure 69 on page 82, then click **execute**.

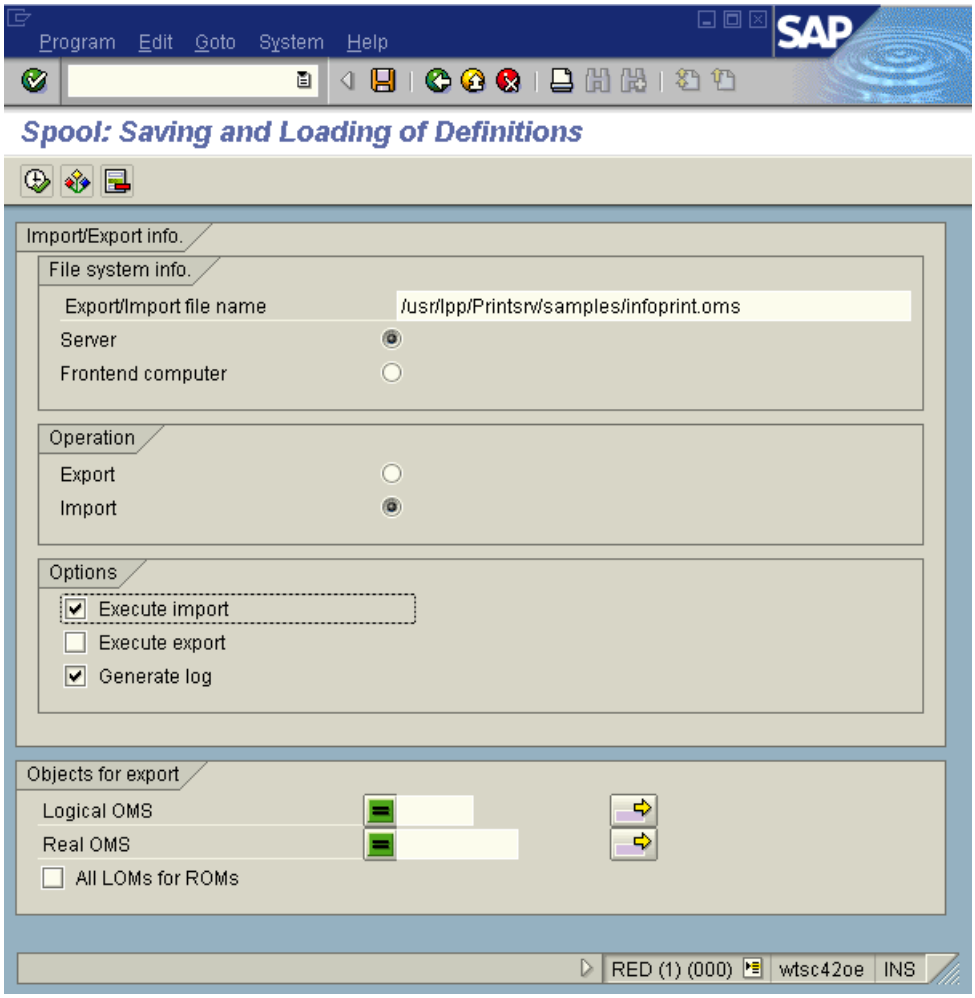

Figure 69. Import of the OMS configuration

After the import of the file, the panels for the real OMS (ROMS) and the logical OMS (LOMS) must be checked for their settings. For that, we click on the “Extended administration” or the “Full administration” button in transaction spad and select the tag “Output management systems”. From there, we can select the configured ROMS and LOMS.

Figure 70 on page 83 shows the ROMS configuration panel of our system. No initialization instance or initialization command need to be entered here.

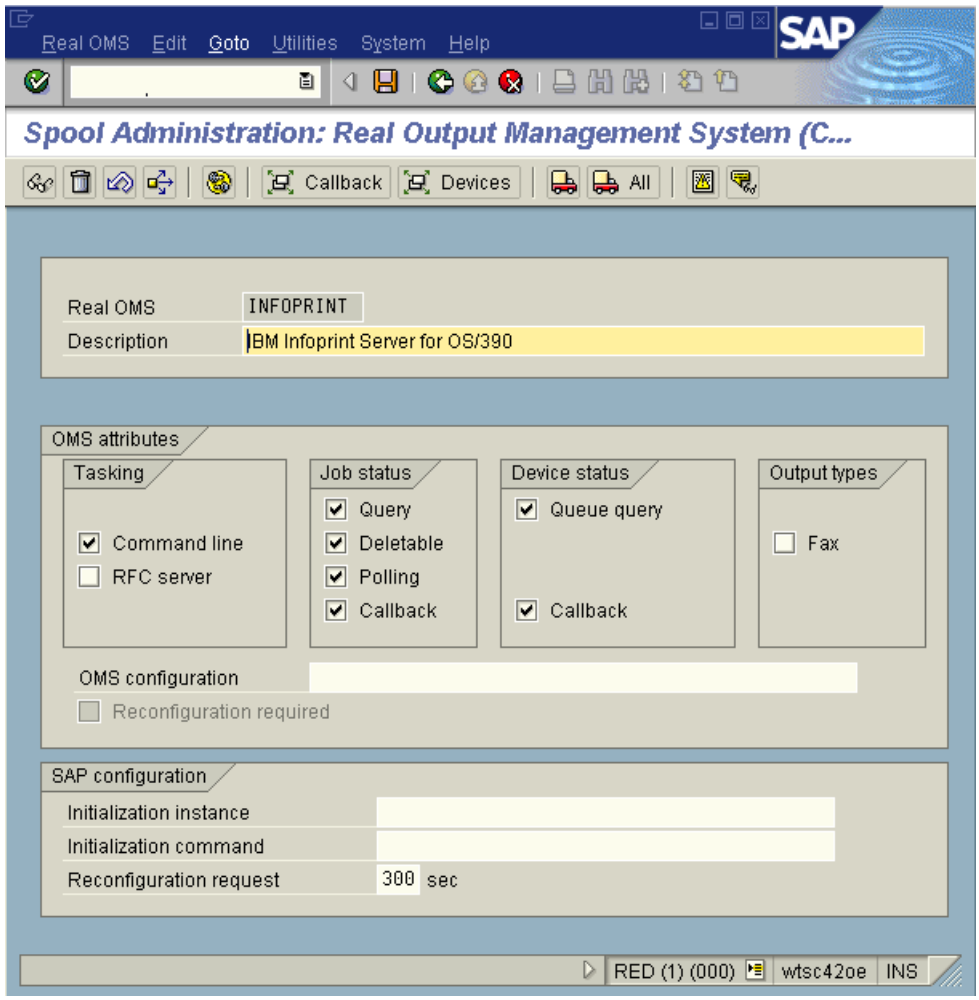

Figure 70. ROMS Configuration Panel

After the ROMS, the LOMS has to be configured. On the SAP R/3 configuration panel shown in Figure 71 on page 85, the tasking target and target for callback are both set to be the OS/390 server, since all printing commands will be issued on OS/390 UNIX and the callback daemon will be started on OS/390 UNIX. For testing, we set the event report level to All available information. On the OMS configuration panel, nothing has to be changed.

The last items to be checked in the OMS setup process are the commands SAP R/3 issues on the printing host. To perform this check, we pressed F6 when one of the LOMS panels shown in Figure 71 on page 85 was open; we then selected the operating system. Next, we checked that the paths to the executable `aopoms` are correct. The command path field should be left blank.

Note

We have been told to expect a change in this area to be implemented in a PTF whose number is not yet available. Then the command path should be: /usr/lpp/Printsrv/bin/ (note the trailing /) which will mean it is no longer necessary to use the complete path in the commands; you will simply use aopms.

For printer setup, we chose one of the printers we defined before for access method L and changed it (using the panel displayed in Figure 67 on page 80) to E: external management system. This creates a new field on the panel called Logical OMS, where we selected **Infoprint Server with callback**.

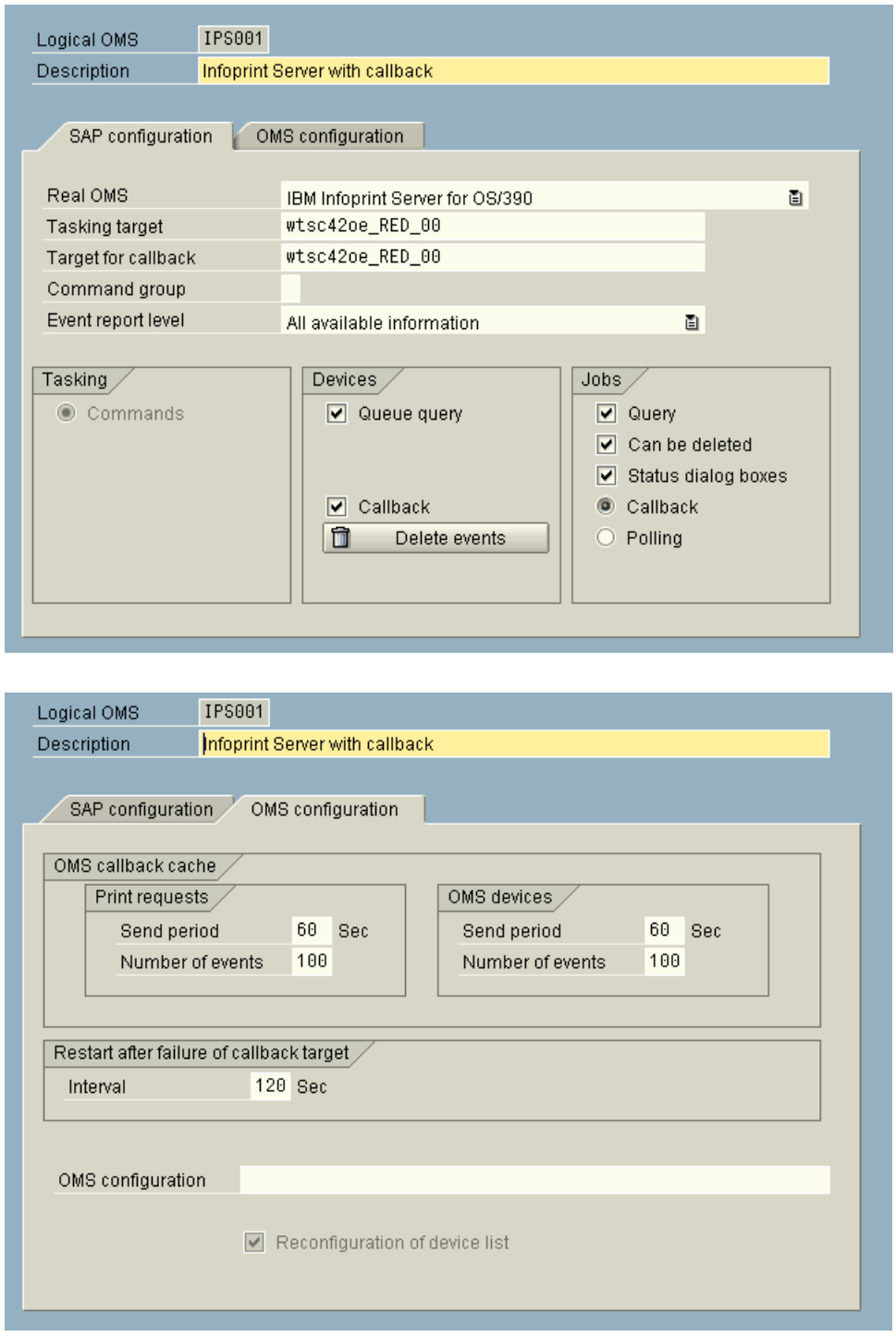

Figure 71. The two LOMS configuration panels

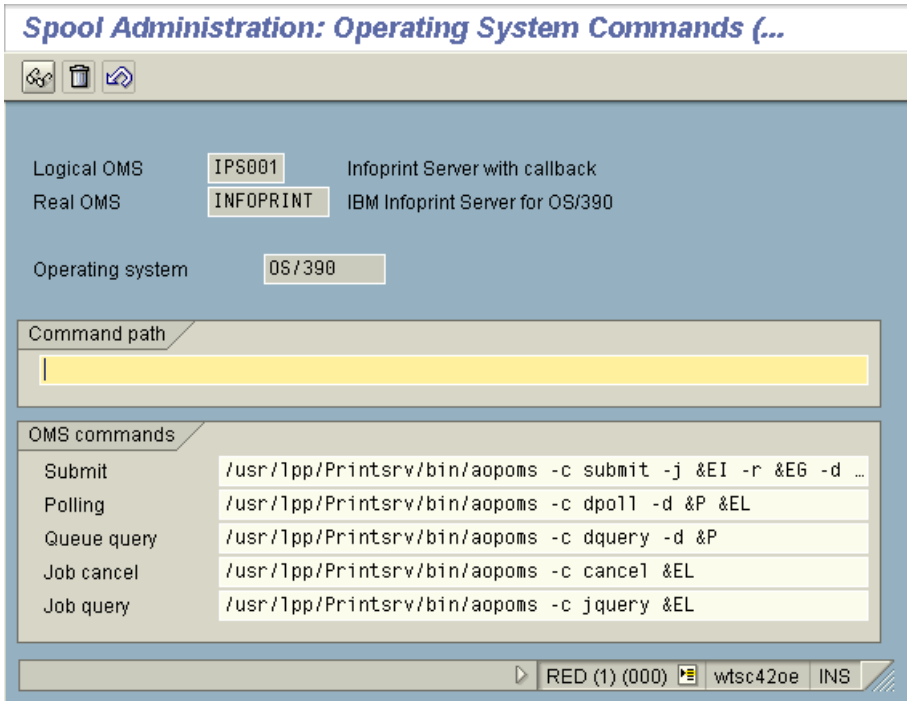

Figure 72. LOMS Operating System Commands panel

Appendix A. Configuration files

This appendix lists the relevant system configuration files as well as the SAP R/3 profiles used in our installation.

A.1 Network configuration

The following examples show the relevant parts of the files and data set members we used to set up our networking environment and the output of appropriate `netstat` commands.

Naming convention: The names of the network adapters on the AIX servers are created by using the prefixes sap1 for the S70 and sap2 for the RS/6000 F50 followed by a short name for the adapter type. For example, the Gb ethernet adapter on the RS/6000 S7A is called sap1en1, and the FDDI adapter on the RS/6000 F50 is called sap2fd0. On the host, the names for the Gb Ethernet and the FDDI adapter are redsap1 and redsap2, respectively.

In the following figures *[...]* denotes that parts of a file or a data set member are omitted.

Figure 73 shows the definitions from /etc/hosts on the RS/6000 S7A.

```
127.0.0.1       loopback localhost
10.1.1.74       sap1fd0
192.168.10.1    sap1en0
10.1.10.2       sap1en1
9.12.0.120      sap2tr0
10.1.10.1       redsap1
10.1.1.80       sap2fd0
9.12.0.74       sap1tr0
[...]
```

Figure 73. /etc/hosts on RS/6000 S7A

Figure 74 shows the /etc/services definitions from RS/6000 S7A.

```
[...]
sapdb2RED       6531/tcp
```

Figure 74. /etc/services on RS/6000 S7A

The output of the command *netstat -in* on RS/6000 S7A is shown in Figure 75 on page 88.

```
Name  Mtu   Network     Address            Ipkts Ierrs    Opkts Oerrs  Coll
lo0   16896 link#1                          33187     0    33504     0     0
lo0   16896 127         127.0.0.1           33187     0    33504     0     0
lo0   16896 ::1                           33187     0    33504     0     0
en1   1492  link#2      0.4.ac.7c.94.27   1418440     0  1350647     0     0
en1   1492  10.1.10     10.1.10.2         1418440     0  1350647     0     0
en0   1500  link#3      0.4.ac.3e.a9.c8         0     0        6     0     0
en0   1500  192.168.10  192.168.10.1            0     0        6     0     0
tr0   1492  link#4      0.20.35.7c.a3.12   479931     0   239225     0     0
tr0   1492  9.12        9.12.0.74          479931     0   239225     0     0
fi0   4352  link#5      0.0.5a.42.22.4c       388     0        7     0     0
fi0   4352  10.1        10.1.1.74             388     0        7     0     0
```

Figure 75. netstat -in on RS/6000 S7A

Figure 76 shows the definitions from /etc/hosts on the RS/6000 F50.

```
    127.0.0.1               loopback localhost      # loopback (lo0)
    name/address
    9.12.14.205     wtsc42.itso.ibm.com     wtsc42 #Host SC42
    9.12.2.11       wtsc42oe.itso.ibm.com   wtsc42oe #Host SC42 OS/390 UNIX
    10.1.1.200      redsap2
    10.1.1.80       sap2fd0
    10.1.6.3        sap2en2
    10.1.9.3        sap2en0
    10.1.10.3       sap2en1
    10.1.1.74       sap1fd0
    9.12.0.74       sap1tr0
    9.12.0.120      sap2tr0
    [...]
```

Figure 76. /etc/hosts on RS/6000 F50

Figure 77 shows the /etc/services definitions from RS/6000 S7A.

```
    [...]
    sapdb2RED       6531/tcp
```

Figure 77. /etc/services on RS/6000 F50

The output of the command *netstat -in* on RS/6000 F50 is shown in Figure 78 on page 89.

```
Name  Mtu   Network     Address            Ipkts Ierrs    Opkts Oerrs  Coll
lo0   16896 link#1                         27403     0    27642     0     0
lo0   16896 127         127.0.0.1          27403     0    27642     0     0
lo0   16896 ::1                            27403     0    27642     0     0
en0   1500  link#2      0.20.35.e2.7f.4d       0     0        3     3     0
en0   1500  10.1.9      10.1.9.3               0     0        3     3     0
en1   1500  link#3      0.4.ac.49.2e.82        0     0        8     0     0
en1   1500  10.1.10     10.1.10.3              0     0        8     0     0
en2   1500  link#4      2.7.1.23.36.bf         0     0        3     0     0
en2   1500  10.1.6      10.1.6.3               0     0        3     0     0
tr0   1492  link#5      0.4.ac.48.2.8e   2175590     0   648652     0     0
tr0   1492  9.12        9.12.0.120       2175590     0   648652     0     0
fi0   4050  link#6      0.0.5a.2.13.2f    494607     0  1025033     0     0
fi0   4050  10.1.1      10.1.1.80         494607     0  1025033     0     0
```

Figure 78. netstat -in on RS/6000 F50

The output of OS/390 UNIX command *netstat -h* from the OS/390 system SC42 is shown in Figure 79.

```
MVS TCP/IP onetstat CS V2R8       TCPIP Name: TCPIPOE          18:02:48
Home address list:
Address          Link             Flg
-------          ----             ---
9.12.2.11        OSAL2160         P
10.1.1.200       OSAL2140
10.1.10.1        OSAGEF8LNK
127.0.0.1        LOOPBACK
```

Figure 79. netstat -h on SC42

The information shown in Figure 80 on page 90 is taken from SYS1.PARMLIB member BPXPRM8A and contains information about the IP physical file system as well as the NFS physical file system.

```
[...]
MAXPROCSYS(4096)
MAXPROCUSER(32767)
[...]
FILESYSTEMTYPE TYPE(UDS) ENTRYPOINT(BPXTUINT)
NETWORK DOMAINNAME(AF_UNIX)
        DOMAINNUMBER(!)
        MAXSOCKETS(64)
        TYPE(UDS)

FILESYSTYPE TYPE(CINET)
        ENTRYPOINT(BPXTCINT)
NETWORK DOMAINNAME(AF_INET)
        DOMAINNUMBER(2)
        MAXSOCKETS(25000)
        TYPE(CINET)
        INADDRANYPORT(5000)
        INADDRANYCOUNT(1000)

SUBFILESYSTYPE NAME(TCPIPOE)
        TYPE(CINET)
        ENTRYPOINT(EZBPFINI)
        DEFAULT

SUBFILESYSTYPE NAME(TCPIPMVS)
        TYPE(CINET)
        ENTRYPOINT(EZBPFINI)

SUBFILESYSTYPE NAME(OESTACK)
        TYPE(CINET)
        ENTRYPOINT(BPXUIINT)
[...]
FILESYSTYPE TYPE(NFS) ENTRYPOINT(GFSCINIT)
            ASNAME(NFSCLNT)
            PARM ('DISABLELLA(Y)')
[...]
```

Figure 80. SYS1.PARMLIB(BPXPRM8A)

Notes

Note the values used in MAXPROCSYS and MAXPROCUSER. The defaults (200 for MAXPROCSYS and 25 for MAXPROCUSER) are *not* adequate for SAP R/3; your administrative user will start more than 25 processes. We have been told of errors resulting from the use of the defaults.

Note also the value in MAXSOCKETS for network AF_UNIX. This was our value but it is *not adequate for production use of SAP R/3*. The recommendation is that this be set to at least 2000. This will be discussed in a future edition of *SAP R/3 on DB2 for OS/390: Planning Guide (IBM)*.

IP profile parameters concerning the connection between OS/390 and the RS/6000 S7A are shown in Figure 81. Those parameters were taken from IP profile dataset TCPIPOE.SC42.TCPPARMS(TCPPROF).

```
[...]
; Hardware definitions:
;

 DEVICE OSAGEF8  MPCIPA   SECROUTER AUTORESTART
 LINK   OSAGEF8LNK  IPAQGNET      OSAGEF8
[...]
;
; HOME internet (IP) addresses of each link in the host.
;
HOME
[...]
10.1.10.1     OSAGEF8LNK
[...]
;
GATEWAY
;
; Network First Hop Link Name Packet Size  Subnet Mask    Subnet Value
[...]
10          =     OSAGEF8LNK   1492      0.255.255.0    0.1.10.0
[...]
START OSAGEF8
```

Figure 81. IP profile definitions

A.2 SAP R/3 configuration and profiles

This section contains the files we used at startup to set the environment for SAP R/3. In addition, the SAP R/3 files (profiles) that specify parameters for our SAP R/3 system are provided.

A.2.1 sh and csh startup configuration on AIX

Some settings for the SAP R/3 systems are specified through environment variables. These can be set either in the SAP delivered configuration files (.sapenv... and .dbenv...) or in the shell startup files .cshrc and .profile.

We decided to put these variables into the shell startup files, because they are smaller and easier to read.

Before doing the upgrade, we added the environment variable THREAD to .cshrc and .profile to allow startsap to fetch the SAPDBHOST value from the instance profile (see SAP note 130163; this was necessary with 4.5B, but 4.6B should do the right thing now without specifying that variable). Additionally, the EXTSHM variable activates extended memory management on AIX.

Figure 82 on page 92 shows the contents of the .cshrc file.

```
# SAP environment
if ( -e $HOME/.sapenv_`hostname`.csh ) then
   source $HOME/.sapenv_`hostname`.csh
else if ( -e $HOME/.sapenv.csh ) then
   source $HOME/.sapenv.csh
endif


# RDBMS environment
if ( -e $HOME/.dbenv_`hostname`.csh ) then
   source $HOME/.dbenv_`hostname`.csh
else if ( -e $HOME/.dbenv.csh ) then
   source $HOME/.dbenv.csh
endif

setenv THREAD YES
setenv EXTSHM ON
```

Figure 82. /home/redadm/.cshrc on AIX

The contents of .profile can be seen in Figure 83.

```
# SAP environment
if [ -f $HOME/.sapenv_`hostname`.sh ]; then
     . $HOME/.sapenv_`hostname`.sh
elif [ -f $HOME/.sapenv.sh ]; then
     . $HOME/.sapenv.sh
fi


# RDBMS environment
if [ -f $HOME/.dbenv_`hostname`.sh ]; then
     . $HOME/.dbenv_`hostname`.sh
elif [ -f $HOME/.dbenv.sh ]; then
     . $HOME/.dbenv.sh
fi

THREAD=YES; export THREAD
EXTSHM=ON; export EXTSHM
```

Figure 83. /home/redadm/.profile on AIX

A.2.2 sh and csh startup configuration on OS/390 UNIX System Services

On OS/390, we had to set the STEPLIB variable in .cshrc and .profile.

Additionally, we deleted the `tset` command from the OS/390 section of .sapenv... as described in SAP note 193208. We also modified the value of ICLI_TRUSTED_CONNECTIONS in .dbenv..., because it was not set up correctly by R3SETUP.

The contents of .cshrc and .profile in OS/390 can be seen in Figure 84 on page 93 and Figure 85 on page 93.

```
# necessary to get hostname without domain (AIX, OS/390 and NOT sun)
switch (`uname`)
   case AIX*:
   case OS/390*:
       alias hostname 'hostname -s'
   breaksw
endsw

# SAP environment
if ( -e $HOME/.sapenv_`hostname`.csh ) then
   source $HOME/.sapenv_`hostname`.csh
else if ( -e $HOME/.sapenv.csh ) then
   source $HOME/.sapenv.csh
endif


# RDBMS environment
if ( -e $HOME/.dbenv_`hostname`.csh ) then
   source $HOME/.dbenv_`hostname`.csh
else if ( -e $HOME/.dbenv.csh ) then
   source $HOME/.dbenv.csh
endif

setenv STEPLIB DSN610.SDSNLOAD
```

Figure 84. /u/redadm/.cshrc in OS/390 UNIX

```
# necessary to get hostname without domain (AIX, OS/390 and NOT sun)
case `uname` in
  AIX* | OS/390*)
       alias hostname='hostname -s';;
esac

# SAP environment
if [ -f $HOME/.sapenv_`hostname`.sh ]; then
     . $HOME/.sapenv_`hostname`.sh
elif [ -f $HOME/.sapenv.sh ]; then
     . $HOME/.sapenv.sh
fi


# RDBMS environment
if [ -f $HOME/.dbenv_`hostname`.sh ]; then
     . $HOME/.dbenv_`hostname`.sh
elif [ -f $HOME/.dbenv.sh ]; then
     . $HOME/.dbenv.sh
fi

STEPLIB=DSN610.SDSNLOAD; export STEPLIB
```

Figure 85. /u/redadm/.profile in OS/390 UNIX

A.2.3 R/3 profiles

The SAP R/3 start, default, and instance profiles reflect the following setup:

- Central instance (message server, enqueue server, gateway, remote syslog collector) on OS/390
- All update processes on OS/390
- Dialog processes on OS/390 for administration and internal purposes only
- Main dialog and batch workload on RS/6000
- SAP html/http online help installed on RS/6000
- Communication between AIX and OS/390 via gigabit ethernet (S/390 interface redsap1)

No performance tuning was done; our main goal was “getting the system to run”.

Figure 86 to Figure 90 show the default, instance, and startup profiles in OS/390 and AIX.

```
#.*****************************************************************************
#.*                                                                           *
#.*      Defaultprofil DEFAULT                                                *
#.*                                                                           *
#.*      Version               = 000003                                       *
#.*      Generiert von Benutzer  = SAPRES4                                    *
#.*      Datum der Generierung   = 06.03.2000 , 17:35:48                      *
#.*                                                                           *
#.*****************************************************************************
eu/iwb/path_win32 = saphelp/helpdata
eu/iwb/server_win32 = sap1tr0.itso.ibm.com:80
eu/iwb/installed_languages = E
eu/iwb/help_type = 2

SAPSYSTEMNAME = RED
dbs/ora/tnsname = RED

rdisp/mshost = wtsc42oe
rdisp/sna_gateway = wtsc42oe
rdisp/sna_gw_service = sapgw00
rdisp/vbname = wtsc42oe_RED_00
rdisp/enqname = wtsc42oe_RED_00
rdisp/btcname = sap1tr0_RED_00
rslg/collect_daemon/listen_port = 3900
rslg/collect_daemon/talk_port = 4000
rdisp/bufrefmode = sendon,exeauto

#    *** UPGRADE EXTENSIONS (RELEASE "46B") ***
dbms/type = db2
SAPDBHOST = wtsc42oe

# needed for SPAU
DIR_EPS = /usr/sap/trans/EPS/--------
```

Figure 86. /sapmnt/RED/profile/DEFAULT.PFL

```
#.*****************************************************************************
#.*                                                                           *
#.*       Instanzprofil RED_DVEBMGS00_WTSC42OE                                *
#.*                                                                           *
#.*       Version                 = 000002                                    *
#.*       Generiert von Benutzer  = SAPRES4                                   *
#.*       Datum der Generierung   = 06.03.2000 , 17:35:49                     *
#.*                                                                           *
#.*****************************************************************************
# Instance Profile (CI, 384 MB RAM)
# Thu Feb 24 12:55:20 2000

SAPSYSTEMNAME = RED
INSTANCE_NAME = DVEBMGS00
SAPSYSTEM = 00
rdisp/wp_no_dia = 2
rdisp/wp_no_vb = 6
rdisp/wp_no_enq = 1
rslg/send_daemon/listen_port = 3700
rslg/send_daemon/talk_port = 1300
zcsa/system_language = E
ztta/roll_first = 1
em/initial_size_MB = 512
ztta/roll_area = 6500000
ztta/roll_extension = 500000000
abap/heap_area_nondia = 900000000
abap/heap_area_dia = 900000000
abap/heap_area_total = 750000000
abap/heaplimit = 40000000
rsdb/ntab/entrycount = 30000
rsdb/ntab/ftabsize = 20000
rsdb/ntab/irbdsize = 4000
rsdb/ntab/sntabsize = 2500
abap/buffersize = 240000
rsdb/cua/buffersize = 5000
zcsa/presentation_buffer_area = 15000000
sap/bufdir_entries = 4500
zcsa/table_buffer_area = 50000000
zcsa/db_max_buftab = 10000
rtbb/buffer_length = 20000
rtbb/max_tables = 500
em/stat_log_size_MB = 20
em/stat_log_timeout = 600
rsdb/obj/buffersize = 4096
rsdb/obj/max_objects = 5000
rsdb/obj/large_object_size = 8192
ES/TABLE = SHM_SEGS
ES/SHM_USER_COUNT = 1024
em/address_space_MB = 512
ipc/sem_fast = 0
rdisp/ROLL_MAXFS = 16384
rdisp/ROLL_SHM = 8192
rdisp/PG_MAXFS = 16384
rdisp/PG_SHM = 1024
ipc/shm_psize_10 = 80000000
ipc/shm_psize_40 = 62000000
```

```
#
#  DB2forOS390 specific parameters:
#
dbms/type = db2
rsdb/db2jcl_library = /usr/sap/RED/SYS/exe/run/db2jcllib.dll
rsdb/db2ps_library = /usr/lib/fome46bp.dll
dbs/db2/planname = SAPR346B
rsdb/max_blocking_factor = 10
rsdb/max_blocking_factor = 10
rsdb/max_in_blocking_factor = 60
rsdb/min_blocking_factor = 3
rsdb/min_in_blocking_factor = 6
rsdb/prefer_fix_blocking = 1
rsdb/prefer_union_all = 1
rsdb/prefer_in_itab_opt = 1
abap/no_dsql95 = "DB2"
dbs/db2/ssid = DBK1
dbs/db2/hosttcp = wtsc42oe

#    *** UPGRADE EXTENSIONS (RELEASE "46B") ***
rdisp/elem_per_queue = 2000
ztta/parameter_area = 8000
```

Figure 87. /sapmnt/RED/RED_DVEBMGS00_wtsc42oe

```
#.*****************************************************************************
#.*                                                                           *
#.*       Instanzprofil RED_D00_SAP1TR0                                       *
#.*                                                                           *
#.*       Version                = 000001                                     *
#.*       Generiert von Benutzer  = SAPRES4                                   *
#.*       Datum der Generierung   = 06.03.2000 , 17:35:48                     *
#.*                                                                           *
#.*****************************************************************************
# Instance Profile (DI, 2048 MB RAM)
# Mon Mar  6 13:54:02 2000

SAPSYSTEMNAME = RED
INSTANCE_NAME = D00
SAPSYSTEM = 00
SAPDBHOST = redsap1

rdisp/wp_no_dia = 10
rdisp/wp_no_vb = 0
rdisp/wp_no_vb2 = 0
rdisp/wp_no_enq = 0
rdisp/wp_no_btc = 6
rdisp/wp_no_spo = 1

rslg/send_daemon/listen_port = 3700
rslg/send_daemon/talk_port = 1300
zcsa/system_language = E
ztta/roll_first = 1
em/initial_size_MB = 1000
```

```
ztta/roll_area = 6500000
ztta/roll_extension = 500000000
abap/heap_area_total = 1500000000
abap/heap_area_dia = 180000000
abap/heap_area_nondia = 180000000
abap/heaplimit = 20000000
rdisp/ROLL_MAXFS = 32768
rdisp/PG_MAXFS = 32768
rdisp/ROLL_SHM = 8000
rdisp/PG_SHM = 1000
rsdb/ntab/entrycount = 30000
rsdb/ntab/ftabsize = 30000
rsdb/ntab/irbdsize = 4000
rsdb/ntab/sntabsize = 2500
abap/buffersize = 400000
rsdb/cua/buffersize = 5000
zcsa/presentation_buffer_area = 20000000
sap/bufdir_entries = 4500
zcsa/table_buffer_area = 50000000
zcsa/db_max_buftab = 10000
rtbb/buffer_length = 30000
rtbb/max_tables = 500
em/stat_log_size_MB = 20
em/stat_log_timeout = 600
ES/TABLE = SHM_SEGS
ES/SHM_MAX_PRIV_SEGS = 4
ES/SHM_PROC_SEG_COUNT = 5
ES/SHM_SEG_SIZE = 256
em/max_size_MB = 4096
rsdb/obj/buffersize = 4096
rsdb/obj/max_objects = 5000
rsdb/obj/large_object_size = 8192
ipc/shm_psize_10 = 214000000
ipc/shm_psize_40 = 494000000

#
#  DB2forOS390 specific parameters:
#
dbms/type = db2
rsdb/icli_library = /usr/sap/RED/SYS/exe/run/ibmiclic.o
rsdb/db2jcl_library = /usr/sap/RED/SYS/exe/run/db2jcllib.o
rsdb/max_blocking_factor = 10
rsdb/max_blocking_factor = 10
rsdb/max_in_blocking_factor = 60
rsdb/min_blocking_factor = 3
rsdb/min_in_blocking_factor = 6
rsdb/prefer_fix_blocking = 1
rsdb/prefer_union_all = 1
rsdb/prefer_in_itab_opt = 1
abap/no_dsql95 = "DB2"
dbs/db2/ssid = DBK1
dbs/db2/hosttcp = redsap1
```

Figure 88. /sapmnt/RED/RED_D00_sap1tr0

```
#.*********************************************************************
#.*                                                                   *
#.*       Startprofil START_DVEBMGS00_WTSC42OE                        *
#.*                                                                   *
#.*       Version                = 000002                             *
#.*       Generiert von Benutzer  = SAPRES4                           *
#.*       Datum der Generierung   = 06.03.2000 , 17:35:49             *
#.*                                                                   *
#.*********************************************************************
#---------------------------------------------------------------------
SAPSYSTEMNAME = RED
INSTANCE_NAME = DVEBMGS00

#---------------------------------------------------------------------
# SCSA-Verwaltung starten
#---------------------------------------------------------------------

Execute_00 = local $(DIR_EXECUTABLE)/sapmscsa -n
                                pf=$(DIR_PROFILE)/RED_DVEBMGS00_wtsc42oe

#---------------------------------------------------------------------
# start message server
#---------------------------------------------------------------------

_MS = ms.sapRED_DVEBMGS00
Execute_01 = local ln -s -f $(DIR_EXECUTABLE)/msg_server $(_MS)
Start_Program_01 = local $(_MS) pf=$(DIR_PROFILE)/RED_DVEBMGS00_wtsc42oe

#---------------------------------------------------------------------
# start application server
#---------------------------------------------------------------------

_DW = dw.sapRED_DVEBMGS00
Execute_02 = local ln -s -f $(DIR_EXECUTABLE)/disp+work $(_DW)
Start_Program_02 = local $(_DW) pf=$(DIR_PROFILE)/RED_DVEBMGS00_wtsc42oe

#---------------------------------------------------------------------
# start syslog collector daemon
#---------------------------------------------------------------------

_CO = co.sapRED_DVEBMGS00
Execute_03 = local ln -s -f $(DIR_EXECUTABLE)/rslgcoll $(_CO)
Start_Program_03 = local $(_CO) -F pf=$(DIR_PROFILE)/RED_DVEBMGS00_wtsc42oe

#---------------------------------------------------------------------
# start syslog send daemon
#---------------------------------------------------------------------

_SE = se.sapRED_DVEBMGS00
Execute_04 = local ln -s -f $(DIR_EXECUTABLE)/rslgsend $(_SE)
Start_Program_04 = local $(_SE) -F pf=$(DIR_PROFILE)/RED_DVEBMGS00_wtsc42oe

#---------------------------------------------------------------------
```

Figure 89. /sapmnt/RED/profile/START_DVEBMGS00_wtsc42oe

```
#.*****************************************************************************
#.*                                                                           *
#.*       Startprofil START_D00_SAP1TR0                                       *
#.*                                                                           *
#.*       Version                = 000001                                     *
#.*       Generiert von Benutzer  = SAPRES4                                   *
#.*       Datum der Generierung   = 06.03.2000 , 17:35:49                     *
#.*                                                                           *
#.*****************************************************************************
#---------------------------------------------------------------------------
SAPSYSTEMNAME = RED
INSTANCE_NAME = D00

#---------------------------------------------------------------------------
# SCSA-Verwaltung starten
#---------------------------------------------------------------------------

Execute_00 = local $(DIR_EXECUTABLE)/sapmscsa -n
                                        pf=$(DIR_PROFILE)/RED_D00_sap1tr0

#---------------------------------------------------------------------------
# start application server
#---------------------------------------------------------------------------

_DW = dw.sapRED_D00
Execute_01 = local ln -s -f $(DIR_EXECUTABLE)/disp+work $(_DW)
Start_Program_01 = local $(_DW) pf=$(DIR_PROFILE)/RED_D00_sap1tr0

#---------------------------------------------------------------------------
# start syslog send daemon
#---------------------------------------------------------------------------

_SE = se.sapRED_D00
Execute_02 = local ln -s -f $(DIR_EXECUTABLE)/rslgsend $(_SE)
Start_Program_02 = local $(_SE) -F pf=$(DIR_PROFILE)/RED_D00_sap1tr0

#---------------------------------------------------------------------------
```

Figure 90. /sapmnt/RED/profile/START_D00_sap1tr0

Appendix B. Output from PREPARE (CHECKS.LOG)

Figure 91 on page 101 to Figure 95 on page 105 show the CHECKS.LOG file that resulted from our successful PREPARE run. This file has the full path name of </usr/sap/put>/log, so it is found in the log subdirectory of your upgrade directory, (in our case, this was /usr/sap/put/log).

```
#======================================================================
# Starting new execution of PREPARE modules
#      Parameter input
#      Initialization
#      Import
#      Read CD
#      General checks
#      Activation checks
#      Necessary checks for conversions
#      Optional checks for conversions
#      Modification support
#      Pre-processing
# at 20000224163610.
#======================================================================


   #=================================================#
   # Requests and information for module Parameter input #
   #=================================================#
INFO> Your database and your central SAP instance
      are running on different hosts. Please note that
      all actions concerning the database have to be
      carried out on the database host.


   #=============================================================#
   # PREPARE module Parameter input finished with status succeeded #
   #=============================================================#


   #=================================================#
   # Requests and information for module Initialization #
   #=================================================#
INFO> Your database and your central SAP instance
      are running on different hosts. Please note that
      all actions concerning the database have to be
      carried out on the database host.

WARNING> *** Patch Level too high ***
         The latest "R/3 Support Package" confirmed
         in your system has patch level 16.
```

Figure 91. CHECKS.LOG (part 1 of 5)

```
      But: the upgrade to be applied here is based on the R/3 Support
           Package state with patch level 10.

      Any conflict with R/3 Support Package, patch level 11 - 16,
      can be resolved with the latest available release for the
      R/3 System or with the latest "R/3 Support Package" for
      Release 46B. Please refer to Note 119738 for details.

      The recommended solution is to include patches
      of the target release during PREPARE. The release date
      of the target patch level has to be newer than
      the release date of the current patch level.
      Now load all available R/3 Support Packages for Release 46B
      into the upgrade directory and include them
      in the upgrade in phase BIND_PATCH.


#============================================================#
# PREPARE module Initialization finished with status succeeded #
#============================================================#


#=========================================#
# Requests and information for module Import #
#=========================================#


#=====================================================#
# PREPARE module Import finished with status succeeded #
#=====================================================#


#=========================================#
# Requests and information for module Read CD #
#=========================================#


#=====================================================#
# PREPARE module Read CD finished with status succeeded #
#=====================================================#


#=================================================#
# Requests and information for module General checks #
#=================================================#
```

Figure 92. CHECKS.LOG (part 2 of 5)

```
INFO> During the upgrade, the new SAP kernel
      will be installed. All files and subdirectories
      in directory /usr/sap/RED/SYS/exe/run which are not used
      in Release 46B will be removed.
      Files and subdirectories can be protected from deletion
      if they appear in a file "protect.lst" in the same directory
      (each protected name in a separate line).
      For security reasons, directory /usr/sap/RED/SYS/exe/run
      should be saved in a backup.


INFO> It is possible to upgrade the frontend software before
      you start R3up with the following exceptions:
         If your operating system version is too low
         (examples: HP-UX 9.0, SOLARIS 2.3, ...)
         you can't update the frontend software before you
         upgraded the operating system to the version,
         supported by the new kernel.

WARNING: Inconsistency between the hostname the user input entered in
phase INITPUT or in 'R3up set stdpar' and the hostname used by the R/3
instance.
hostname entered by the user:    sap1en1
Hostname used by the R/3 system: sap1tr0
This might be the case if the R/3 system runs on a high availability
(HAV) cluster.
If this is the case change the hostname to the logical name (probably
sap1tr0)
with 'R3up set stdpar'.

INFO> Errors occurred during CHECK OF UPDATE TASK
         (batch job RSVBCHCK)
         The contents of the summery error log file is as follows.
         Details can be seen in the log file of the batch job: RSVBCHCK.RED
         The following messages can be ignored in certain circumstances.
         Please see the extended error message(s) below.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
CHECK OF UPDATE TASK Errors and RETURN CODE in RSVBCHCK.RED
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
2EETG050 Update records still exist - Please process


   #============================================================#
   # PREPARE module General checks finished with status succeeded #
   #============================================================#


   #=====================================================#
   # Requests and information for module Activation checks #
   #=====================================================#
```

Figure 93. CHECKS.LOG (part 3 of 5)

```
   #=================================================================#
   # PREPARE module Activation checks finished with status succeeded #
   #=================================================================#


   #=====================================================================#
   # Requests and information for module Necessary checks for conversions #
   #=====================================================================#


#=====================================================================#
   # PREPARE module Necessary checks for conversions finished with status
succeeded #

#=====================================================================#


   #=====================================================================#
   # Requests and information for module Optional checks for conversions #
   #=====================================================================#



#=====================================================================#
   # PREPARE module Optional checks for conversions finished with status
succeeded #

#=====================================================================#


   #=========================================================#
   # Requests and information for module Modification support #
   #=========================================================#

INFO> R3up will not stop for any repository adjustments.


   #=====================================================================#
   # PREPARE module Modification support finished with status succeeded #
   #=====================================================================#
```

Figure 94. CHECKS.LOG (part 4 of 5)

```
   #=================================================#
   # Requests and information for module Pre-processing #
   #=================================================#


   #=============================================================#
   # PREPARE module Pre-processing finished with status succeeded #
   #=============================================================#


#=================================================
# Execution of all selected PREPARE modules finished.
#=================================================
```

Figure 95. CHECKS.LOG (part 5 of 5)

Appendix C. R3up log excerpts

This appendix shows files related to running R3up. We provide our R3SETUP parameters and excerpts of UpgDialog.log for the PREPARE and UPGRADE phases of R3up.

C.1 Input parameters for PRER3UP.R3S

We recorded the parameters shown in Figure 96 that we passed to R3SETUP while adapting the OS/390 UNIX environment.

```
step CENTRALINSTANCE_IND_DB2:

    key SAPSYSTEMNAME:        RED
    key SAPSYSNR:             00
    key SAPMOUNT:             /sapmnt/RED
    key CIHOSTNAME:           wtsc42oe
    key DBHOSTNAME:           wtsc42oe


step DBCOMMONPARAMETERS_IND_DB2:

    key DBATTACHNAME:         DBK1

step CALCRAM_IND_IND:

    key RAM_INSTANCE:         512


step KERNELCD_IND_DB2:

    key 1_LOCATION:           /sapcd/kernel


step R3MESSAGEPORT_IND_IND:

    key PORT:                 3600


step OSGROUPSAPSYS_IND_IND:

    key GROUPID:              202


step OSUSERSIDADM_IND_IND:

    key USERID:               204
```

Figure 96. Input parameters for PRER3UP.R3S

C.2 PREPARE phases from UpgDialog.log

The following figures show the log from the R3up PREPARE phases. Due to the size of the log, these figures only show an excerpt including user input and some other relevant information. The user input is shown in bold italic letters.

```
Start of R3up (/usr/sap/put/bin/R3up stdout=/usr/sap/put/log/R3up.out
upgdir=/usr/sap/put uaport=4240 check ) was successful.

Try to connect to R3up.

  Connect to R3up was successful.

Welcome to the R/3 upgrade control program.

Enter the name of your R/3 system ÝRED¨:
? SAP SYSTEM ID =
> SAP SYSTEM ID = RED

Select type of database for system RED:
? ORACLE
? INFORMIX
? SAPDB
? DB6
? DB2forOS/390
? MSSQL
> DB2forOS/390

Start import of data from CD ?
? import
? skip
> import

Enter mount point for CDROM Ý¨:
? CD MOUNT POINT =
> CD MOUNT POINT = /sapcd/kernel

R/3  UPGRADE  CONTROL  PROGRAM
==============================

This is R3up version 4.6B upgrade to release
        46B of SAP_BASIS
        46B of SAP_APPL

Target R/3 system is RED, DB2forOS/390 database
R3up started in PREPARE mode.

Enter the language for the error help function (E/D) ÝE¨:
? HELP LANGUAGE =
> HELP LANGUAGE = E
```

Figure 97. PREPARE phases from UpgDialog.log (part 1 of 7)

```
Select the PREPARE modules
?                              name     status  mandatory
?                   Parameter input    initial        yes
?                    Initialization    initial        yes
?                            Import    initial        yes
?                         Read CD      initial        yes
?                   General checks    initial        yes
?                 Activation checks    initial        yes
? Necessary checks for conversions    initial        yes
?  Optional checks for conversions    initial         no
?              Modification support    initial         no
?                    Pre-processing    initial         no
>                   Parameter input    initial        yes
>                    Initialization    initial        yes
>                            Import    initial        yes
>                         Read CD      initial        yes
>                   General checks    initial        yes
>                 Activation checks    initial        yes
> Necessary checks for conversions    initial        yes
>  Optional checks for conversions    initial         no
>              Modification support    initial         no
>                    Pre-processing    initial         no

Confirm the name of your R/3 system:
? SAP SYSTEM ID     =
The hostname of your central R/3 server:
? SAP SYSTEM HOST   =
Enter the R/3 instance number:
? INSTANCE NUMBER   =

> SAP SYSTEM ID     =  RED
> SAP SYSTEM HOST   =  sap1en1
> INSTANCE NUMBER   =  00

The path to the R/3 start procedure:
? STARTSAP PATH     =
The path to the R/3 kernel:
? KERNEL PATH       =

> STARTSAP PATH     =  /u/redadm
> KERNEL PATH       =  /usr/sap/RED/SYS/exe/run

The system identifier of your database:
? DATABASE ID       =
The hostname of your database server:
? DATABASE HOST     =

> DATABASE ID       =  DBK1
> DATABASE HOST     =  wtsc42oe

Enter the name of your DB2 subsystem ÝDBK1¨:
? DB2 SUBSYSTEM =
> DB2 SUBSYSTEM = DBK1
```

Figure 98. PREPARE phases from UpgDialog.log (part 2 of 7)

```
Enter the name of your load-library ÝDSN610.SDSNLOAD¨:
(This dataset name must be fully qualified and without ''.)
? DATASET =
> DATASET = DSN610.SDSNLOAD

Enter the name of your dsntiad-library ÝDSN610.RUNLIB.LOAD¨:
(This dataset name must be fully qualified and without ''.)
? DATASET =
> DATASET = DSN610.RUNLIB.LOAD

Enter the port number of the ICLI server
for the instance of RED running on sap1en1 Ý6531¨:
(This portnumber is specified by the service entry sapdb2RED
in the /etc/services file on host sap1en1.)
? PORT NUMBER =
> PORT NUMBER = 6531

Specify wether pass ticket signon is enabled on host sap1en1 (yes/no).
If the environment variable ICLI_TRUSTED_CONNECTIONS is set to 1
pass ticket signon is disabled.
? yes
? no
> no

Enter actual password for user redadm on host sap1en1 (may be sapr3):
? redadm PASSWORD =
> redadm PASSWORD = <hidden input>

Enter actual password for user redadm on host sap1en1 (may be sapr3):
? Verification of redadm PASSWORD =
> Verification of redadm PASSWORD = <hidden input>

Enter the name of the home directory for user redadm on host sap1en1
Ý/home/redadm¨:
? HOMEDIR =
> HOMEDIR = /home/redadm

Service entry sapmsRED with  port 3600 detected.
Make sure that the message server
on host sap1en1 uses port 3600.
(Check for service entry sapmsRED.)
? continue
? cancel
> continue

Service entry sapgw00 with  port 3300 detected.
Make sure that the gateway
on host sap1en1 uses port 3300.
(Check for service entry sapgw00.)
? continue
? cancel
> continue
```

Figure 99. PREPARE phases from UpgDialog.log (part 3 of 7)

```
Please enter up to 16 mount points for CDs.

? CD MOUNT POINT 01 =
? CD MOUNT POINT 02 =
? CD MOUNT POINT 03 =
       .
       .
? CD MOUNT POINT 16 =
> CD MOUNT POINT 01 =  /sapcd/kernel
> CD MOUNT POINT 02 =  /sapcd/up1
> CD MOUNT POINT 03 =  /sapcd/up2
> CD MOUNT POINT 04 =  /sapcd/up3
> CD MOUNT POINT 05 =  /sapcd/up4
> CD MOUNT POINT 06 =  /sapcd/lang


The actual password for R/3 user DDIC in client 000
(may be 19920706):
? DDIC PASSWORD  =
Verify actual password for R/3 user DDIC:
? DDIC PASSWORD  =

> DDIC PASSWORD  =  <hidden input>
> DDIC PASSWORD  =  <hidden input>

The instance profile:
? INSTANCE PROFILE  =
The default profile (full path):
? DEFAULT PROFILE   =
The R/3 start profile (without path):
? R/3 START PROFILE =

> INSTANCE PROFILE  =  /usr/sap/RED/SYS/profile/RED_DVEBMGS00_sap1tr0
> DEFAULT PROFILE   =  /usr/sap/RED/SYS/profile/DEFAULT.PFL
> R/3 START PROFILE =  START_DVEBMGS00_sap1tr0

The hostname of your batch server:
? BATCH HOST        =
> BATCH HOST        =  sap1en1

The number of parallel import processes:
? R3TRANS PROCESSES =
The the maximum profile value of "bufreftime":
? MAXIMUM SYNC TIME =

> R3TRANS PROCESSES =  3
> MAXIMUM SYNC TIME =  60
```

Figure 100. PREPARE phases from UpgDialog.log (part 4 of 7)

```
The path to the EPS inbox directory:
? EPS INBOX         =
The local syslog directory:
? LOCAL SYSLOG PATH =

> EPS INBOX         =  /usr/sap/trans/EPS/in
> LOCAL SYSLOG PATH =  /usr/sap/RED/DVEBMGS00/log

The central syslog directory:
? CENTRAL SYSLOG PATH =
> CENTRAL SYSLOG PATH =  /usr/sap/RED/SYS/global

No R/3 add-on has been registered in the past.
Did you install any additional software, like an
industrial solution (IS), or R/3+S, ... in the past ?
? nothing else
? next product
> nothing else

You can include Support Packages of the target release in the upgrade.
You need this if the current patch level can only be retained
with equivalent Support Packages of the target release. Please follow
the directions given in Note 119738.
Do you want to include Support Packages of the target release ?
? No, continue
? Yes
> Yes

        Patch types that can be included in the upgrade
? R/3 Support Package
? R/3 HR Support Package
? Basis Support Package
? Application Interface Support Package
? Single Change Request
> R/3 Support Package

Enter the highest R/3 Support Package number to be included in the upgrade:
? UPPER PATCH NUMBER =
> UPPER PATCH NUMBER = 2

R/3 Support Package 1 - 2 are already included in this upgrade.
You can include Support Packages of the target release in the upgrade.
You need this if the current patch level can only be retained
with equivalent Support Packages of the target release. Please follow
the directions given in Note 119738.
Do you want to include further Support Packages of the target release ?
? No, continue
? Yes
> Yes
```

Figure 101. PREPARE phases from UpgDialog.log (part 5 of 7)

```
 Patch types that can be included in the upgrade
? R/3 Support Package
? R/3 HR Support Package
? Basis Support Package
? Application Interface Support Package
? Single Change Request
> R/3 HR Support Package

Enter the highest R/3 HR Support Package number to be included in the
upgrade:
? UPPER PATCH NUMBER =
> UPPER PATCH NUMBER = 1

R/3 Support Package 1 - 2 are already included in this upgrade.
R/3 HR Support Package 1 - 1 are already included in this upgrade.
You can include Support Packages of the target release in the upgrade.
You need this if the current patch level can only be retained
with equivalent Support Packages of the target release. Please follow
the directions given in Note 119738.
Do you want to include further Support Packages of the target release ?
? No, continue
? Yes
> Yes

        Patch types that can be included in the upgrade
? R/3 Support Package
? R/3 HR Support Package
? Basis Support Package
? Application Interface Support Package
? Single Change Request
> Basis Support Package

Enter the highest Basis Support Package number to be included in the
upgrade:
? UPPER PATCH NUMBER =
> UPPER PATCH NUMBER = 1

R/3 Support Package 1 - 2 are already included in this upgrade.
R/3 HR Support Package 1 - 1 are already included in this upgrade.
Basis Support Package 1 - 1 are already included in this upgrade.
You can include Support Packages of the target release in the upgrade.
You need this if the current patch level can only be retained
with equivalent Support Packages of the target release. Please follow
the directions given in Note 119738.
Do you want to include further Support Packages of the target release ?
? No, continue
? Yes
> Yes
```

Figure 102. PREPARE phases from UpgDialog.log (part 6 of 7)

```
 Patch types that can be included in the upgrade
? R/3 Support Package
? R/3 HR Support Package
? Basis Support Package
? Application Interface Support Package
? Single Change Request
> Application Interface Support Package

Enter the highest Application Interface Support Package number to be
included in the upgrade:
? UPPER PATCH NUMBER =
> UPPER PATCH NUMBER = 2

R/3 Support Package 1 - 2 are already included in this upgrade.
R/3 HR Support Package 1 - 1 are already included in this upgrade.
Basis Support Package 1 - 1 are already included in this upgrade.
Application Interface Support Package 1 - 2 are already included in this
upgrade.
You can include Support Packages of the target release in the upgrade.
You need this if the current patch level can only be retained
with equivalent Support Packages of the target release. Please follow
the directions given in Note 119738.
Do you want to include further Support Packages of the target release ?
? No, continue
? Yes
> Yes

        Patch types that can be included in the upgrade
? R/3 Support Package
? R/3 HR Support Package
? Basis Support Package
? Application Interface Support Package
? Single Change Request
> Single Change Request

Enter the name of the change request you want to include in the upgrade:
? CHANGE REQUEST =
> CHANGE REQUEST = SAPKD00030

Execution of PREPARE module Pre-processing ends at 20000228121738
Execution of the selected PREPARE modules finished
with the statuses as follows:
'Parameter input'  status: succeeded
'Initialization'  status: succeeded
'Import'  status: succeeded
'Read CD'  status: succeeded
'General checks'  status: succeeded
'Activation checks'  status: succeeded
'Necessary checks for conversions'  status: succeeded
'Optional checks for conversions'  status: succeeded
'Modification support'  status: succeeded
'Pre-processing'  status: succeeded
Please see file /usr/sap/put/log/CHECKS.LOG
for the actions which have to be performed.
```

Figure 103. PREPARE phases from UpgDialog.log (part 7 of 7)

C.3 UPGRADE phases of UpgDialog.log

The following figures show the log from the R3up UPGRADE phases. Due to the size of the log, these figures only show an excerpt including user input and some other relevant information. The user input is shown in bold italic letters.

```
Start of R3up (/usr/sap/put/bin/R3up stdout=/usr/sap/put/log/R3up.out
upgdir=/usr/sap/put uaport=4240 ) was successful.

Try to connect to R3up.

  Connect to R3up was successful.

Welcome to the R/3 upgrade control program.

R/3  UPGRADE  CONTROL  PROGRAM
================================

This is R3up version 4.6B upgrade to release
        46B of SAP_BASIS
        46B of SAP_APPL

Target R/3 system is RED, DB2forOS/390 database

Confirm the name of your R/3 system:
? SAP SYSTEM ID     =
The hostname of your central R/3 server:
? SAP SYSTEM HOST   =
Enter the R/3 instance number:
? INSTANCE NUMBER   =

> SAP SYSTEM ID     =  RED
> SAP SYSTEM HOST   =  sap1en1
> INSTANCE NUMBER   =  00

The path to the R/3 start procedure:
? STARTSAP PATH     =

The path to the R/3 kernel:
? KERNEL PATH       =

> STARTSAP PATH     =  /u/redadm
> KERNEL PATH       =  /usr/sap/RED/SYS/exe/run

The system identifier of your database:
? DATABASE ID       =
The hostname of your database server:
? DATABASE HOST     =

> DATABASE ID       =  DBK1
> DATABASE HOST     =  wtsc42oe
```

Figure 104. UPGRADE phases from UpgDialog.log (part 1 of 5)

```
Enter the name of your DB2 subsystem ÝDBK1":
? DB2 SUBSYSTEM =
> DB2 SUBSYSTEM = DBK1

Enter the name of your load-library ÝDSN610.SDSNLOAD":
(This dataset name must be fully qualified and without ''.)
? DATASET =
> DATASET = DSN610.SDSNLOAD

Enter the name of your dsntiad-library ÝDSN610.RUNLIB.LOAD":
(This dataset name must be fully qualified and without ''.)
? DATASET =
> DATASET = DSN610.RUNLIB.LOAD


Enter the port number of the ICLI server
for the instance of RED running on sap1en1 Ý6531":
(This portnumber is specified by the service entry sapdb2RED
in the /etc/services file on host sap1en1.)
? PORT NUMBER =
> PORT NUMBER = 6531

Specify wether pass ticket signon is enabled on host sap1en1 (yes/no).
If the environment variable ICLI_TRUSTED_CONNECTIONS is set to 1
pass ticket signon is disabled.
? yes
? no
> no

Enter actual password for user redadm on host sap1en1 (may be sapr3):
? redadm PASSWORD =
> redadm PASSWORD = <hidden input>

Enter actual password for user redadm on host sap1en1 (may be sapr3):
? Verification of redadm PASSWORD =
> Verification of redadm PASSWORD = <hidden input>

Enter the name of the home directory for user redadm on host sap1en1
Ý/home/redadm":
? HOMEDIR =
> HOMEDIR = /home/redadm

Service entry sapmsRED with  port 3600 detected.
Make sure that the message server
on host sap1en1 uses port 3600.
(Check for service entry sapmsRED.)
? continue
? cancel
> continue
```

Figure 105. UPGRADE phases from UpgDialog.log (part 2 of 5)

```
Service entry sapgw00 with  port 3300 detected.
Make sure that the gateway
on host sap1en1 uses port 3300.
(Check for service entry sapgw00.)
? continue
? cancel
> continue

Please enter up to 16 mount points for CDs.

? CD MOUNT POINT 01 =
? CD MOUNT POINT 02 =
? CD MOUNT POINT 03 =
? CD MOUNT POINT 04 =
       .
       .
       .
> CD MOUNT POINT 01 =  /sapcd/kernel
> CD MOUNT POINT 02 =  /sapcd/up1
> CD MOUNT POINT 03 =  /sapcd/up2
> CD MOUNT POINT 04 =  /sapcd/up3
> CD MOUNT POINT 05 =  /sapcd/up4
> CD MOUNT POINT 06 =  /sapcd/lang
The actual password for R/3 user DDIC in client 000
(may be 19920706):
? DDIC PASSWORD  =
Verify actual password for R/3 user DDIC:
? DDIC PASSWORD  =

> DDIC PASSWORD  =  <hidden input>
> DDIC PASSWORD  =  <hidden input>

The instance profile:
? INSTANCE PROFILE  =
The default profile (full path):
? DEFAULT PROFILE   =
The R/3 start profile (without path):
? R/3 START PROFILE =

> INSTANCE PROFILE  =  /usr/sap/RED/SYS/profile/RED_DVEBMGS00_sap1tr0
> DEFAULT PROFILE   =  /usr/sap/RED/SYS/profile/DEFAULT.PFL
> R/3 START PROFILE =  START_DVEBMGS00_sap1tr0

The hostname of your batch server:
? BATCH HOST        =
> BATCH HOST        =  sap1en1

The number of parallel import processes:
? R3TRANS PROCESSES =
The the maximum profile value of "bufreftime":
? MAXIMUM SYNC TIME =

> R3TRANS PROCESSES =  3
> MAXIMUM SYNC TIME =  60
```

Figure 106. UPGRADE phases from UpgDialog.log (part 3 of 5)

```
The path to the EPS inbox directory:
? EPS INBOX         =
The local syslog directory:
? LOCAL SYSLOG PATH =

> EPS INBOX         =  /usr/sap/trans/EPS/in
> LOCAL SYSLOG PATH =  /usr/sap/RED/DVEBMGS00/log

The central syslog directory:
? CENTRAL SYSLOG PATH =
> CENTRAL SYSLOG PATH =  /usr/sap/RED/SYS/global

Enter the R3up keyword of note 179373
? R3up keyword =
> R3up keyword = 143665

Select the upgrade strategy (current selection is A_switch):

? A_switch
? A_on
? A_off
> A_off

It is possible to interrupt the upgrade process during the final
R3up phases to go live again. If you want to do that,
select "define upgrade stop" to enter the latest possible time
for making a full DB-backup and switch DB-archiving on again.

R3up will interrupt the upgrade before that point in time
or as soon as it's possible to start production operation.

Do you want R3up to stop?
? do not stop
? define upgrade stop
> do not stop

Enter the number of parallel table importers Ý1":
? TABLE IMPORTERS =
> TABLE IMPORTERS = 6

Enter maximum number of batch processes during the upgrade Ý3"
? BATCH PROCESSES =
> BATCH PROCESSES = 5

Please enter number of parallel TP processes Ý3"

? TP PROCESSES with DDL =
> TP PROCESSES with DDL = 6
```

Figure 107. UPGRADE phases from UpgDialog.log (part 4 of 5)

```
Note: All secondary application servers of SAP system RED
      must be shutdown now.

? continue
? exit
> continue

The central Application Server of system RED will
be shutdown now!

? shutdown
? exit
> shutdown

Starting R/3 system ...

Starting system ...

Note: All secondary application servers of R/3 system RED
      can be restarted now.

? continue
? exit
> continue


             ************
       *******            *******
    ***                          ***
   *    YOUR UPGRADE IS COMPLETE    *
    ***                          ***
       *******            *******
             ************


The Upgrade is finished. Exiting R3up ...

Connection to R3up was closed
```

Figure 108. UPGRADE phases from UpgDialog.log (part 5 of 5)

Appendix D. Upgrade runtime

SAP R/3 provides the report RSUPGSUM to calculate the upgrade runtime. See *Upgrade to Release 4.6B: OS/390 UNIX System Services, "Post-Upgrade Activities: Evaluating the Upgrade Runtime*" for more information about how to run this report.

We provide our report output for informational purposes only. There are many factors that influence upgrade runtime. When comparing your results to ours, bear in mind that our system had only slight similarities to "real world" systems:

- There was no production data in the database.
- No modifications had been made to the SAP R/3 standard.
- We did not tune our system to increase performance.
- We chose upgrade strategy A_off because downtime did not matter.

The program only counts R3up runtime; user input and error recovery are not reported. Only upgrade steps with runtime more of than 120 seconds are shown.

```
Upgrade analysis for 45B/          Customer:      IBM ITSO, Poughkeepsie
                                   Inst. No.:     0120010327
                                   Contact:
10.03.2000     RED                 Phone:
                                   Cutoff:        120

DB-size (GB):  12                  Upgrade model: A_off
DB-system:     DB2forOS/3          OP-system:     OS/390
DB-version:    6.1.0               OS-version:    08.00
DB-host:       wtsc42oe            SAP-host:      wtsc42oe
DB-subtype:    STANDARD            Machine type:  000953294C
clients:       3                   system type:   PROD.
Component/Rel: SAP_BASIS           46B
               SAP_APPL            46B
Hot Package level:       0
LCP level:               0
imported languages:     DE
parallel import procs.: 4          parallel batch procs.:   5
parallel data loader:   6
Mod. Adjustment (min):  0
closed Adjustments:     0          Adjustment Halt:         -
Dict. Adjustments:      -          through transports:      -
other Adjustments:      -          through transports:      -

Phase                   time       sum time  errors
------------------------------------------------------------------------------
INITPUT                 00:04:42   00:04:42  0
EU_IMPORT3              00:27:43   00:32:25  0
EU_IMPORT4              00:24:05   00:56:30  0
EU_IMPORT5              02:50:10   03:46:40  0
NEWTAB_CRE              02:09:08   05:55:48  3
RUN_RDDIT006            00:13:12   06:09:00  0
RUN_RDDNT4MD            00:03:46   06:12:46  0
JOB_RSPUSCAD            00:02:53   06:15:39  0
DDIC_IMPORT             00:02:06   06:17:45  0
```

```
SHADOW_IMPORT           00:39:46  06:57:31  2
DIFFEXPGEN              00:10:16  07:07:47  0
DIFFEXPTSAP             00:02:22  07:10:09  0
RUN_RDDCP4TB            00:07:09  07:17:18  0
NTACT_PREMV             00:05:21  07:22:39  0
NTACT_DEL               00:07:12  07:29:51  0
BASDDIMPORT             00:11:16  07:41:07  0
RUN_PRELDIST            00:02:48  07:43:55  0
JOB_RDDGENBB            00:02:03  07:45:58  0
XTERN_CNV               00:15:15  08:01:13  0
EU_SWITCH               00:08:08  08:09:21  0
NTACT_RWR               00:07:50  08:17:11  0
KX_SWITCH               00:02:10  08:19:21  0
TABUIMP_BAS             00:02:12  08:21:33  0
TABUIMP_WBO             00:03:03  08:24:36  0
PORT_IM2                00:02:55  08:27:31  0
JOB_DL4TA_46B           00:02:04  08:29:35  0
DDIC_46B                00:04:20  08:33:55  0
JOB_UMOD20_46B          00:04:27  08:38:22  0
ACT_46B                 02:27:33  11:05:55  0
RUN_INDC_46B            00:03:38  11:09:33  0
PCON_46B                01:01:58  12:11:31  2
 * distribution           00:39:20
 * data conversion        00:09:26
PMVNTAB_46B             00:14:18  12:25:49  0
STARTR3_I46B            00:02:25  12:28:14  0
JOB_DCXTF_46B           00:02:25  12:30:39  0
TABIM_46B               04:29:06  16:59:45  0
 * mainimport time        04:21:55
ALTER_TABIMUPD          00:02:05  17:01:50  0
ADOIM_46B               00:31:31  17:33:21  0
 * ado import time        00:00:11
XPRAS_46B               02:00:10  19:33:31  0
 * xpra time              00:01:00
JOB_RUTTYREP            00:07:41  19:41:12  0
LANG_IMP2               02:48:28  22:29:40  0
LANG_IMP3               00:42:40  23:12:20  1
JOB_RDDNTPUR            00:02:10  23:14:30  0
MODPROFP_46B            00:06:06  23:20:36  0
SAVELOGS                00:09:19  23:29:55  0
------------------------------------------------------------------------------

Start upgrade:          15:20:25 28.02.2000
End   upgrade:          13:39:35 02.03.2000

A-on      down time:    12:10:52
A-switch  down time:    16:07:16
A-off     down time:    23:25:13
R3up      run  time:    23:29:55

------------------------------------------------------------------------------
Program Executions:     (10/77)
Program                 time      runs      errors    deferred  aborts
------------------------------------------------------------------------------
AGR_XPRA_REGENERATE_SAP_00:32:32  1         0         0         0
MLXPRA46A               00:04:43  1         0         0         0
```

```
AGR_XPRA_MENUS_TRANSFER 00:04:22  1         0         0         0
RGZZGLUX                00:04:14  1         0         0         0
FICON46A                00:03:58  1         0         0         0
CONTEXT_GENERATE_ALL    00:03:37  1         0         0         0
RKETKEF_46A             00:03:19  1         0         0         0
RPUMKX00                00:02:45  1         0         0         0
DEPRECIATION_METHODS_FIL00:02:32  1         0         0         0
RKEDRXPRA               00:02:04  1         0         0         0
-------------------------------------------------------------------------------
Table conversions:      (3/117)
Table                   time      runs
-------------------------------------------------------------------------------
ALMONISETS              00:02:09  1
CMPWLH                  00:02:08  1
AT56R                   00:02:03  1
-------------------------------------------------------------------------------
DDL executions:         (0/420)
Table                   time      runs
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
```

Figure 109. Upgrade runtime analysis

Appendix E. Getting files from sapserv

References

- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966, Chapter 5, File transfer with FTP

During the upgrade we had to replace several SAP R/3 libraries and executables with newer versions from sapserv. The different code pages on OS/390 and UNIX caused some confusion when unpacking and transferring these files.

We recommend that you check the unpacked executables and libraries with the `file` command before executing them.

E.1 Using NFS to transfer data

In a heterogeneous environment (OS/390 as well as UNIX/NT application server) several NFS mounts are required. These mounts transparently convert between ASCII and EBCDIC (or more specifically, between ISO8859-1 and IBM-1047).

SAP designed its CAR utility on OS/390 to take advantage of this conversion. So if you download a *.CAR file as usual to your UNIX machine and put it into one of these NFS file systems, you can use the CAR utility on OS/390 to extract the contents without specifying any conversion switch; see Figure 110 and Figure 111.

```
sap1tr0:redadm 1> cd /usr/sap/trans
sap1tr0:redadm 2> ftp sapservx
[...]
ftp> cd /general/R3server/patches/rel46B/UNIX/OS390_32/DB2
ftp> bin
ftp> get tp_83.CAR
ftp> quit
sap1tr0:redadm 3>
```

Figure 110. Download with NFS: Tasks on the UNIX machine

```
wtsc42oe:/u/redadm (1)> cd /sapmnt/RED/exe
wtsc42oe:/sapmnt/RED/exe (2)> mv tp tp.save
wtsc42oe:/sapmnt/RED/exe (3)> CAR -xvf /usr/sap/trans/tp_83.CAR
x tp
wtsc42oe:/sapmnt/RED/exe (4)>
```

Figure 111. Download with NFS: Tasks on the OS/390 machine

It does not matter whether you extract your files on the UNIX or the OS/390 machine. If you mount the OS/390 exe directory via NFS on the UNIX machine, you do not even need to log on to OS/390 to install new software components.

E.2 Using FTP to transfer data directly from sapserv

If you open the FTP connection directly from OS/390 to sapserv, or from OS/390 to a UNIX machine in between, you need to explicitly convert the *.CAR files before being able to unpack them. Make sure you always use binary transmission.

```
wtsc42oe:/u/redadm (1)> cd /tmp
wtsc42oe:/tmp (2)> ftp sapservx
[...]
ftp> cd /general/R3server/patches/rel46B/UNIX/OS390_32/DB2
ftp> bin
ftp> get tp_83.CAR
ftp> quit
wtsc42oe:/tmp (3)> mv tp_83.CAR tp_83.ascii
wtsc42oe:/tmp (4)> iconv -f ISO8859-1 -t IBM-1047 tp_83.ascii > tp_83.CAR
wtsc42oe:/tmp (5)> rm tp_83.ascii
wtsc42oe:/tmp (6)> cd /sapmnt/RED/exe
wtsc42oe:/sapmnt/RED/exe (7)> CAR -xvf /tmp/tp_83.CAR
x tp
wtsc42oe:/sapmnt/RED/exe (8)>
```

Figure 112. Direct download using FTP

E.3 Upload to sapserv

When you run into a problem, SAP may ask you to put one or more log files on sapserv. If you want to bundle them together, we recommend you use the CAR utility. CAR will extract text files in the local encoding, so you don't need to convert them explicitly.

To upload the CAR files, follow the download instructions in the opposite direction. When using NFS, create the CAR file on OS/390, put it on a shared filesystem, and connect to sapserv from your UNIX application server using binary ftp. When using direct FTP, create the CAR file on OS/390, convert it to ISO8859-1, and connect to sapserv directly using binary ftp.

If you wish to use the tar utility to bundle these files, don't do any character conversion. OS/390 writes the tar file's header in ASCII. Use ftp in **binary** mode to transfer this file to UNIX. UNIX is able to unpack that file; the extracted files remain in EBCDIC. You cannot access or move an OS/390-created tar file via NFS, because the implicit character conversion destroys its header structure.

Appendix F. Special notices

This publication is intended to help database administrators, analysts, consultants, and managers in to plan and implement SAP R/3 on DB2 UDB for OS/390 with applications servers on OS/390. The information in this publication is not intended as the specification of any programming interfaces that are provided by SAP R/3, DB2 UDB for OS/390, or OS/390. See the PUBLICATIONS section of the IBM Programming Announcement for the relevant software for more information about what publications are considered to be product documentation. See SAP announcement material for more information about what publications are considered to be product documentation for SAP R/3.

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Appendix G. Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

G.1 IBM Redbooks publications

For information on ordering these publications see “How to get IBM Redbooks” on page 133.

- *SAP R/3 on DB2 for OS/390: Implementing with AIX or Windows NT Applications Servers*, SG24-4945
- *Database Administration Experiences: SAP R/3 on DB2 for OS/390*, SG24-2003
- *High Availability Considerations: SAP R/3 on DB2 for OS/390*, SG24-2078
- *SAP R/3 on DB2 for OS/390: Disaster Recovery*, SG24-5343

G.2 IBM Redbooks collections

Redbooks are also available on the following CD-ROMs. Click the CD-ROMs button at http://www.redbooks.ibm.com/ for information about all the CD-ROMs offered, updates and formats.

CD-ROM Title	Collection Kit Number
System/390 Redbooks Collection	SK2T-2177
Networking and Systems Management Redbooks Collection	SK2T-6022
Transaction Processing and Data Management Redbooks Collection	SK2T-8038
Lotus Redbooks Collection	SK2T-8039
Tivoli Redbooks Collection	SK2T-8044
AS/400 Redbooks Collection	SK2T-2849
Netfinity Hardware and Software Redbooks Collection	SK2T-8046
RS/6000 Redbooks Collection (BkMgr Format)	SK2T-8040
RS/6000 Redbooks Collection (PDF Format)	SK2T-8043
Application Development Redbooks Collection	SK2T-8037
IBM Enterprise Storage and Systems Management Solutions	SK3T-3694

G.3 Other resources

These publications are also relevant as further information sources.

G.3.1 SAP AG Resources

G.3.1.1 Manuals

- *Upgrade to Release 4.6B: OS/390 UNIX System Services*, Material Number 51009018
- *R/3 Installation on UNIX - OS-Dependencies*, Material Number 51008168
- *R/3 Installation on OS/390 UNIX System Services: DB2 UDB for OS/390*, Material Number 51008496

G.3.1.2 OSS Notes

- *DB2/390: Released operation systems R/3 4.6x DB2/390*, Note Number 156554
- *DB2/390: APAR list*, Note Number 0081737
- *DB2/390: Installing saposcol manually*, Note Number 0103135
- *DB2/390: Automated PTF check*, Note Number 0183311
- *DB2/390: Ergänzungen Upgrade auf 4.6B auf OS/390* (presently only available in German), Note Number 193208
- *Additional info for upgrade to 4.6B*, Note Number 0179373
- *DB2/390: 4.6B Installation on OS/390*, Note Number 0195524
- *Problems during upgrade with support packages*, Note Number 0119738
- *DB2/390: Transports for 4.6B*, Note Number 0191215
- *DB2/390: Planning info (release,connectivity matrix)*, Note Number 0138906
- *DB2/390: Variable SAPDBHOST in startsap script*, Note Number 0130163

G.3.2 IBM Resources

- *SAP R/3 on DB2 for OS/390: Planning Guide (IBM)*, SC33-7962
- *SAP R/3 on DB2 for OS/390: Connectivity Guide*, SC33-7965
- *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 4.6B*, SC33-7966
- *OS/390 Network File System Customization and Operation*, SC33-7253
- *DB2 UDB for OS/390 V6 Installation Guide*, GC26-9008
- *UNIX System Services tcsh (C-Shell) Kit Support Guide*, available via IBM Web site `http://www.s390.ibm.com/unix/tcsh/`
- *OS/390 V2R9.0 UNIX System Services Planning*, SC28-1890-09
- *OS/390 V2R9.0 UNIX System Services User's Guide*, SC28-1891-08
- *OS/390 V2R8 Infoprint Server Customization*, G544-5694

G.4 Referenced Web sites

These Web sites are also relevant as further information sources:

- `www.s390.ibm.com/sap/` IBM S/390 Solution Partners - SAP
- `http://www.s390.ibm.com/unix/tcsh` IBM OS/390 UNIX System Services C-shell Web site

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Abbreviations and acronyms

AIX	Advanced Interactive Executive (an IBM version of the UNIX operating system)
ARM	Automatic Restart Manager
CCMS	computing center management system (SAP)
CD	compact disk
CD-ROM	compact disk - read only memory
CI	central instance (SAP)
CLI	call level interface (DB2)
CSI	consolidated software inventory
DASD	direct access storage device
DB	database
DB2	Database 2 (an IBM relational database management system)
DB2PM	Database 2 performance monitor (IBM)
DBA	database administrator
DBIF	database interface (SAP)
DBMS	database management system
DBSL	database service layer (SAP)
DDIC	data dictionary (SAP)
DDL	data definition language
EDM	environmental descriptor manager (DB2)
ESS	Enterprise Storage System (IBM System/390)
FDDI	Fiber Distributed Data Interface (100 Mbits/s fiber optic LAN)
FMID	function modification identifier
FTP	file transfer program; File Transfer Protocol
Gb	gigabit (one Gb $=10^9$ bits)
Gb/s	gigabits per second
GID	group identifier
HFS	hierarchical file system
IBM	International Business Machines Corporation
ICLI	integrated call level interface
ID	identifier
IP	Internet Protocol (ISO); internetwork protocol (OSI)
IT	information technology
ITG	International Technology Group
ITSO	International Technical Support Organization
JCL	job control language
LAN	local area network
LPAR	logical partition
MB	1,000,000 bytes
NFS	network file system (USA, Sun Microsystems Inc)
OMS	Output Management System (SAP)
OSA	Open Systems Adapter (IBM System/390)
OTF	Output Text Format (SAP)
PC	personal computer
PCL	printer control language
PDF	Portable Document Format
PS	Postscript
PSF	Print Service Facility
PTF	program temporary fix (IBM)
QMF	Query Management Facility (IBM program product)
RACF	Resource Access Control Facility
RFC	remote function call
RRS	recoverable resource manager services
RRSAF	Recoverable Resource Manager Services Attachment Facility
SAP	Systems, Applications, Products in Data Processing (software vendor)
SAP R/3	SAP Release 3 (software product of SAP)
SAPGUI	SAP Graphical User Interface (SAP)
SDSF	Spool Display and Search Facility

SMS	System Managed Storage
SQL	structured query language
STC	started task control
TB	terabyte (one TB = 10^{12} bytes)
TCB	task control block (OS/390)
TCP/IP	Transmission Control Protocol/Internet Protocol
TMS	transport management system (SAP)
TSO	Time Sharing Option (OS/390)
UDB	universal database
UID	user identifier
UNIX	An operating system developed at Bell Laboratories
USS	UNIX system services (OS/390)
VSAM	Virtual Storage Access Method (IBM)
VTOC	volume table of contents
WLM	Workload Manager (OS/390)
XMS	cross-memory services (OS/390)

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