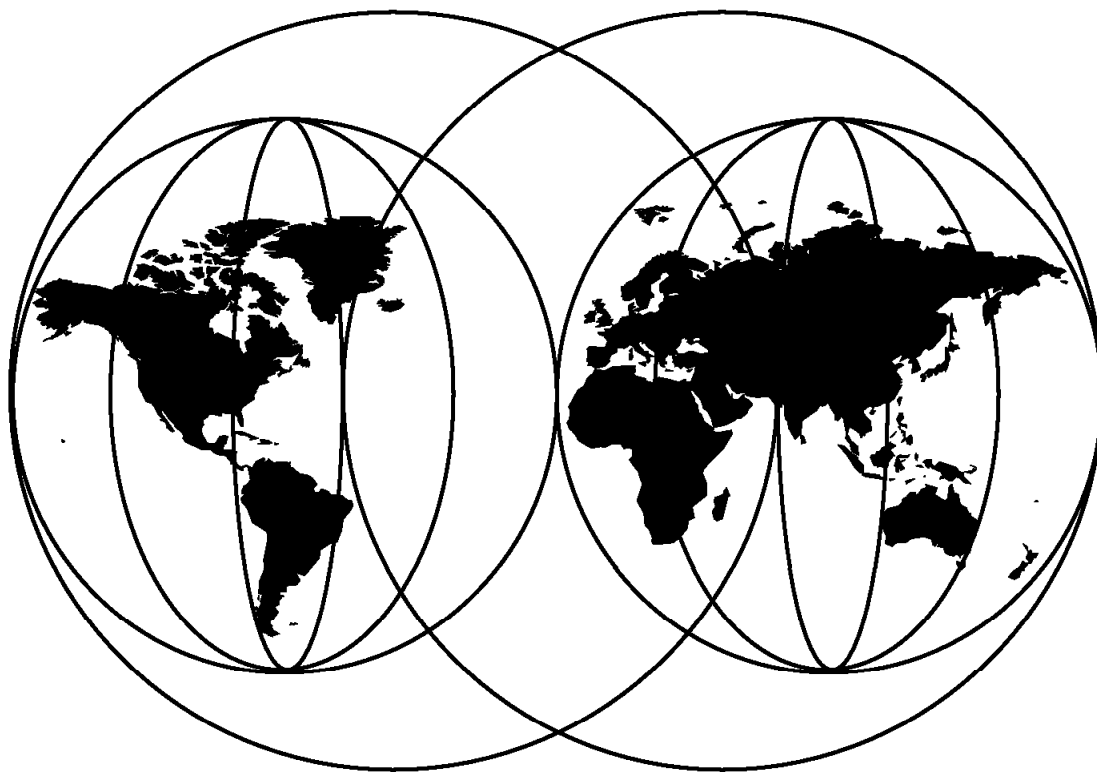




Database Administration Experiences: SAP R/3 on DB2 for OS/390

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International Technical Support Organization

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SAP R/3 on DB2 for OS/390**

April 1999

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix G, "Special Notices" on page 259.

Second Edition (April 1999)

This edition applies to SAP R/3 on DB2 for OS/390, SAP R/3 Release 4.5A, OS/390 Release 2.6 (5645-001), AIX Release 4.3.1 (5765-603), and IBM DATABASE 2 Server for OS/390 Version 5.1 (DB2 for OS/390) Release 4.1 (5655-DB2), and to all subsequent releases and modifications until otherwise indicated in new editions or Technical Newsletters.

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Contents

Figures	vii
Tables	xi
Preface	xiii
The Team That Wrote This Redbook	xiii
Other Contributors	xiv
Comments Welcome	xv
Chapter 1. Introduction	1
1.1 Overview of SAP R/3 and Its Architecture	1
1.2 OS/390 Features for SAP R/3	4
1.3 DB2 for OS/390 Features	5
1.4 SAP R/3 on DB2 for OS/390 Structure	6
1.5 Network Connectivity	7
1.5.1 Physical Connection	8
1.5.2 Communication Protocols	8
1.5.3 SAP R/3 Database Integrity	10
1.6 Terminology Used in This Redbook	12
1.7 Overview of the Remaining Chapters	12
Chapter 2. Performing SAP R/3 Database Administration with DB2	15
2.1 Database Layout	17
2.2 Starting and Stopping the Database Subsystem and Tablespaces	19
2.3 Backup, Restore and Archiving	19
2.3.1 COPY	20
2.3.2 DSN1COPY	20
2.3.3 ADSTAR Distributed Storage Manager (ADSM)	20
2.3.4 Recovery	21
2.4 Monitoring and Analyzing	21
2.4.1 DB2 Utilities	21
2.4.2 DB2 Tools	22
2.4.3 OS/390 Tools	29
2.4.4 Installation Checks	31
2.4.5 Monitoring the Database	32
2.4.6 Monitoring Tablespaces	34
2.4.7 Monitoring Tables	37
2.4.8 Monitoring Indexes	40
2.4.9 Monitoring Volumes, Data Sets, and DASD	42
2.4.10 Monitoring Database Buffers	46
2.5 Reorganization	46
2.6 Exporting and Importing	47
2.7 Changing the Database Layout	48
Chapter 3. Database Administration with SAP R/3 Transactions	51
3.1 Outputs We Reached from Menus	52
3.1.1 Administrator Scheduling	53
3.2 Outputs We Reached from Transaction Codes	89
3.2.1 Transaction DB02	89
3.2.2 Transaction DB03	100
3.2.3 Transaction DB05	101

3.2.4 Transaction DB2C	104
3.2.5 Transaction DB2J	105
3.2.6 ST Transactions	108
3.2.7 Transaction ST02	108
3.2.8 Transaction ST03	110
3.2.9 Transaction ST05	117
3.2.10 Transaction ST06	118
3.2.11 Transaction ST07	120
3.2.12 Transaction ST10	121
Chapter 4. Backup and Restore Scenarios	125
4.1 SAP R/3 and DB2 for OS/390 Architectural Comparison	125
4.1.1 Architectural Differences	125
4.1.2 SAP R/3 and DB2 for OS/390: Installation Differences	126
4.2 Backup and Recovery for SAP R/3 Supporting Software and Files	127
4.3 DB2 for OS/390 Utilities	128
4.3.1 Additional Notes on COPY	129
4.4 Backup Alternatives	129
4.4.1 The COPY Utility	130
4.4.2 DSN1COPY - No Concurrent Access	131
4.4.3 OS/390 DFSMSdss (Data Set Dump/Restore)	132
4.5 Recovery Alternatives	132
4.5.1 Recover to Currency	132
4.5.2 Point-in-Time Recovery	133
4.6 SAP R/3 Point-in-Time Recovery	137
4.6.1 Point-In-Time Recovery Preventive Measures	138
4.6.2 Point-In-Time Recovery Techniques	138
4.6.3 Point-in-Time Recovery Recommendations	143
4.7 Utility Job Control Examples	145
4.7.1 COPY Utility, All SAP R/3 Tablespaces	146
4.7.2 DSN1COPY Utility	149
4.8 Sample RECOVER TABLESPACE JCL: Recover to Currency	150
4.9 Sample RECOVER TABLESPACE JCL: Point-in-Time Recovery	151
4.9.1 Sample JCL: RECOVER INDEX ALL	153
Chapter 5. Reorganization of Tablespaces	157
5.1 Considerations for Doing Tablespace Reorganizations	157
5.2 Offline Reorganization	158
5.2.1 How Does It Work	158
5.2.2 What Is the Impact on Users	158
5.3 Online Reorganization	158
5.3.1 How Does It Work	158
5.3.2 What Is the Impact on Users	159
5.4 Methods of Testing	159
5.5 Guidelines	160
5.5.1 Scenarios for High Availability	160
Chapter 6. Planning for Growth	163
6.1 How to Find Growing Tablespaces, Index Spaces or Tables	163
6.1.1 LISTCAT	163
6.1.2 RUNSTATS Utility	166
6.1.3 STOSPACE Utility	171
6.1.4 DB2ADM Growth Monitoring	173
6.1.5 DB2AUG Growth Monitoring	173
6.1.6 Table Statistics Workload	174

6.1.7 SQL Trace in SAP R/3	175
6.1.8 Performance Traces	176
6.2 Hot Spot Tables in SAP R/3	176
6.2.1 High Insert Tables in SAP R/3	176
6.2.2 Size Category and Data Class in SAP R/3	177
6.2.3 Scratch Tables	179
6.3 How to Handle Growing Tablespaces or Index Spaces	179
6.3.1 Increase Size of Tablespace or Index Space	179
6.3.2 Reaching 255 VSAM Extents	184
6.3.3 All Volumes in Storage Group Full	185
6.4 How to Handle a Specific Table Growing in Tablespace	186
6.4.1 Isolate Table to Separate Tablespace	187
6.4.2 Isolate Table to Separate, Partitioned Tablespace	189
Appendix A. JCL Examples	201
A.1 Backup and Recovery JCL	201
A.1.1 COPY TABLESPACE Catalog and Directory	201
A.1.2 RESTORE TABLESPACE Catalog and Directory	207
A.2 DB2AUG JCL Examples	209
A.2.1 DB2AUG JCL for Full Copy	209
A.2.2 Reorg JCL Created with DB2AUG	212
Appendix B. Useful Scripts	215
B.1 Monitoring Table Growth	215
B.1.1 SPUFI SQL Script Displaying Table Growth	215
B.1.2 Creating Tables for Storing Table Statistics	217
B.1.3 SQL Statements for Storing the Table Statistics in the Statistics Tables	218
B.1.4 SPUFI SQL Script Displaying Table Space Growth	218
B.1.5 Creating Tables for Storing Table Space Statistics	219
B.1.6 SQL Statements for Storing the Table Space Statistics in the Statistics Tables	219
B.2 Sample ABAP/4 Report for Querying the DB2 Catalog	220
B.3 Sample ABAP/4 Report for Displaying the Statistics	222
B.4 Sample Program for Consistency Check	222
Appendix C. Tables with Size Category 4 and Data Class APPL1	225
Appendix D. Detailed Index Recovery Statistics	233
Appendix E. APAR PQ19077 Text	235
E.1 APAR Text	235
Appendix F. Tablespaces Shipped in SAP R/3 4.5A	237
Appendix G. Special Notices	259
Appendix H. Related Publications	261
H.1 International Technical Support Organization Publications	261
H.2 Redbooks on CD-ROMs	261
H.3 SAP References	261
H.4 Other Publications	262
How to Get ITSO Redbooks	263
IBM Redbook Fax Order Form	264

Glossary	265
List of Abbreviations	273
Index	275
ITSO Redbook Evaluation	277

Figures

1.	SAP R/3 Basis and Application Layers	2
2.	Three-Tier Architecture of SAP R/3	3
3.	Structure of SAP R/3 on DB2 for OS/390	6
4.	ICLI Architecture	7
5.	Examples of Physical Connections	8
6.	SAP R/3 Transaction	11
7.	Available Performance Queries in DB2 Administration Tool	23
8.	R/3 Tablespaces with No RUNSTATS Information	23
9.	DB2AUG Extent Statistics	25
10.	Number of Extents in DB2AUG Database (with DB2 Administration Tool)	26
11.	Exception Threshold Category Selection (DB2PM)	28
12.	Exception Threshold Field Selection (DB2PM)	29
13.	Sample Program for Consistency Check	32
14.	R/3 Transaction ST04	33
15.	SYSTABLEPART Entries for R/3 Tablespaces	35
16.	R/3 Tablespaces (with DB2 Administration Tool)	35
17.	Tablespace Details (with DB2 Administration Tool)	36
18.	SYSTABLES	37
19.	Table Status (with DB2 Administration Tool)	38
20.	Table Growth (Partial List, Created with SPUFI)	39
21.	Overview of R/3 Indexes (with DB2 Administration Tool)	40
22.	Detailed Status of Index CCPP_____0 (with DB2 Administration Tool)	41
23.	Volume Contents (with ISMF)	42
24.	Data Set Contents (with ISMF)	43
25.	Data Sets with More Than One Extent (with ISMF)	44
26.	DB2AUG Data Set Statistics for Tablespaces (Panel 1 of 2)	45
27.	DB2AUG Data Set Statistics for Tablespaces (Panel 2 of 2)	45
28.	DASD State	46
29.	Invoking the UNLOAD Table Function in DB2 Administration Tool	47
30.	Alter Tablespace with DB2 Administration Tool	48
31.	Free Space for a Tablespace	48
32.	SAP R/3 System Status	52
33.	DBA Planning Calendar	53
34.	Job Submission Choices	54
35.	Backup Status Choices	55
36.	Tablespaces without Backup	56
37.	Tablespaces - Last Successful Backup	57
38.	Workload Analysis	58
39.	Database Activity Initial Screen	59
40.	DB2 Subsystem Activity Overview (Part 1 of 2)	60
41.	DB2 Subsystem Activity Overview (Part 2 of 2)	61
42.	DB2 Subsystem Activity: Group Buffer Pool	62
43.	DB2 Activity Summary List (1 of 9)	63
44.	DB2 Activity Summary List (2 of 9)	63
45.	DB2 Activity Summary List (3 of 9)	64
46.	DB2 Activity Summary List (4 of 9)	64
47.	DB2 Activity Summary List (5 of 9)	65
48.	DB2 Activity Summary List (6 of 9)	65
49.	DB2 Activity Summary List (7 of 9)	66
50.	DB2 Activity Summary List (8 of 9)	67
51.	DB2 Activity Summary List (9 of 9)	67

52.	Data Sharing Locking (Part 1 of 2)	68
53.	Data Sharing Locking (Part 2 of 2)	69
54.	Buffer Pool List	70
55.	Buffer Pool Activity (Detail)	71
56.	Locking Activity	72
57.	Logging Activity	73
58.	EDM Pool	74
59.	Dynamic Statement Cache	75
60.	Open/Close Activity	76
61.	Subsystem Services	77
62.	SQL Activity	78
63.	RID List Processing	79
64.	Thread Activity: Thread List	80
65.	Choosing a Specific Thread	81
66.	SQL Activity for a Thread	82
67.	Choosing SQL Statement Filters	83
68.	Statement Cache Statistics Details	83
69.	Global Times	84
70.	Installation Parameters	85
71.	DB2 Command List	86
72.	DB2 Display Thread Report	86
73.	System Log Choice	87
74.	ICLI Trace Control	88
75.	Extent Monitor	89
76.	Extent Monitor: Change Thresholds	90
77.	Database Performance: Tables and Indexes	91
78.	Database Checks	92
79.	Tables without Unique Indexes	93
80.	Volume Choice	93
81.	Database History	94
82.	Tablespace History	95
83.	Tablespace Analysis	96
84.	Analysis of Tables and Indexes: Choice	97
85.	Analysis of Tables and Indexes: Table List	98
86.	Analysis of Tables and Indexes: Data for a Table	99
87.	Missing Database Indexes	100
88.	Parameter Changes in Database	100
89.	Analysis of Table with Respect to Indexes	101
90.	Input Help Personal Value List	102
91.	Table Choice: Analysis of Table with Respect to Indexes	102
92.	Index Analysis	103
93.	SQL Statement Entry	104
94.	JCL Management Entry	105
95.	JCL Management Entry - All Jobs	106
96.	Display JCL Job	107
97.	Tuning Summary	108
98.	Tuning Profile Parameters	109
99.	Choose Server Name	110
100.	Choose Time Period	111
101.	Workload Overview	112
102.	Workload Top 40 (Time Consumption)	113
103.	Local Workload Data Choice	114
104.	Statistics Records Choice	115
105.	Workload: Display Statistical Records	116
106.	Trace Requests	117

107.	Local Server Monitor: General Information	118
108.	Local Server Monitor: Choose Detail Information	119
109.	Application Monitor User Distribution	120
110.	Table Call Statistics Choice	121
111.	Table Call Statistics (Generic Key Buffered)	122
112.	Table Call Statistics (All Tables)	123
113.	Table Call Statistics (Single Table)	124
114.	COPY Utility: Image Copy after Initial Install, Image Copy Job BAKT11	148
115.	DSN1COPY: Sample JCL to Copy the DOKCLU Index Data Set	150
116.	Recover to Currency - Sample JCL	150
117.	Point in Time Recovery from Image Copy, Tablespace Job 1	152
118.	Point in Time Recovery: RECOVER INDEX ALL, Index Job 1	154
119.	Example LISTCAT Command in TSO	163
120.	Example JCL for LISTCAT Command	164
121.	Output of LISTCAT Command for One Tablespace	165
122.	Example JCL for RUNSTATS Utility	167
123.	JCL to Query Catalog Columns Updated by RUNSTATS	169
124.	JCL to Update NPAGES after RUNSTATS	170
125.	Sample RUNSTATS Output for a Table in a Tablespace	171
126.	JCL to Query Catalog Columns Updated by STOSPACE	172
127.	JCL to Run STOSPACE Utility	173
128.	Table Statistics Workload (Transaction ST10)	174
129.	Table Call Statistics (Transaction ST10)	175
130.	ABAP Dictionary: Display Technical Settings	178
131.	Example JCL for ALTER TABLESPACE to Change Primary and Secondary Allocations	180
132.	SPUFI to Create Tablespace for REORG Mapping Table	181
133.	SPUFI to Create REORG Mapping Table	181
134.	Example JCL to Run Online REORG	181
135.	OS/390 System Log Timeout Error during Online REORG	182
136.	ICLI Server Message File Timeout Error during Online REORG	183
137.	ABAP/4 Shortdump for Timeout during Online REORG (Extract)	183
138.	Messages in SAP R/3 System Log for Timeout during Online REORG	184
139.	Errors on OS/390 System Log If Maximum Number of VSAM Extents Reached	185
140.	Sample Errors in OS/390 System Log When All Volumes of Storage Group Are Full	186
141.	Example JCL for ALTER STOGROUP to Add a Volume	186
142.	Example SPUFI to Create Storage Group	187
143.	Example SPUFI to Create Database	187
144.	Example RUNSTATS Output for a Table in a Tablespace	188
145.	Example SPUFI to Create Tablespace	188
146.	Example SPUFI to Find All Indexes on a Table	189
147.	Example SPUFI to Change Bufferpool Assignment of an Index	189
148.	Example SPUFI to Create Storage Groups for Partitioned, Separate Tablespace	190
149.	Example SPUFI to Create Storage Groups for the Index Spaces of a Partitioned Tablespace	190
150.	Example SPUFI to Create Database for Partitioned, Separated Tablespace	190
151.	Example RUNSTATS Output for a Table in a Tablespace	190
152.	SPUFI to Create Tablespace for Partitioned, Separated BKPF Table	191
153.	Example JCL to Unload Table BKPF with Program DSNTIAUL	192
154.	SQL Statements to Query Catalog for BKPF Table and Index Definitions	193

155. SPUFI to Drop Non-Partitioned BKPF Table	193
156. SPUFI to Create Partitioned BKPF Table	194
157. SPUFI to Create Partitioning Index for the BKPF Table	195
158. SPUFI to Create Indexes on Table BKPF after Partitioning	196
159. SPUFI to Create the Views on Table BKPF after Partitioning	197
160. Example JCL to Reload Table BKPF with DB2 for OS/390 LOAD Utility	200
161. Create Image Copies of DB2 System Catalog Tables	201
162. Copy Utility: Initial Image Copy after Install, Image Copy Job 6	208
163. Definition of Statistics Table ZSTRU1	222

Tables

1.	Official Names and Usage in This Redbook	12
2.	Comparison of AIX and DB2 Functions	15
3.	Tools Used in DB2	17
4.	Other Tools	17
5.	SAP R/3 Data Classes - Database Layout	18
6.	Backup Statistics	146
7.	Recovery Statistics	151
8.	Index Recovery Statistics (Detail)	153
9.	RUNSTATS Utility Times: SHRLEVEL CHANGE versus SHRLEVEL REFEENCE	166
10.	High Insert Tables in SAP R/3	176
11.	Data Classes in SAP R/3	178
12.	Scratch Tables in SAP R/3	179
13.	Tables with Size Category 4 and Data Class APPL1 in SAP R/3	225
14.	Index Recovery Statistics (Detail)	233
15.	Databases and Tablespaces in SAP R/3 4.5A, Format: Database.Tablespace	237

Preface

The objective of this redbook is to relate our experiences in performing database administration in an environment where the database server of SAP R/3 Release 4.5A is DB2 for OS/390. We used DB2 for OS/390 Release 5.1; this redbook does contain some preliminary information about Release 6. OS/390 Release 2.6 was the operating system on our S/390. The areas documented show the practicality of that environment; that is, how these products deliver a modern reliable processing system with real value to an enterprise.

All the subjects covered by this redbook deal with database administration. We include common commands an administrator will probably need to use, then include those commands in functions necessary in an SAP R/3 installation. Those functions include backup/restore, reorganization, and handling growth. There is some performance and tuning information, but it is related to the reports and commands that would be used.

This redbook is especially useful for database administrators who need to perform the tasks that are the heart of the solution environment. Those database administrators who are familiar with other database servers commonly used with SAP R/3 will find this book valuable in determining which functions are done differently when using this solution. The book is also of value to consultants and systems administrators who must understand the environment and the means of providing the benefits of that environment.

An understanding of SAP R/3 is assumed, as well as some knowledge of DB2 and how it functions; the book is meant to supplement the information from the standard document libraries of SAP R/3, DB2 for OS/390, OS/390, and AIX.

The Team That Wrote This Redbook

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Chapter 1. Introduction

In this book, it is assumed that you have the current SAP documentation for SAP R/3 on DB2 for OS/390 available. See Appendix H, “Related Publications” on page 261 for the SAP R/3 documents you should have.

This chapter gives an overview of SAP R/3 on DB2 for OS/390, and describes its components.

1.1 Overview of SAP R/3 and Its Architecture

SAP R/3’s suite of client/server data processing products 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.

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, MAC, Motif or Java platforms.

- 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 on page 2 illustrates the layering of the application service.

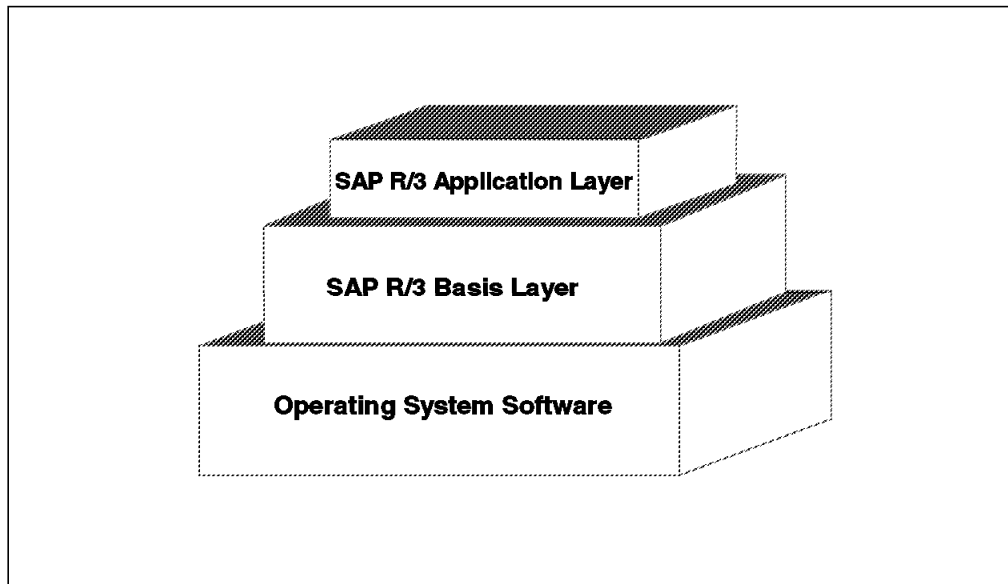


Figure 1. SAP R/3 Basis and Application Layers

The client/server architecture employed by SAP R/3 removes from administration tasks many configuration details about the network and individual machines in use by SAP R/3. 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 server within the same SAP system. Further, this application task can use services on the server it is on, as well as services from other servers in the SAP system. The SAP R/3 system routes these requests to the appropriate server.

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, which has services such as dialog, update, enqueue, batch, message, gateway, and spool. After installation, these services can be moved 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. Others 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 on page 3 illustrates the three-tiered architecture of SAP R/3.

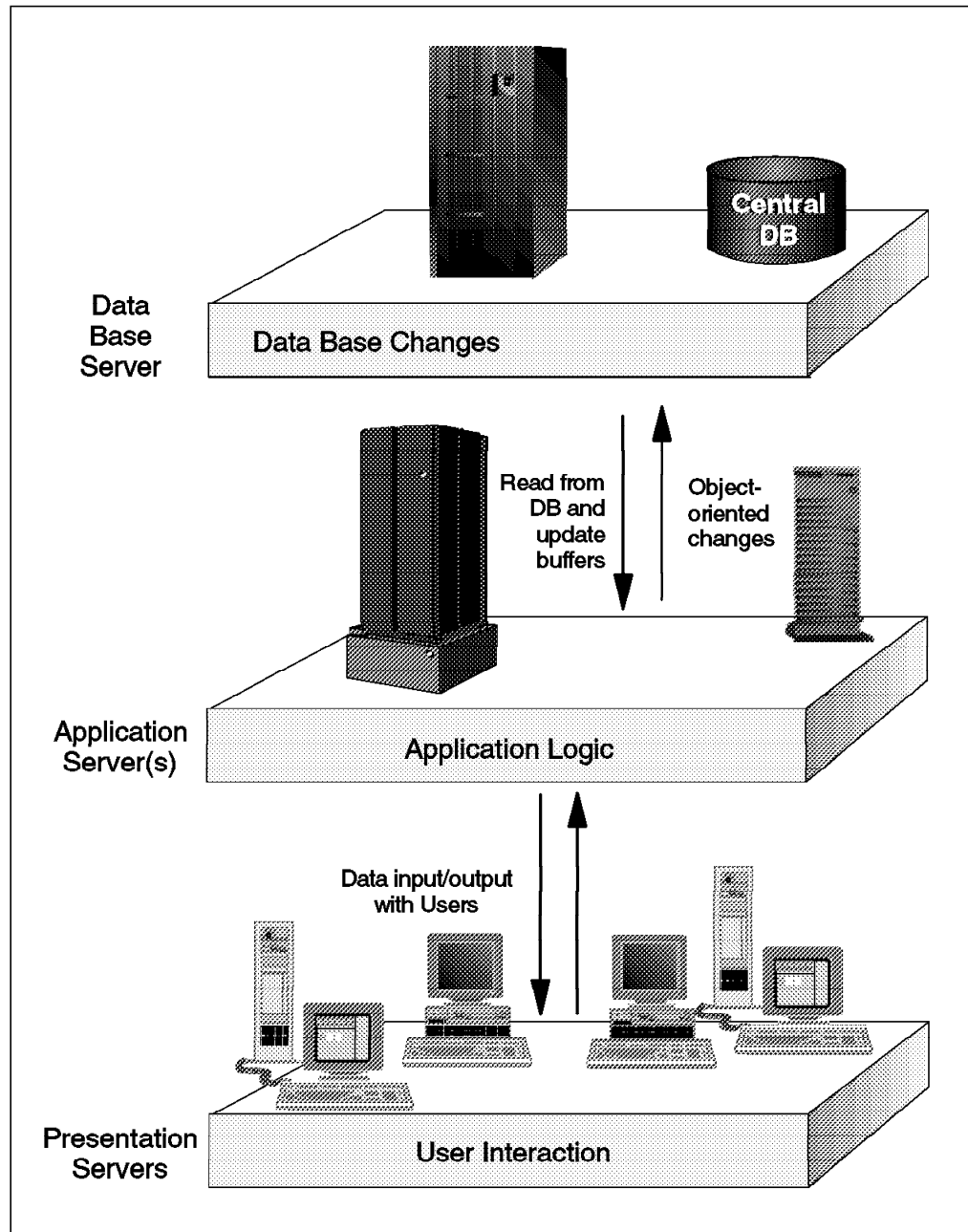


Figure 2. Three-Tier Architecture of SAP R/3

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, databases and networks.

In multiple-tier configurations, TCP/IP is usually used for network communication. As explained in 1.4, "SAP R/3 on DB2 for OS/390 Structure" on page 6, SAP R/3 on DB2 for OS/390 is a three-tier structure in which DB2 for OS/390 and the OS/390 operating system supply database services. The network

communication between the application services (running on AIX or Windows NT) and DB2 for OS/390 is handled by a special high speed protocol. There are three different types of this high speed protocol, as explained in 1.5.2, “Communication Protocols” on page 8. Note that communication between application servers and presentation servers is done through TCP/IP.

1.2 OS/390 Features for SAP R/3

OS/390 is an integrated enterprise server operating system environment. It incorporates into one product an open communication server, distributed data and file services, Parallel Sysplex support, object-oriented programming, and open application interfaces.

OS/390 continues to build on the classic strengths of MVS—reliability, continuous availability, serviceability, data integrity, workload management, and security. OS/390 gives you a scalable system that supports massive transaction volumes and large numbers of users with high performance, as well as advanced system and network management.

Through its support of UNIX interfaces in OS/390 UNIX Services, OS/390 becomes a database server for SAP R/3, allowing you to profit from client/server technology benefits such as distributed processing and extensive scalability. SAP R/3 application programs and user data, including data and process models, are stored on the database server. SAP R/3 uses DB2 for OS/390 as the database server, which can manage large amounts of data on behalf of many users.

IBM adds an UNIX System Services program, called ICLI, which passes DB2 data to the SAP R/3 Database Interface (DBIF). Communication services support TCP/IP for general access to the internet. Additionally, IBM provides a special, high-speed communications interface, called “Enhanced ESCON” support that is used by SAP R/3 application servers and the OS/390 system.

The strengths that OS/390 and System/390 bring to the SAP R/3 environment include:

- Reliability, Availability, and Serviceability

SAP R/3 customers need continuous data availability and integrity. OS/390 reliability and availability is unsurpassed and it has a history of unmatched security and integrity. SAP R/3 benefits from these underlying characteristics.

- Scalability

The System/390 platform ranges from small uniprocessors to 10-way processors to Parallel Sysplex environments, which allow you to connect up to 32 OS/390 systems. The platform can thus support thousands of users. The architecture of the System/390 I/O subsystem and the OS/390 operating system allow data to be transferred into memory from many devices simultaneously, allowing the processing of data requests for many users at high data rates. The requests may require accessing data residing in multiple-terabyte repositories.

- System Management

OS/390 has many system management capabilities, providing data security, strong operations tools, and the ability to manage diverse workloads.

System/390 has proven procedures and tools to manage systems in a very efficient way.

- Cost of Ownership

System/390 is acknowledged by consultants such as IDC, GartnerGroup, Xephon, ITG, and others as having one of the lowest overall costs of ownership in a client/server environment when calculated over multiple years. CMOS technology and software pricing actions have drastically reduced the cost of System/390 enterprise computing.

1.3 DB2 for OS/390 Features

DB2 for OS/390 is engineered to deliver the high performance and high levels of availability, integrity, and security needed for your business applications. The strengths DB2 for OS/390 brings to the SAP R/3 environment include:

- Continuous Operation and High Availability

DB2 for OS/390 can operate for long periods without interruption. With data sharing, work can be transferred between DB2 for OS/390 subsystems within a Parallel Sysplex as a result of a planned or unplanned outage. Online reorganization provides greater availability during database unload and reload processes. See *High Availability Considerations: SAP R/3 on DB2 for OS/390*, SG24-2003, for more detail on high availability planning.

- Data Sharing in a Parallel Sysplex Environment

DB2 for OS/390 exploits the Parallel Sysplex environment through data sharing, which allows applications running on more than one DB2 for OS/390 subsystem to read from and write to the same set of data concurrently.

- High Data Integrity

DB2 for OS/390 provides high data integrity through capabilities such as a sophisticated lock manager and integration with IBM system security products. DB2 for OS/390 also protects data from subsystem failure, media failures, and application failures with integrated recovery schemes.

- Very Large Database Support

DB2 for OS/390 works with the System/390 I/O subsystem to allow the rapid parallel processes needed for very large database backup, reorganization, and recovery of data. The maximum table space size is now one terabyte (1 TB = 10^{12} bytes).

- Database and System Administration Aids

To help database administrators manage their database environments, DB2 for OS/390 offers an integrated set of tools and functions, including flexible security mechanisms, an extensive set of logging and recovery utilities, trace facilities for tuning, and functions and tools to monitor and tune subsystems. DB2 for OS/390 can use hardware compression to drive down the cost of data storage.

- Other Features

In addition to the preceding items, the following features have been added to DB2:

- Dynamic Statement Cache
- ASCII Tables
- Isolation Level Read Stability

- Keep Exclusive Locks
- Improvements in DDL Concurrency
- SQL RENAME of Tables
- SQL STRIP Function

These features are particularly beneficial (in some cases required) for an enterprise using SAP R/3, although the SQL STRIP function is no longer used by SAP R/3.

1.4 SAP R/3 on DB2 for OS/390 Structure

As previously mentioned, the SAP R/3 on DB2 for OS/390 implementation is a three-tier structure. Presentation services run on workstations connected to application services that are running on AIX or Windows NT. The SAP R/3 database runs on an OS/390 system connected to AIX or Windows NT application servers over a network connection. The different options regarding network connectivity are explained in 1.5.1, "Physical Connection" on page 8.

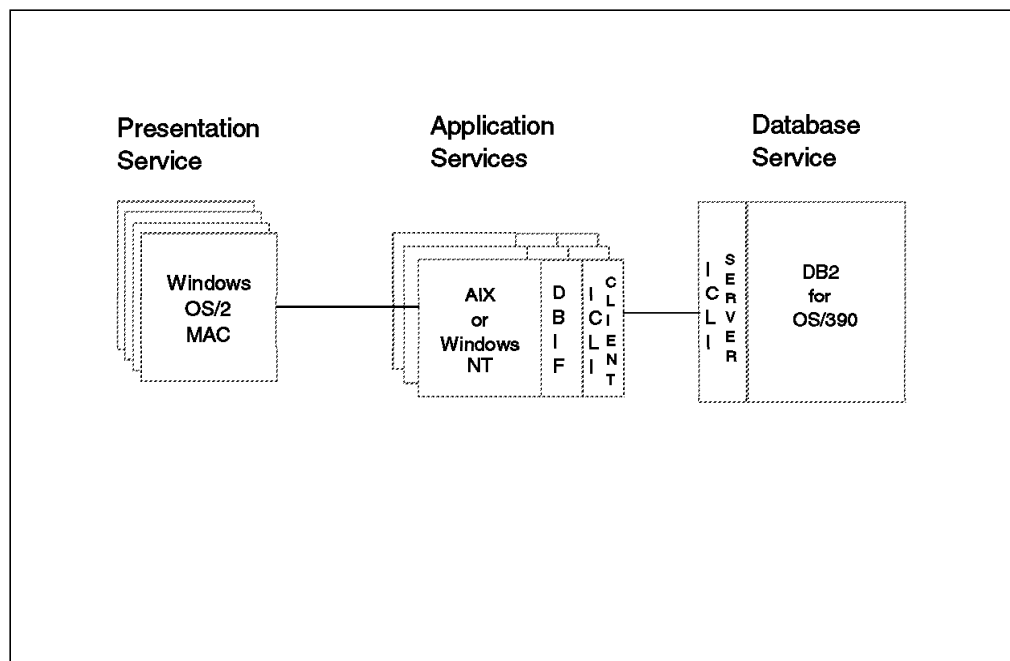


Figure 3. Structure of SAP R/3 on DB2 for OS/390

The SAP R/3 system is comprised of all of the hardware and software components used in the SAP R/3 on DB2 for OS/390 solution, including the database, application, and presentation server(s) and the services that they provide.

Figure 3 shows important components for SAP R/3 on DB2 for OS/390:

- DBIF** The Database Interface (DBIF) of SAP R/3 has been modified to support DB2 for OS/390. The DBIF resides on the application server and is responsible for interacting with the database.
- ICLI** For communication with the database service, the DBIF uses a component called the Integrated Call Level Interface (ICLI). The ICLI consists of a client and server component, which allows AIX and Windows NT application servers to access an OS/390 database server

remotely across a network. The DBIF uses only a subset of database functions and the ICLI delivers exactly that subset.

The server component of the ICLI is a program based on OS/390 UNIX Services; it executes on S/390 usually as a started task. The client component is downloaded as an AIX shared library member or a Windows NT dynamic link library member; there is also a “keep-alive” executable that continuously checks that the ICLI client is functioning. The ICLI components are provided as a part of OS/390 UNIX Services; users should consult SAP notes to determine the ICLI level (and IBM service identifiers) they require. Figure 4 shows how an ICLI connection between an application server and an OS/390 database server is established.

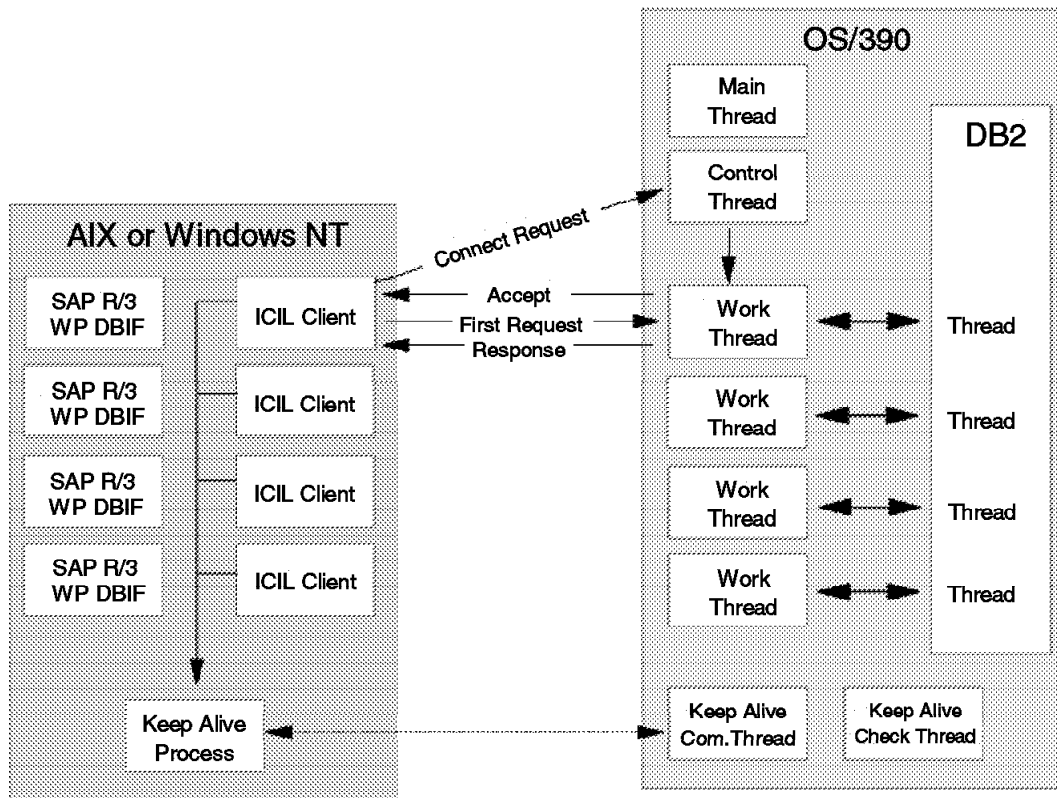


Figure 4. ICLI Architecture

1.5 Network Connectivity

The three-tier structure that the implementation of SAP R/3 on DB2 for OS/390 uses requires a high-speed, high-bandwidth communication connection between the database server and the application server.

On the current release of OS/390, the options for network connectivity can be divided into two separate areas:

- Physical Connection
- Network Protocol

1.5.1 Physical Connection

For the physical connections between the application server and the database server, three types of connection hardware are supported:

- ESCON channel
- FDDI LAN
- Fast Ethernet LAN

Attention

All information about FDDI LANs in this chapter also applies to Fast Ethernet LANs.

The ESCON channel option is only available for a connection between OS/390 and AIX. It is not possible to use an ESCON channel between OS/390 and Windows NT. Figure 5 shows examples of possible physical connections.

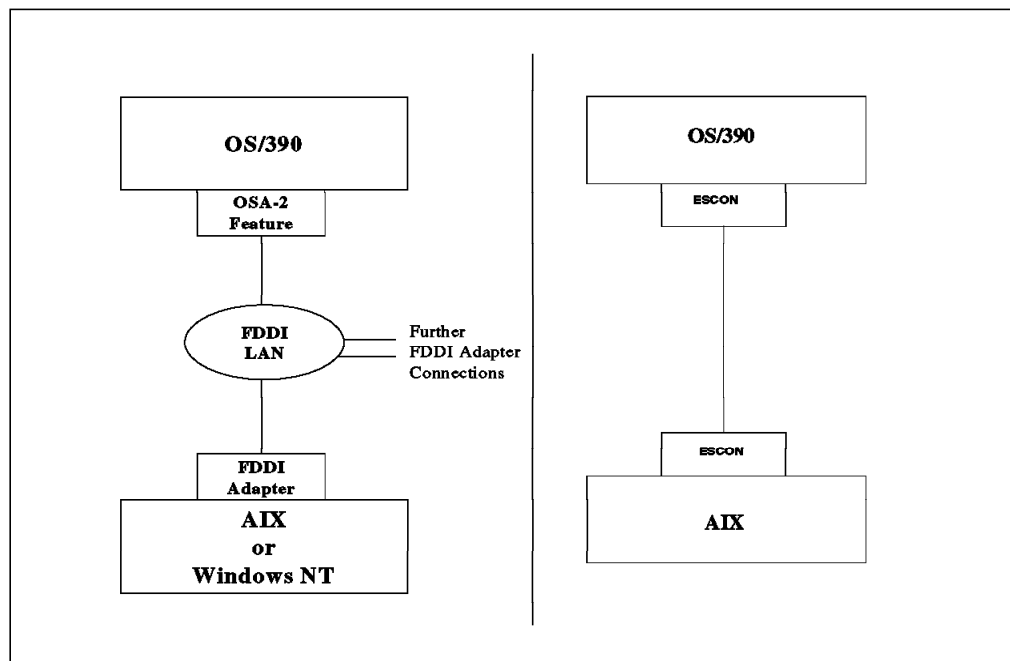


Figure 5. Examples of Physical Connections

1.5.2 Communication Protocols

Three communication protocols are available for communication between the SAP R/3 work processes on the application server and the database server:

- TCP/IP
- High Speed UDP

Attention

- In OS/390 Version 2 Release 5, the name of this communication protocol has changed from HPDT UDP to High Speed UDP. We use the new name throughout the book.

- Enhanced ESCON

The Enhanced ESCON and High Speed UDP protocols are now supported only as a service for customers who have already implemented SAP R/3. We recommend that customers implementing DB2 for OS/390 database servers use TCP/IP. For a complete discussion, refer to *SAP R/3 on DB2 for OS/390: Connectivity Guide*, SC33-7965.

1.5.2.1 TCP/IP

The TCP/IP protocol is best strategic choice for users of SAP R/3 on DB2 for OS/390. While the other protocols will continue to be supported for current releases of SAP R/3 and OS/390, the end of such support is foreseeable (see *SAP R/3 on DB2 for OS/390: Connectivity Guide*).

New connectivity hardware will be supported by this protocol; it also has advantages in connectivity recovery, administrative functions, and flexibility of use.

Note: You will also have to define a VTAM Transport Resource List Entry (TRLE) to be able to use TCP/IP support.

1.5.2.2 High Speed UDP

As previously mentioned, IBM has implemented a high-speed protocol named High Speed UDP that can use both OSA-2 and ESCON connections. This support allows Windows NT application servers, in addition to AIX servers, to be connected to the same OS/390 system through an OSA-2 feature and an FDDI LAN.

The High Speed UDP protocol provides efficient communications for applications such as SAP R/3 through its short OS/390 instruction path. The protocol uses UDP as its method for transferring data packets. Over ESCON, this support uses the HPDT MPC channel protocol, which requires special device drivers for AIX. Over an FDDI LAN, this support uses the HPDT MPC mode to communicate with the OSA-2 feature, which sends IP packets over the FDDI LAN. Thus, there are no special requirements for application servers connected to an FDDI LAN.

Note that while High Speed UDP is UDP-based, you will still have to configure the normal full-function TCP/IP stack for it to work. TCP/IP is necessary during the installation process for ftp, and during normal operation by the SAP R/3 system and OS/390 for performance monitoring and CCMS remote job submission. The logical file system support in OS/390 allows several different backend stacks to coexist. The OS/390 system transparently directs standard inbound and outbound data to the correct backend stack.

Note: You will also have to define a VTAM Transport Resource List Entry (TRLE) to be able to use High Speed UDP support.

1.5.2.3 Enhanced ESCON

Enhanced ESCON support provides high-performance communications between an OS/390 system and an AIX system that is attached through the ESCON channel interface. Typically, this connection will be between an OS/390 and an IBM RS/6000 Scalable POWERparallel System (SP2) processor. In such cases, only a subset of the SP2 nodes running SAP R/3 applications need to be connected to the System/390 through the ESCON channel. The SAP R/3 applications on remaining SP2 nodes access OS/390 by using the ESCON-connected nodes as gateways (which are accessed through the SP2 High Performance Switch).

The Enhanced ESCON support provides an OS/390 internal communications protocol that is roughly compatible with the standard AF_INET UDP protocol for ESCON-connected RS/6000s.

Enhanced ESCON support consists of the following parts:

- An OS/390 physical file system (PFS) that provides enhanced ESCON communications through a new I/O device driver for the ESCON channel interface. This new PFS is called the AF_UEINT PFS.
- A complementary network interface driver for AIX that supports both the existing Common Link Access to Workstation protocol (CLAW) and the new Enhanced ESCON communication interfaces.

1.5.3 SAP R/3 Database Integrity

Database integrity in an SAP R/3 environment with DB2 for OS/390 is provided by functions of SAP R/3 and features of DB2 for OS/390 working together. It is important for a database administrator to understand the cooperative processing involved; backup and recovery operations depend on the features of both SAP R/3 and DB2 for OS/390.

Two principles that are basic to database integrity are *locking* and the concept of a *unit of work*.

Locking prevents concurrent users from accessing inconsistent data. For example, by getting a lock for a database record before modifying it, you prevent more than one user transaction from modifying the same record at the same time.

Locking in SAP R/3 is done by the Enqueue Server that runs as a process in the central instance of the SAP Application Server. It is the application's responsibility to request an enqueue (ENQ) for a data object before accessing it.

Changes to a database made by an application are not visible to other applications until the changes are committed. The application can commit its changes explicitly, or the commit can occur implicitly when the application terminates. If the application terminates abnormally, then all changes to the database made since the last commit point are "rolled back." The processing between the start of the application and the commit point is called a *logical unit of work* (LUW). Database integrity is maintained by ensuring that all changes to a database made during a unit of work are either committed or rolled back; there can be no partial updates.

1.5.3.1 Transaction Concept in SAP R/3

Each dialog step of a business transaction in SAP R/3 can be processed on a different work process in the application server host, and would therefore use a different ICLI thread to communicate with DB2. The database changes made in a dialog step are all committed at the end of the dialog step. This is acceptable to some applications, but most business transactions consist of multiple dialog steps. In other words, the SAP R/3 LUW is expected to consist of the complete business transaction, while DB2 treats each dialog step as a discrete unit of work. The SAP R/3 system has special Update Services to manage this difference in scope; see Figure 6 on page 11.

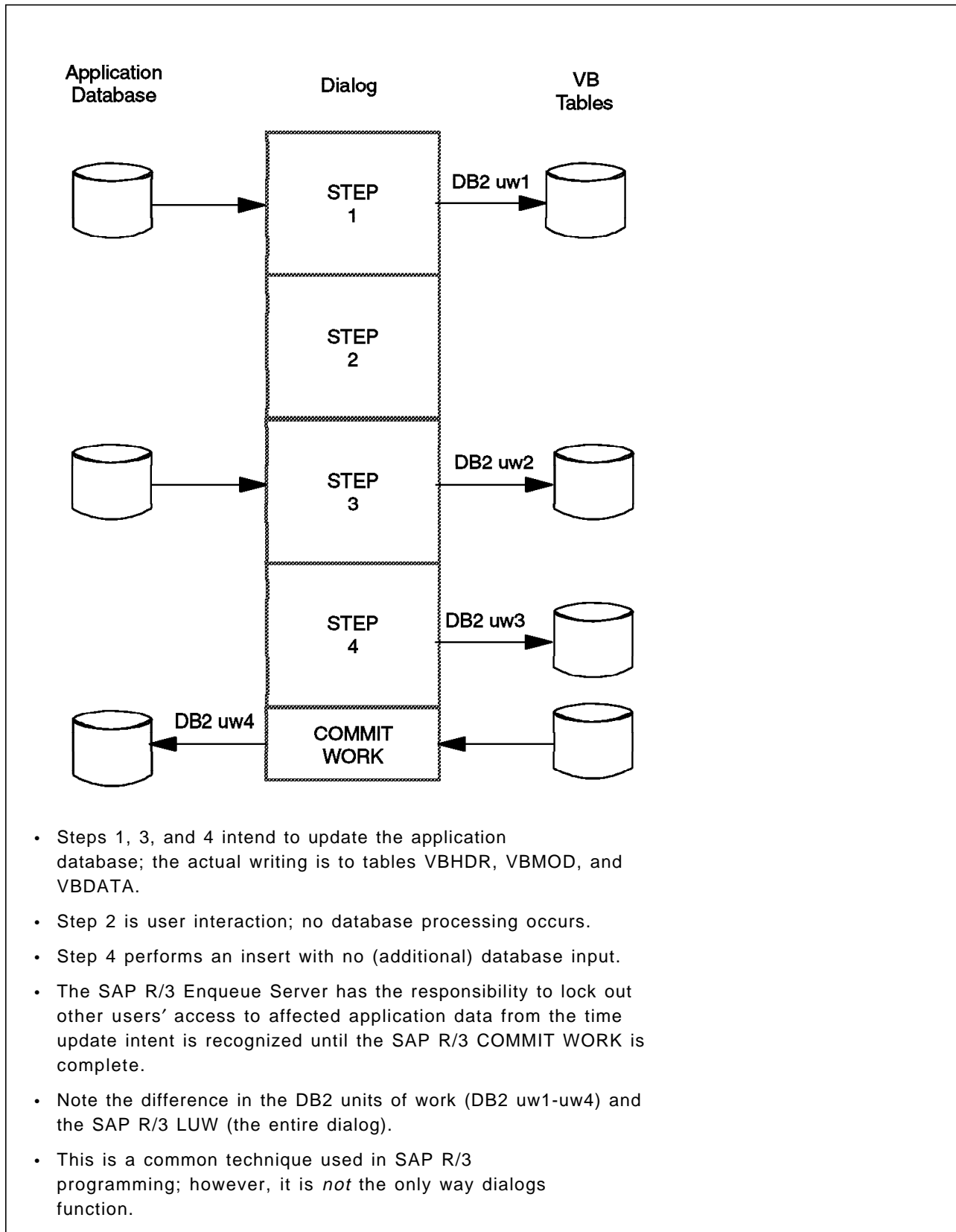


Figure 6. SAP R/3 Transaction

An SAP/R3 LUW starts when the transaction starts. As the transaction changes data, all updates are consolidated through VB Protocol entries in database

tables called VBHDR, VBMOD, and VBDATA. At the end of the dialog step, these updates to the VB tables are committed to DB2. In the last dialog step of the business transaction, an SAP COMMIT WORK is executed by the ABAP/4 program.

The execution of the transaction now moves to the update task, which processes all of the entries in the VB tables (VBHDR, VBMOD, and VBDATA) for this SAP LUW. All of the changes to all of the databases modified by this SAP LUW are made at this time, in a single DB2 unit of work. The entries in the VB tables are deleted in this same unit of work.

After a failure, DB2 will recover the database to a consistent state, rolling back those units of work that were “in flight” at the time of failure, and committing those units of work that had completed. Note that this database state, even though consistent from the DB2 point of view, may have incomplete SAP LUWs. SAP R/3 recognizes that the transactions have been aborted, and processes the data in the previously mentioned VB tables, backing out changes for business transactions that are not complete (that is, have not executed a COMMIT WORK).

1.6 Terminology Used in This Redbook

Some of the official titles of software can be quite long; the problems compound when these titles must be used in combinations. Also these titles are commonly used in shorter versions by both the writers and readers of this book. We decided to use these shorter versions here unless there is likely to be confusion over which specific product we are discussing. The shorter titles we will use are shown in Table 1.

Official Product Name	Shorter Version Used in This Book
DB2 for OS/390	DB2
SAP R/3 Database Server	DB Server
SAP R/3 Application Server	Application Server
SAP R/3 Central Instance	Central Instance

There may be a requirement for an explanation of these terms and products. See “Glossary” on page 265 for definitions and explanations. Also consult the publications noted in Appendix H, “Related Publications” on page 261 for more information.

1.7 Overview of the Remaining Chapters

This section lists overviews of the remaining chapters of the redbook:

Chapter 2, “Performing SAP R/3 Database Administration with DB2” on page 15, provides a comparison of how to administer an DB2 for OS/390 database server with other commonly used SAP R/3 servers.

Chapter 3, “Database Administration with SAP R/3 Transactions” on page 51, exhibits the screens in SAP R/3 transactions that are used to administer DB2 for OS/390.

Chapter 4, “Backup and Restore Scenarios” on page 125, provides descriptions of various backup and restore strategies, how to accomplish those strategies, and the time requirements of the strategies.

Chapter 5, “Reorganization of Tablespaces” on page 157, contains a discussion of reorganization, especially online reorganization and the associated benefits.

Chapter 6, “Planning for Growth” on page 163, describes how you can recognize that tables are growing in an installation, and how that growth can be managed.

Chapter 2. Performing SAP R/3 Database Administration with DB2

This publication is directed to those familiar either with DB2 on OS/390 or with R/3 in a AIX environment. It gives an overview of database administration with DB2 in comparison with Oracle on AIX, since Oracle is generally understood in the R/3 environment, although we know that other AIX databases sometimes have different attributes than Oracle.

R/3 on DB2 is a heterogeneous product where the database is located in OS/390 and the R/3 application server on AIX or Windows NT. For a detailed description of the configuration, see *SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 Release 4.5A* from SAP.

This chapter shows how to accomplish DBA operations using tools such as SAPDBA and the SAP R/3 transactions DBxx using DB2 for OS/390 utilities. Table 2 compares the R/3 implementations on Oracle for AIX and DB2 for OS/390.

<i>Table 2 (Page 1 of 3). Comparison of AIX and DB2 Functions</i>		
Function	Oracle for AIX	DB2 for OS/390
Starting and Stopping		
Permission for starting and stopping	As R/3 administrator or DB administrator	As DB administrator
Reasons for stopping	Reorganization requires the R/3 system to be stopped (for some databases)	
Backup and Restore		
Database backup and restore	<ul style="list-style-type: none"> • Online/offline backup of the database or tablespaces with SAPDBA • Backup/restore on file system level (for example with tar) • ADSM (from SAPDBA via Backint) possible 	<ul style="list-style-type: none"> • Online/offline backup of databases or tablespaces with DB2 online utility COPY • ** NOT RECOMMENDED ** Offline backup with various tools at the data set or volume level including: <ul style="list-style-type: none"> – DFSMS-DSS – DFSMS-HSM • ADSM cannot be used for backing up DB2 databases
Archiving logs	Automatic archiving only with additional software	Automatic archiving
Scheduling backups	R/3 transaction DB13, AIX commands (at, cron)	<ul style="list-style-type: none"> • R/3 transaction DB13 • Schedulers from IBM (OPC/ESA) and various vendors • DB2AUG
Monitoring and Analysis		
Missing indexes check	Available	Performed in ICLI for primary indexes, R/3 transaction DB02

<i>Table 2 (Page 2 of 3). Comparison of AIX and DB2 Functions</i>		
Function	Oracle for AIX	DB2 for OS/390
Reorganization checks	<ul style="list-style-type: none"> • R/3 transaction DB02 • SAPDBA 	<ul style="list-style-type: none"> • R/3 transaction DB02 • Native SQL queries • Monitoring with JCL • DB2AUG
Monitoring database buffers	R/3 transaction ST04	<ul style="list-style-type: none"> • R/3 transaction ST04 • DB2 Administration Tool • DB2PM • Various tools from vendors
Space status	DB02, SAPDBA, Logical Volume Manager (LVM), AIX commands	<ul style="list-style-type: none"> • R/3 transaction DB02 • STOSPACE • ISMF • VTOC • IEHLIST • DB2AUG
Historic space statistics	DB02	DB02, DB2AUG
Access statistics	R/3 transaction ST03	R/3 transaction ST03
Database alert monitor	R/3 transaction ST04	R/3 Alert Monitor, DB2PM
Database monitoring tools	Several products via SNMP	<ul style="list-style-type: none"> • R/3 transaction ST04, see <i>BC SAP Database Administration Guide: DB2 for OS/390</i>, "Monitoring and CCMS Topics" • DB2PM and many third-party tools
Reorganization		
Reorganization types	Offline (Oracle)	Offline and online
Exporting and importing data		
Tools for exporting and importing	SAPDBA, Oracle tools	<ul style="list-style-type: none"> • Sample program DSNTIAUL • DB2 Administration Tool • Load utility
Changing the configuration		
Tools	<ul style="list-style-type: none"> • SAPDBA • R/3 DDIC transaction SE11 • SQLDBA • AIX commands 	<ul style="list-style-type: none"> • DB2 utilities (see <i>DB2 for OS/390 V5 Utility Guide and Reference</i>, SC26-8967) • DB2 tools (see table Table 3 on page 17) • VSAM tools (see <i>DFSMS/MVS V1R4 Access Method Services for the Integrated Catalog Facility</i>, SC26-4906) • OS/390 Space Management Tools (DFSMS, ISMF) • R/3 DDIC transaction SE11

<i>Table 2 (Page 3 of 3). Comparison of AIX and DB2 Functions</i>		
Function	Oracle for AIX	DB2 for OS/390
Maintenance		
Definitions for backup and restore	<ul style="list-style-type: none"> • SAPDBA • Configuration files 	<ul style="list-style-type: none"> • R/3 transaction DB13 • Defined in JCL jobs or DB2 tools
Displaying active database parameters	R/3 transaction DB03	R/3 transaction DB03, SDSNSAMP.DSNTIJUZ <ul style="list-style-type: none"> • DB2PM tool • In member SDSNSAMP.DSNTIGUZ
Protocols of database tools	SAPDBA, R/3 transaction DB12	R/3 transaction DB12 (backups)

The DB2 utilities and some tools come with DB2. Table 3 shows the tools we used in this book.

<i>Table 3. Tools Used in DB2</i>		
Functions	Tool	Reference
DB2 standard		
Performing SQL statements	SPUFI	<i>DB2 for OS/390 V5 SQL Reference, SC26-8966</i>
Performing SQL statements	QMF	<i>QMF User's Guide and Reference (Current Release), SC26-4096</i>
Optional software products		
Database administration	DB2 Administration Tool	<i>DB2 Admin Tool User's Guide Ver. 1 Rel. 2, SC26-8428</i>
Automation of DB2 administration	DB2 Automated Utility Generator (DB2AUG)	<i>DB2AUG Reference Guide, SC23-0591</i>
Performance Monitor	DB2 Performance Monitor	<i>DB2 PM for OS/390 V5 Online Monitor User's Guide, SC26-8990</i>

Table 4 shows references for other tools.

<i>Table 4. Other Tools</i>		
Functions	Tool	Reference
Storage Management	Interactive Storage Management Facility (ISMF)	<i>ISMF User's Guide, SC26-4508</i>
Storage Management	Data Facility Storage Management Subsystem (DFSMS)	<i>DFSMS/MVS V1R3 General Information, GC26-4900</i>

2.1 Database Layout

The layout of the database for the different platforms and DBMS combinations on which R/3 run, can be very different. For example, R/3 systems on Oracle for AIX as well as DB2 for AIX utilize one database for the R/3 system. To ensure optimal performance and operation, SAP R/3 on DB2 for OS/390 has 100 tables per tablespace for *buffered* tables (buffered tables are less active and usually small), while *unbuffered* tables are in single-table tablespaces.

See *BC SAP Database Administration Guide: DB2 for OS/390* for a detailed description of the database layout.

This book also explains the relation between the data classes that are defined in R/3 for each table and the associated DB2 storage groups as shown in Table 5. (This table is the same as that shown in *BC SAP Database Administration Guide: DB2 for OS/390* except we added a row for the table we defined for point-in-time recovery; see Chapter 4, “Backup and Restore Scenarios” on page 125).

<i>Table 5. SAP R/3 Data Classes - Database Layout</i>					
	Data Class (TABART)	Storage ID	Data Stogroup	Index Stogroup	Description
Customer Data	APPL0	A0	SAPSTD	SAPSTI	Master data, transparent tables
	APPL1	A1	SAPBTD	SAPBTI	Transaction data, transparent tables
	APPL2	A2	SAPPOD	SAPPOI	Organization and customizing
	USER	U0	SAPU1D	SAPU1I	User tables
	USER1	U1	SAPU1D	SAPU1I	User tables
System Data	CLUST	CL	SAPCLD	SAPCLI	Cluster tables (not visible to the user)
	POOL	PO	SAPPOD	SAPPOI	Pooled tables (not visible to the user)
	SDIC	DI	SAPDID	SAPDII	ABAP Dictionary Tables
	SDOCU	D0	SAPDOD	SAPDOI	Documentation
	SLOAD	LO	SAPLOD	SAPLOI	Screen and report load tables
	SPROT	PR	SAPPRD	SAPPRI	Spool and logs
	SLDEF	LD	SAPELD	SAPELI	Repository switch
	SLEXC	LX	SAPELD	SAPELI	Repository switch
	SSDEF	SD	SAPESD	SAPESI	Repository switch
	SSEXC	SX	SAPESD	SAPESI	Repository switch
	SSRC	SO	SAPSOD	SAPSOI	Source for screens and reports
	TEMP	TM	SAPPRD	SAPPRI	Temporary tables
Recovery	-----	----	PITST	-----	Dummy Table (for Point-in-time Recovery)

Note: One storage group can contain volumes or parts of volumes; a volume can belong to more than one storage group.

Tables with data class APPLx (defined in transaction SE11) are used for the data of the application (for example, master data). Tables of data class USERx contain additional data and are usually created by the project team.

DB2 user SAPR3 is the owner of all R/3 objects. System tables of DB2 (the DB2 catalog and the DB2 directory) are in the databases DSNDB01 and DSNDB06, the owner is SYSIBM (as is true in any DB2 subsystem).

Note: R/3 tables are defined as ASCII tables. SYSIBM tables are defined as EBCDIC tables. Joining ASCII and EBCDIC tables through one SQL statement is not possible.

R/3 transparent tables have the same definition (columns) within the R/3 data dictionary and within DB2. Non-transparent R/3 tables are merged into a fewer

number of DB2 tables with fewer columns (mostly for SAP R/3 internal purposes).

R/3 application tables you might want to process outside of SAP R/3 usually are transparent. You can access and process data from these tables either with SQL (SPUFI) or with non-R/3 applications.

2.2 Starting and Stopping the Database Subsystem and Tablespaces

The section “Stop and Restart Operations” of *BC SAP Database Administration Guide: DB2 for OS/390* contains the order of the server and subsystems (R/3 instances, ICLI Server, DB2) that are stopped and restarted. According to that order, DB2 is started first and stopped last. The R/3 databases are normally started with the DB2 subsystem.

You can start the DB2 subsystem either from SDSF by entering:

```
/-<dbid> start db2
```

or from the console by entering:

```
-<dbid> start db2
```

You can stop the DB2 subsystem either from SDSF by entering:

```
/-<dbid> stop db2
```

or from the console by entering:

```
-<dbid> stop db2
```

In the preceding examples, <dbid> refers to your DB subsystem.

Notes:

1. The subsystem command prefix “-” might be different for your company.
2. The ICLI server must be stopped before stopping DB2.
3. DB2 places no requirement on SAP R/3 database administrators to force shutdown of the subsystem; however, it is possible to stop DB2 with the FORCE option.
4. When altering storage attributes USING, or ERASE, a tablespace or partition must be stopped.

2.3 Backup, Restore and Archiving

Note: You should back up with the DB2 online utility COPY.

Use of an offline procedure such as utility DSN1COPY *should not be considered* for the following reasons:

1. The copy is independent of DB2, so the management and awareness of data related to the copy is a manual responsibility of the DBA.
2. The copy is independent of SAP R/3, so the management and awareness of data in SAP R/3 areas is a manual responsibility of the DBA.
3. Referential integrity is the responsibility of SAP R/3. Any use of DSN1COPY to restore an object that is referentially constrained within SAP R/3 can compromise the integrity of your data.

Archiving is done *automatically* by DB2 based on system installation parameters, and archive logs are applied automatically during recovery.

The R/3 transaction DB12 shows the protocols of the backups.

2.3.1 COPY

COPY can be run in either of two modes. COPY (SHRLEVEL=CHANGE) provides a backup while application changes to the data are allowed. COPY (SHRLEVEL= REFERENCE) provides a backup while the application has read-only access to the data. This can be thought of as an online backup (SHRLEVEL=CHANGE) or an offline backup (SHRLEVEL= REFERENCE).

Note: COPY backs up a tablespace. The DB2 RECOVER utility recovers a tablespace. Through DB2 Version 5, indexes are not backed up using the COPY utility. RECOVER Index causes the index to be rebuilt. In DB2 Version 6, you will be able to COPY indexes and RECOVER the indexes from the copies.

2.3.2 DSN1COPY

DSN1COPY backs up the data independently from DB2, so the DBA must manage the DSN1COPY output. DSN1COPY should be run with the tablespace or DB2 stopped. DSN1COPY cannot be used in a forward recovery situation. DSN1COPY could be considered to support a point-in-time recovery strategy, because it can be used to backup indexes as well as the tablespaces. This could enable restoring to a point in time by means of restoring indexes from a backup instead of rebuilding them as part of the recovery process. The dangers associated with this use are rooted in the fact that much of the coordination (with SAP R/3 data or operating system fixes) is left to the manual efforts of a DBA. Consequently the use of DSN1COPY to support the SAP R/3 user's point in time recovery requirement is not recommended.

2.3.3 ADSTAR Distributed Storage Manager (ADSM)

ADSM is IBM's solution to enterprise distributed storage management. The ADSM main functions are backup and restore. ADSM consists of two parts, the server and the client that are supported on various platforms. BACKINT is an interface of SAP R/3 to some backup tools, for example ADSM. Oracle databases are usually backed up using SAPDBA to ADSM server via the BACKINT interface, on DB2/AIX the interface to ADSM is part of the product.

At this time there is no client for OS/390 available, thus you cannot use ADSM for the backup and restore of the database. However, you can backup the Open Edition part (ICLI Server) and the R/3 application servers on AIX with ADSM.

We recommend that you use ADSM to back up AIX file systems, NT file systems, and HFS file systems (executables, profiles, and so forth).

2.3.4 Recovery

The effort for recovery on DB2 is much more automated than for UNIX databases, where more manual effort is necessary. DB2 supports point-in-time recovery and recover to currency. A difference from UNIX recovery support is the DB2 QUIESCE utility which enables a special user-defined point of consistency. Executing the QUIESCE utility positions you to recover to a specific point (for example after the last online REORG).

For more information, refer to Chapter 4, “Backup and Restore Scenarios” on page 125. You may also refer to *BC SAP Database Administration Guide: DB2 for OS/390*, or to *DB2 for OS/390 V5 Administration Guide, Volumes I and II*.

2.4 Monitoring and Analyzing

Monitoring the database and its components is important to ensure a running system and to plan extensions and performance improvements. Results of monitoring can lead to changes in the configuration.

Release 4.5A of SAP R/3 has considerably improved the area of monitoring by providing analysis data using R/3 transactions. See *BC SAP Database Administration Guide: DB2 for OS/390* “Monitoring and CCMS Topics,” for detail on the usage of the transactions and recommendations on parameter settings for gathering performance information.

There are several transactions for R/3 for Oracle to monitor the database, the tablespaces, tables, and indexes. The *R/3 Alert Monitor* summarizes the database states and shows them in a graphic overview. Furthermore, monitoring tools are able to gather the states either from SAP R/3 or from the database for further processing.

Note: Due to the different structure of Oracle and DB2 for OS/390, different data is needed for monitoring.

The DB2 management of extents is different from Oracle. DB2 allocates extents at the dataset (tablespace) level, while Oracle allocates extents at the table level. DB2 utilizes VSAM to manage extents of the dataset. Therefore VSAM tools (IDCAMS - LISTCAT) are used to obtain data about tablespace information at the dataset level (see 6.1.1, “LISTCAT” on page 163 and *DFSMS/MVS V1R4 Access Method Services for the Integrated Catalog Facility*).

We assume that the DB2 administrators are familiar with the DB2 tools they use in their companies. However, we want to give some introductory comments for those administrators coming from other R/3 database platforms. Also see Chapter 3, “Database Administration with SAP R/3 Transactions” on page 51 for a description of how this information is obtained from the new SAP R/3 transactions.

2.4.1 DB2 Utilities

DB2 allows the user to update statistics in the DB2 catalog at user-defined times. You can evaluate this data either by invoking SQL statements on these tables or by using tools. Furthermore, you can write an ABAP/4 report that moves the catalog data into R/3. For an example see B.2, “Sample ABAP/4 Report for Querying the DB2 Catalog” on page 220.

RUNSTATS updates the DB2 catalog in order to signal a need for reorganization and to enable DB2 to optimize the access paths for retrieving the data. This is important for applications that join tables or process many rows sequentially. R/3 generally processes one row at a time, however the use of generic key searches and other “sequential-like” functions implies *RUNSTATS* should be regularly executed for optimization purposes on tables that frequently change. *RUNSTATS* is also used to determine the growth of tablespaces, see 6.1.2, “*RUNSTATS* Utility” on page 166.

The *STOSPACE* utility updates the *SPACE* columns in the following DB2 catalog tables:

- SYSIBM.SYSINDEXES
- SYSIBM.SYSTABLESPACE
- SYSIBM.SYSINDEXPART
- SYSIBM.SYSTABLEPART
- SYSIBM.SYSSTOGROUP

It also updates the column *SPCDATE* in *SYSIBM.SYSSTOGROUP*. For further information, see 6.1.3, “*STOSPACE* Utility” on page 171.

Note: While *RUNSTATS* for DB2 for AIX can optimize access to data on the table level, *RUNSTATS* and *STOSPACE* for DB2 for OS/390 process data on the tablespace level.

2.4.2 DB2 Tools

This section contains short descriptions of IBM DB2 tools with some examples. For a detailed description of the tools, see the guides mentioned in Table 3 on page 17.

2.4.2.1 DB2 Administration Tool for MVS/ESA (DB Admin Tool)

The DB2 Administration Tool makes it easy to retrieve DB2 related data because of its interactive interface, which makes the following possible:

- Displaying the DB2 catalog quickly and logically, it can:
 - Display any object in the catalog
 - Display related DB2 objects using special line commands
 - Interpret catalog information
 - Display the authorization for objects
 - Display the DDL for existing views
- Executing dynamic SQL statements (in many cases, without requiring that you remember SQL syntax)
- Issuing DB2 commands against databases and tablespaces (without requiring that you remember DB2 command syntax)
- Running most DB2 utilities
- Allowing complex performance and space queries
- Using EXPLAIN functions
- Managing SQL IDs
- Performing various system administration functions, such as updating RLIMITs, displaying threads

- Extending existing DB2 administrative applications, or rapidly developing new applications

You can see performance queries in Figure 7.

```

DB2 administrator ----- DB2 Performance Queries ----- 17:45
Option ==>

    1 - Table spaces without RUNSTATS information          DB2 System: DB2R
    1X - Indexes without RUNSTATS information             DB2 SQL ID: PETER
RUNSTATS information is required for options 2 through 9.
    2 - Table spaces with more than 10 percent relocated rows
    3 - Indexes with clustering level problems
    4 - Table spaces with more than 5 percent dropped space
    5 - Table spaces with locking rule = 'S' (table space locking)
    6 - Index levels
    7 - Indexes with a large leaf page distance
    8 - Indexes on tables with fewer than 6 pages
    9 - Indexes not used by any plans or packages
    10 - Table spaces containing more than one table
    11 - Table spaces without STOSPACE information
    11X - Indexes without STOSPACE information
STOSPACE information is required for options 12 through 13.
    12 - Table spaces exceeding allocated primary quantity
    12X - Indexes exceeding allocated primary quantity
    13 - Allocated and used space for table spaces

WHERE Database LIKE ==> BTAB00%

```

Figure 7. Available Performance Queries in DB2 Administration Tool

Figure 8 shows tables spaces with no RUNSTATS data (selection 12 in Figure 7).

```

DB2 administrator ---- DB2 Table Spaces Without RUNSTATS Information --- Row 1 from 30
Command ==>                                           Scroll ==> PAGE

The following table spaces do not have RUNSTATS information. Consider running
the RUNSTATS utility on them.

Valid line commands are:
S - Select

Select Name      Owner   DB Name  BP   L E S I C Ntable  N Active      Space
      *          SAPR3*  *      *   * * * * * *      *              *
-----
      BBTAB02    SAPR3   BTAB02  BP32 R N T N N        0              0          5040
      BBTAB08    SAPR3   BTAB08  BP32 R N T N N        0              0          7200
***** END OF DB2 DATA *****

```

Figure 8. R/3 Tablespace with No RUNSTATS Information

You can find more examples of the DB2 Administration Tool in Chapter 6, “Planning for Growth” on page 163.

2.4.2.2 DB2 Automated Utility Generator (DB2AUG)

DB2AUG is a product that automates the daily tasks of the database administrator by automatically creating JCL statements used.

It does the following:

- Generates DB2 utility JCL.
A.2, “DB2AUG JCL Examples” on page 209 contains examples for JCL created with DB2AUG.
- Supports dynamic DB2 object definition (by using wildcards or object groups), which means that changed and new tablespaces and indexes within DB2 are reflected automatically in DB2AUG. Since R/3 creates tablespaces, this function is quite helpful.
- Maintains space allocation for data sets
- Monitors reorganization; in conjunction with user-defined criteria and thresholds, DB2AUG evaluates REORG requests and generates the appropriate JCL. The following list contains possible criteria for reorganization.

Criteria	Definition
Percent Dropped	If the amount of wasted space of a simple tablespace is greater than the threshold value, a REORG is generated.
Physical Extents	If the number of physical extents exceeds a threshold, a REORG is generated.
Fragmentation	If the calculated fragmentation of either a tablespace or an index exceeds a threshold, a REORG is generated.
Percent Used	If the calculated percent-utilization is less than a low value threshold or greater than a high value threshold, a REORG is generated (for tablespaces and indexes).
Cluster Ratio	A REORG is generated for a tablespace with a clustering index, if the cluster ratio that is stored in the DB2 catalog falls below an installation-determined threshold.

- Provides Utility Restart assistance
- Monitors data set and volume

In response to the needs of database administrators, DB2AUG has several scheduling functions and the ability to define and assign objects that are managed together.

DB2AUG automatically generates the JCL for the following DB2 utilities:

- Check Index and Check Data
- Full and Incremental Copy

Because of the nature of SAP R/3, no “canned” JCL jobs for backup will long be sufficient. Before each backup, a *new* job should be created so that it may include new tablespaces and databases created by administrators and Basis consultants since the last backup job was generated.

- Mergecopy
- Modify Recovery and Modify Statistics
- Rebind plans and packages

- Recover
- Reorg
- Repair
- Runstats
- Stospace
- Quiesce
- Report
- DSN1COPY - not generally recommended for use with SAP R/3
- DSN1PRNT
- DSN1CHKR

Using DB2AUG, utilities that need to be generated for a specified object are logically collected into sets. These sets allow an installation to define common utility processes. For example, it is common for a site to request the generation of a FULL COPY and RUNSTATS for an object at some regular interval. The pairing of a set of DB2 objects to a set of utilities is accomplished through a schedule table.

Notes:

1. You can tailor the JCL before submitting the job.
2. DB2AUG has an interface to HSM and to an external job scheduler.

We created a job that gathers the data set extent statistics of certain tablespaces and stores them in the DB2AUG database. After that we were able to see the result in DB2AUG (Figure 9).

```

*** Ver 1.2 ***** DB2 Automated Utility Generator *****
Command ==>                                     Row 1 of 1
Extent Statistics Table: EXTENT_STATS           Panel 1 of 1

Statistics Date ==> 1997-05-21-14.27.13.571984
Database Name   ==> STAB00
Space Name      ==> SSTAB00
Partition Number ==> 0          0 <= X <= 64
Extent Number   ==> 1

Volume         ==> SAP005
Volume Number   ==> 1
Extent Start    ==> 0000000000000000
Extent Size     ==> 300
Contig Extent   ==> N          N = No  Y = Yes  Blank = na

```

Figure 9. DB2AUG Extent Statistics

You can dynamically access this information by using the SQL statement
SELECT * FROM EZK120.V120_EXTSTATS

in appropriate applications (see Figure 10 on page 26). If you are familiar with ABAP/4, you may write a small application that processes the DB2AUG statistics. DB2AUG provides three tables that can be used to collect data that is helpful in monitoring DB2 data sets and volumes (for DB2 DASD volumes, DB2 data sets, and DB2 extents).

```

DB2 Admin ----- DB2 Result of the SQL SELECT ----- Row 67 from 88
Command ==>                                           Scroll ==> PAGE

```

L	GENERATOR_STAMP	DBAS_NAME	SPAC_NAME	SPAC_PART	EXTENT_NUM	VOLUME
*	*	ST*	*	*	*	*
-	-----	-----	-----	-----	-----	-----
	1997-05-21-14.27.13.571984	STAB00	SSTAB00	0	1	SAP005
	1997-05-21-14.27.13.571984	STAB01	SSTAB01	0	1	SAP002
	1997-05-21-14.27.13.571984	STAB02	SSTAB02	0	1	SAP001
	1997-05-21-14.27.13.571984	STAB03	SSTAB03	0	1	SAP001
	1997-05-21-14.27.13.571984	STAB04	SSTAB04	0	1	SAP002
	1997-05-21-14.27.13.571984	STAB05	SSTAB05	0	1	SAP003
	1997-05-21-14.27.13.571984	STAB06	SSTAB06	0	1	SAP005
	1997-05-21-14.27.13.571984	STAB06	SSTAB06	0	2	SAP005
	1997-05-21-14.27.13.571984	STAB07	SSTAB07	0	1	SAP002

Figure 10. Number of Extents in DB2AUG Database (with DB2 Administration Tool)

As you can see, DB2AUG gathers both LISTCAT (ICF) and DB2 Catalog data for tablespaces.

2.4.2.3 DB2 Performance Monitor

DB2 Performance Monitor (DB2PM) is a separately priced feature of DB2 for OS/390. The feature code and price depends on the processor on which it runs, and obviously on whether a one-time charge or monthly charge is chosen. IBM marketing support can help to determine these in your installation. For more information about the release of DB2 that includes DB2PM, see the following Web page:

<http://www.software.ibm.com/data/db2/os390>

DB2 without DB2PM generates data about its own performance, but does not provide any reporting facilities for analyzing this data. The Online Monitor provides you with the capability to view an active DB2 subsystem and identify performance issues online.

Note: There is also a very powerful batch tool called the DB2 batch performance monitor, that is not covered in this publication. See *DB2 Performance Monitor for OS/390 V5 Batch User's Guide*, SC26-8991, for more information on this tool.

The Online Monitor displays DB2 performance information in a comprehensive form that is easy to understand and analyze.

You can use the Online Monitor to:

- Determine DB2 subsystem performance and efficiency
- Measure an application's performance and resource use
- Evaluate an application's impact on other applications and the system
- Identify potential problems
- Determine tuning requirements for DB2

When changes are made to R/3 or to the DB2 subsystem, the Online Monitor can help you analyze the impact. This is very important for determining whether the changes increased or decreased performance.

DB2PM is a tool that can produce exceptions to inform you about special states of the database (events, exceeded thresholds). Using display and periodic exception processing, you can monitor and identify the following:

- Threads that might be experiencing problems
- Subsystem-wide DB2 conditions that might be causing performance problems
- Exception events (see 2.4.5.2, “Alerts” on page 34)
- Exceeding of user-defined thresholds

DB2PM has a user exit for connecting with the DB2PM console or other programs (for example, Netview). With the product comes a sample program that passes the events and threshold alerts to the console. It can be modified in order to send the messages to a program of your choice (see “Customizing and Activating User Exits” of *DB2 PM for OS/390 V5 Online Monitor User’s Guide*). Figure 11 on page 28 shows the input mask for thresholds and exceptions:

```
Exception Threshold Category Selection
Command ==> _____

Select one or more categories, then press Enter. Overtyping with space to
deselect any category. Request EXIT when complete.

Category
s Elapsed, CPU, and Waiting Times per Plan Execution
_ Elapsed, CPU, and Waiting Times per Program Execution
_ CPU Times per Address Space
_ SQL Statements per Plan Execution
_ SQL Statements per Program Execution
_ SQL Statements per System
_ Subsystem Events per Plan Execution
_ Subsystem Events per System
_ Locking Activity per Plan Execution
_ Locking Activity per System
_ RID List Processing per Plan Execution
_ RID List Processing per System
_ Query Parallelism per Plan Execution
_ Query Parallelism per System
_ Buffer Pools Activity per Plan Execution
_ Buffer Pools Activity per System
_ Distributed Activity per Location per Plan Execution
_ Distributed Activity per System
_ Distributed Activity per Location per System
_ IFI and Data Capture Activity per Plan Execution
_ IFI Activity per System
_ EDM Pool Activity per System
_ Open/Close Activity per System
_ Plan/Package Processing per System
_ Log Activity per System
_ DB2 Commands Activity
_ DB2 Instrumentation Statistics
_ Group Buffer Pools Activity per Plan Execution
_ Group Buffer Pools Activity per System
_ Data Sharing Locking Activity per Plan Execution
_ Data Sharing Locking Activity per System
_ Stored Procedures per Plan Execution
_ Stored Procedures per System
_ Global Group Buffer Pool Statistics
```

Figure 11. Exception Threshold Category Selection (DB2PM)

Each category leads to a subsequent mask (see Figure 12 on page 29).

```

Exception Threshold Field Selection
Command ==> _____

Select one or more fields, then press Enter. Overtyping with space to
deselect any field. Request EXIT when complete.

Field category . . : Elapsed, CPU, and Waiting Times per Plan Execution

Field      Description
- ADRECETT Elapsed time in application (Class 1)
- ADCPUT   CPU time in application (Class 1)
- ADTWTAP  Total wait time in application (Class 1)
- ADDB2ETT Elapsed time in DB2 (Class 2)
- ADDBCPUT CPU time in DB2 (Class 2)
- ADTWTDB  Total wait time in DB2 (Class 2)
- ADTSUST  Total Class 3 suspensions time
- ADTSUSC  Total Class 3 suspensions
- QWACAWTL Lock/latch suspensions time (Class 3)
- ADLLSUSC Lock/latch suspensions (Class 3)
- QWACAWTI Synchronous I/O susp. time (Class 3)
- ADIOSUSC Synchronous I/O suspensions (Class 3)
- QWACAWTR Other read I/O susp. time (Class 3)
- ADARSUSC Other read I/O suspensions (Class 3)
- QWACAWTW Other write I/O susp. time (Class 3)
- ADAWSUSC Other write I/O suspensions (Class 3)
- QWACAWTE Serv.task switch susp. time (Class 3)
- ADSTSUSC Serv.task swtch suspensions (Class 3)

```

Figure 12. Exception Threshold Field Selection (DB2PM)

You can find more examples in “Using DB2 Performance Monitor on OS/390” of *Implementing SAP R/3 in an OS/390 Environment*, SG24-4945.

2.4.3 OS/390 Tools

This section describes OS/390 tools for managing disk space. You can find additional information about monitoring the database (for example with the Resource Measurement Facility, which monitors the performance of each address space) in *Implementing SAP R/3 in an OS/390 Environment*, SG24-4945; *OS/390 V2R6.0 RMF User’s Guide*, SC28-1949; and *OS/390 V2R6.0 RMF Report Analysis*, SC28-1950.

2.4.3.1 DFSMS/MVS 1.3

Storage Management Subsystem (SMS) is an OS/390 function that automatically controls system storage and decreases user concern about the physical characteristics of storage devices. It automatically assigns service requirements and attributes to new data when that data is created. This is important because of the large number of data sets that have to be monitored (over 10,000) and assigned to storage, particularly if a data set containing a tablespace or index exceeds its allocated size.

At R/3 installation time, you have a choice of using SMS-managed or DB2-managed storage.

ACS routines are used to determine the target storage group and assign data classes, storage classes, and management classes to SMS-managed data sets

and objects. Thus SMS automatically establishes the relation between storage groups and volumes as described in 2.1, “Database Layout” on page 17.

Note: With R/3 on DB2, your data can be managed either by DB2 or SMS. (There is a third option called user-managed data, where the user defines the VSAM-DB2 data sets using AMS; however, user-managed data is not supported by R/3.) If your data is managed by DB2, each DB2 storage group specifies on which volumes data for this storage group should be placed. If the data is managed by SMS, DB2 storage groups also exist but volumes are not specified in the DB2 specifications. Instead, SMS storage classes and SMS storage groups are defined to allow SMS to place the data. The SMS storage groups do not need to match the DB2 storage groups.

DFSMS is the central component of both system-managed and non-system-managed storage environments. DFSMS/MVS is comprised of the following functional components:

- DFSMS-DFP

This product provides the foundations for:

- Storage management (managing SMS, including ISMF)
- Tape management
- Program management (managing executables)
- Device management (input and output)
- Distributed data access (including the Hierarchical File System HFS OS/390 can become a full-feature UNIX server when coupled with the DFSMS Network File Server)

This product comes with OS/390, the other components are additional.

- DFSMS-DSS

This product is used for:

- Data movement and replication
- Space management (reducing DASD free-space fragmentation)
- Data backup and recovery
- Data set and volume conversion (to system-managed)

- DFSMS-HSM

This product uses a hierarchy of storage devices (similar to ADSM on UNIX platforms) in its automatic management of data, relieving professional personnel and end users from manual storage management tasks, and improving DASD utilization. It provides functions for:

- Storage management
- Space management
- Tape mount management
- Availability Management (automatically ensures valid data if data sets are damaged accidentally)

- DFSMS-RMM

This product manages removable media resources, including tape cartridges and reels. It provides functions for:

- Library management
- Shelf management
- Volume management
- Data set management

2.4.3.2 Interactive Storage Management Facility (ISMF)

This product analyzes and manages data and storage interactively. It is a tool for end users and storage administrators.

The end user functions are:

- Recover unused space from data sets or DASD volumes
- Migrate less active data sets or DASD volumes to another migration level
- Recall data sets, DASD volumes, or tapes that have been migrated
- Copy data sets or DASD volumes to another device
- Back up and Recover data sets or DASD volumes
- Delete data sets
- Edit, browse, and sort data set records
- List and display storage an management classes
- Protect data sets by controlling their security level

The Storage Administrator functions are:

- Analyze volumes to distinguish errors that are caused by drive problems and errors caused by media problems
- Change volume labels
- Generate authorization codes
- Initialize volumes
- Inspect volumes to determine if there are defective tracks
- Modify the performance, availability, and resource characteristics of the storage control units associated with specific DASD volumes

An example is given in 2.4.9, “Monitoring Volumes, Data Sets, and DASD” on page 42.

2.4.4 Installation Checks

This section describes checks performed in SAP R/3 with Oracle and compares them with DB2 checks.

2.4.4.1 Missing Unique Indexes

Indexes may enhance the performance of table and index access. SAP R/3 on DB2 defines primary indexes on DB2 tables, according to the primary key definitions in the SAP R/3 Data Dictionary (DDIC). If a primary index for a DB2 table does not exist for a SAP R/3 table with a primary key, DB2 is *not* notified during normal operations. That is why a *missing indexes* check was not originally implemented in R/3 for DB2. With SAP R/3 4.5A, the DB02 transaction can be used to perform a missing indexes check.

2.4.4.2 Consistency Check

SAP R/3 for DB2 has no consistency check to compare *all* tables defined in the R/3 Data Dictionary (DDIC) with the definitions in the DB2 catalog. Therefore we created for our purposes a sample program that does this comparison, Figure 13 shows the result. You can find the source in B.4, "Sample Program for Consistency Check" on page 222.

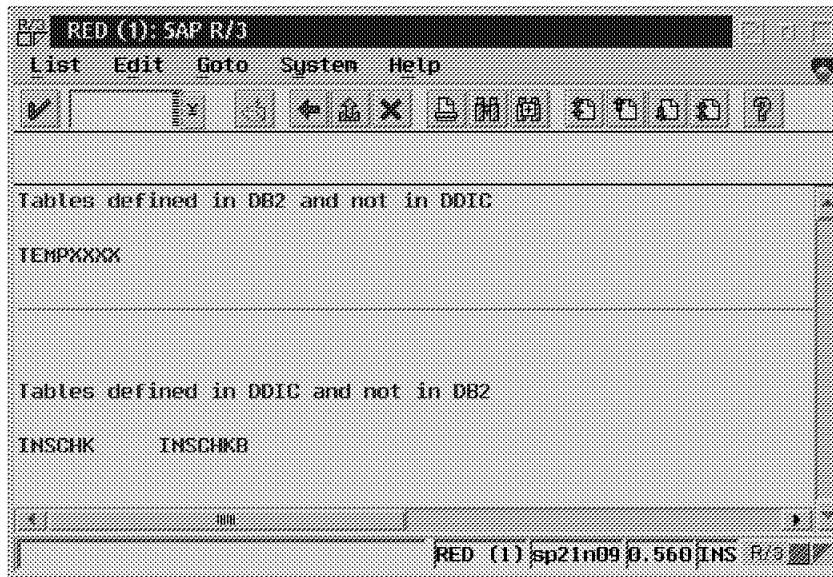


Figure 13. Sample Program for Consistency Check

You may add checks for indexes and columns (see SAP function group SAPLSDB5).

Transaction SE14 allows you to compare the DDIC and DB2 definitions (for example the columns) of a *specific* table.

2.4.5 Monitoring the Database

Monitoring allows you to supervise the R/3 database and its components in detail, as in the following examples:

- The status of the respective object (buffers have a hit ratio, tablespaces may be online or offline)
- Statistics, that is, the development of certain characteristics over a specific time period (for example, table growth)
- Activities on the object (reorganization, backup, and so on)
- Alerts, if a specific threshold of an object attribute has been exceeded (for example, hit ratio is less than 95%)

Since there were insufficient tools available for Oracle when SAP began to develop R/3, many database administration functions were implemented in the SAP R/3 CCMS and SAPDBA.

On the other hand, there are tools for managing DB2 available from IBM and vendors. That is why only a subset of the R/3 DBA transactions were integrated in R/3 for DB2. Now, most of the DBA transactions are available for SAP R/3 with DB2 for OS/390.

A graphic alert monitor is available for R/3 on Oracle. However, this is not the case for DB2. Oracle's statistics data can be shown within R/3. DB2 has a catalog in the SYSIBM tables with status information about tables, tablespaces, database and so on. The catalog statistics may be periodically refreshed by using the DB2 RUNSTATS and STOSPACE utilities. There is no historic statistic information in these tables. If you want to compare different time periods and to estimate your future growth, this information has to be collected, for example with DB2AUG (see 2.4.2.2, "DB2 Automated Utility Generator (DB2AUG)" on page 24), or by appropriate vendor products. See also Chapter 6, "Planning for Growth" on page 163.

2.4.5.1 Status

The R/3 transaction ST04 shows the status of the database and allows a DBA to monitor various database activities as shown in Figure 14.

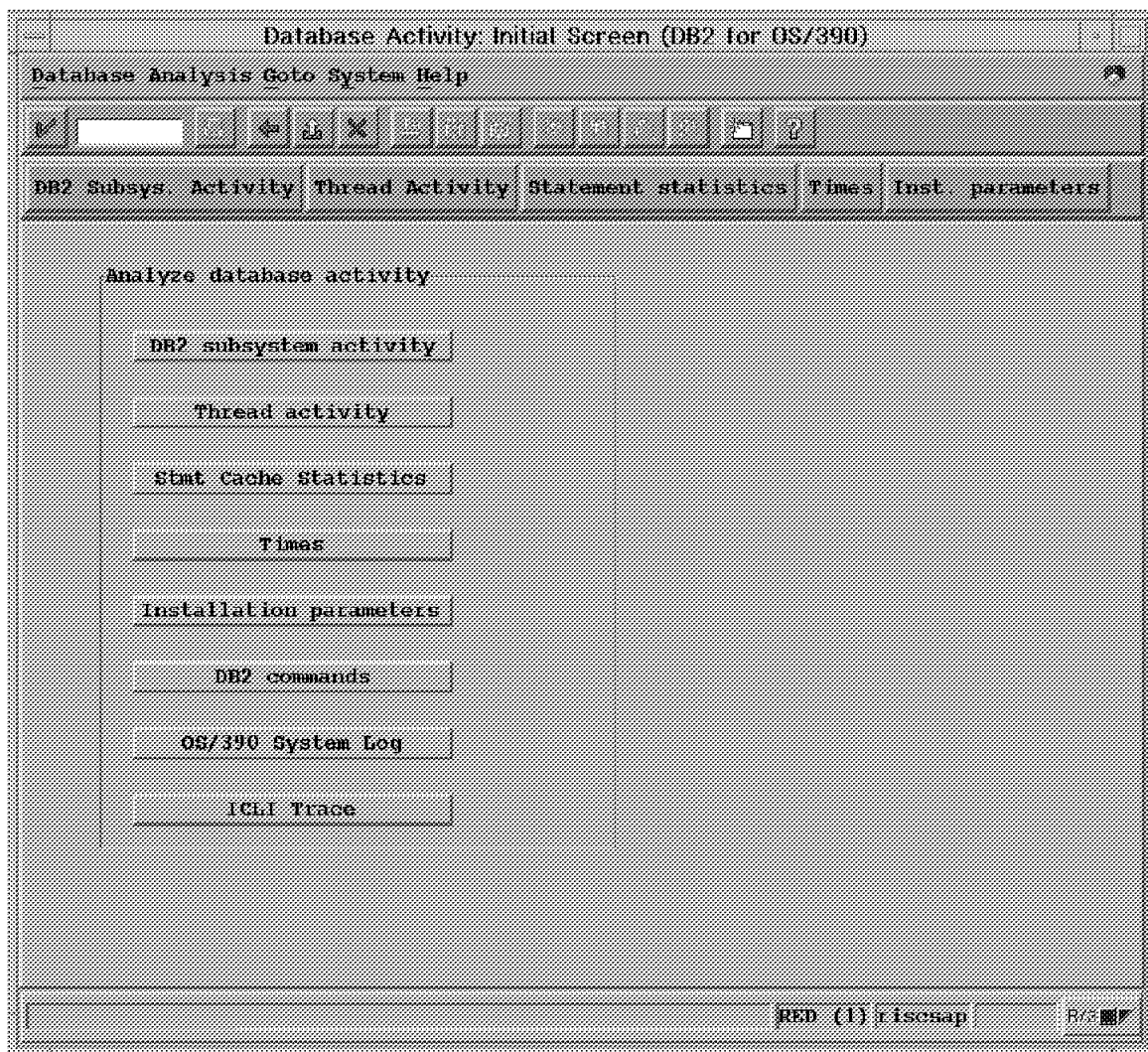


Figure 14. R/3 Transaction ST04

See Figure 39 on page 59 and the examples that follow that figure for explanations of the options available from this display.

See “Performance Monitoring” in *Implementing SAP R/3 in an OS/390 Environment*, SG24-4945, for a detailed description.

Other information is available in the *DB2 Performance Monitor*. The following display action can be accomplished with the DB2 Administration Tool:

- Database status
- Information about allocated pagesets
- Information about SQL claimers
- Display information about locks
- Information about restrict use
- Database status in ISPF table format
- Information about current use
- Database Structure
- Storage group
- Details on database
- Image copy status
- Table spaces
- Tables
- Indexes

For information about how to monitor the ICL server using the Resource Measurement Facility (RMF) on OS/390, Netview, and DB2PM, see *Implementing SAP R/3 in an OS/390 Environment*.

2.4.5.2 Alerts

The DB2 Performance Monitor is a tool that generates alerts if certain events occur. Some examples of events and threshold you can see in Figure 11 on page 28. The alerts can be passed to a console and to other monitors.

2.4.6 Monitoring Tablespaces

R/3 for DB2 (at initial installation) has more than 7200 tablespaces, which contain one or more tables. The rows of all tables are stored one behind the other, unless the tablespace is segmented. In this case the rows of one table are stored together. The tables for R/3 for DB2 are all segmented. The segment size can be adjusted at R/3 installation time, see “Database Build and Database Load” in *R/3 Installation on UNIX: DB2 for OS/390*, Material Number: 51003808, or *R/3 Installation on Windows NT: DB2 for OS/390*, Material Number: 51002660.

2.4.6.1 Status

DB2 stores the attributes of each tablespace in the table SYSIBM.SYSTABLESPACE. There is one row for each non-partitioned tablespace in the table SYSIBM.SYSTABLEPART and one row for each partition of a partitioned table space. A good description of the columns of these tables is in *DB2 for OS/390 V5 SQL Reference*. The tables are updated by the DB2 subsystem and by the DB2 utilities RUNSTATS and STOSPACE.

All R/3 tablespaces are non-partitioned when the R/3 database is built during installation (see Figure 15 on page 35, the column PARTITION is 0).

```

SELECT
PARTITION, TSNAME, DBNAME, STORNAME, PQTY, SQTY
FROM SYSIBM.SYSTABLEPART
WHERE
  TSNAME IN (SELECT NAME FROM SYSIBM.SYSTABLESPACE
             WHERE CREATOR = 'SAPR3')
ORDER BY TSNAME
WITH UR;
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
PARTITION  TSNAME    DBNAME    STORNAME    PQTY    SQTY
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
          0  ATAB      ATAB       I        DATAB    31296   3130
          0  BBTAB00  BTAB00    I        DBTAB00    400    2560
          0  BBTAB02  BTAB02    I        DBTAB02   1168   5120

```

Figure 15. SYSTABLEPART Entries for R/3 Tablespace

Note: Each tablespace or partition has one primary space allocation (PQTY) and one secondary space allocation (SQTY) (in units of 4 KB storage blocks). PQTY is the size for the first extent of the tablespace. SQTY is the extent size for the subsequent extents.

If you have the DB2 Administration Tool, you can select the R/3 table spaces with the option Owner = SAPR3. Figure 16 shows the name, the owner, the name of the database, the buffer pool used for the tablespace, the lock rule, the erase rule, the status, whether or not the tablespace was created implicitly, the close rule, the numbers of tables, the number of active pages, and the number of kilobytes of DASD storage allocated by the tablespace.

```

DB2 administrator ----- DB2R Table Spaces ----- Row 21 from 143
Command ==>                                           Scroll ==> PAGE

Valid line commands are:
T - Tables  D - Database  A - Auth  G - Storage group  ICS - Image copy status
DIS - Display database  STA - Start database  STO - Stop database
? - Show all line commands

Select Name      Owner   DB Name  BP  L E S I C Ntable  N Active  Space
   *          *          *      *  * * * * * * *      *          *
-----+-----+-----+-----+-----+-----+-----+-----+-----+
SPOOL07  SAPR3   POOL07  BP2  R N A N N    100      3240   14400
SPOOL28  SAPR3   POOL28  BP2  R N A N N    100      3240   14400
SPOOL29  SAPR3   POOL29  BP2  R N A N N    100      3240   14400
SPOOL32  SAPR3   POOL32  BP2  R N A N N    100      3240   14400

```

Figure 16. R/3 Tablespace (with DB2 Administration Tool)

Figure 17 on page 36 shows the details of tablespace SPOOL07.

```
DB2 Admin ----- DB2R Interpretation of an Object in SYSTABLESPACE ----- 18:48
Option ==>
```

```
Details for table space : POOL07.SPOOL07
TS owner       : SAPR3   TS name       : SPOOL07   Database name : POOL07
Created by    : ICLIRUN
Descriptor ID : 1       TS ID (PSID) : 2         Database ID   : 323
Partitions   : Not part. Page size KB : 4         Tables in TS  : 100
Segment size : 32      Lock max      : 0
```

```
Table space status      : Available
TS allocation status    : Table space was explicitly created
Buffer pool name       : BP2
Lock size for TS       : ROW - Row is locked
Close rule for data set : N - Data sets remain open after use
Erase rule for data set : N - Data sets are not erased by DROP
```

```
Statistical data : RUNSTATS timestamp: 1997-05-14-18.06.27.444998
Number of pages used  : 3240
Allocated space (KB)  : 14400
```

Figure 17. Tablespace Details (with DB2 Administration Tool)

The following display action can be accomplished with the DB2 Administration Tool:

- Authorizations on tablespace
- Show database
- Tablespace status
- Information about allocated pagesets
- Information about SQL claimers
- Information about locks
- Information about restrict use
- Information about current use
- Storage group
- Details on tablespace
- Image copy status
- Tablespace parts
- Tables in tablespace

Note: It is recommended that to enhance performance, you attempt to keep the tablespace data set within a single extent.

2.4.6.2 Statistics

You can monitor the tablespace statistics either with a tool (for example DB2AUG) or by writing your own application (see B.2, “Sample ABAP/4 Report for Querying the DB2 Catalog” on page 220 for a sample ABAP/4 report querying the DB2 catalog).

2.4.7 Monitoring Tables

The usage of tables depends on the SAP R/3 modules and/or applications developed with the ABAP/4 Development Workbench, the customization of the business processes and the number of users. Therefore, the table utilization is unpredictable. One should monitor attentively the growth and access patterns of tables. Should they grow appreciably or have very high levels of access, common sense dictates that such tables should be isolated. SAP R/3 transaction SE11 can be used to perform this isolation. Using SE11, SAP R/3 will move tables to their own tablespace when given the right technical settings.

2.4.7.1 Status

The DB2 RUNSTATS utility maintains some columns of the DB2 catalog table SYSTABLES. The accuracy of those values depends on how recently RUNSTATS was run. Figure 18 shows SPUFI output with table data including the table's name, the names of the corresponding tablespace and database, the total number of pages on which the table appears, the percentage of active tablespace pages that contain rows of the table, and the status (ASSOB_HR is a view).

```
SELECT
  NAME, TSNAME, DBNAME, NPAGES, PCTPAGES, STATUS
FROM SYSIBM.SYSTABLES
WHERE CREATOR = 'SAPR3'
ORDER BY NAME
WITH UR;
```

NAME	TSNAME	DBNAME	NPAGES	PCTPAGES	STATUS
AABLG	SCLU00	CLU00	100	0	X
AANK	SPOOL36	POOL36	100	0	X
ASSOB_HR	SBTAB00	BTAB00	-1	-1	
ATAB	ATAB	ATAB	23544	99	X
AT70	SPOOL00	POOL00	100	3	X

Figure 18. SYSTABLES

Figure 19 on page 38 shows the attributes of table MARA:

```
DB2 Admin ----- DB2R Interpretation of an Object in SYSTABLES ----- 12:17
Option ==>
```

```
Details for table (label) : SAPR3.MARA
Table owner       : SAPR3           Table name       : MARA
Created by       : ICLIRUN         Created        : 1997-04-30-10.15.25.364681
Table space name : SSTAB06         Database name    : STAB06
Object ID for table: 216           DB ID for database : 289
Maximum row length : 679           Primary key OBID  : 217
Number of columns : 104            Primary key columns :
Validat procedure : N/A           EDIT procedure name : N/A
Parent relations  : 0              Child relations   : 0
Auditing         : AUDIT NONE      Status           : Primary key avail
Check pending flag : No            Altered        : 1997-04-30-10.15.30.058751
Data capture     : No              Check constraints : None
Restrict on DROP : No
Statistical data : RUNSTATS timestamp: 1997-05-14-18.10.41.706767
Row count       : 4104             Occupied pages  : 684             Pct of TS pages : 97
% compress     : 0
Associated remarks :
```

Figure 19. Table Status (with DB2 Administration Tool)

The following display actions can be accomplished on tables with the DB2 Administration Tool, although not all of them are needed in an R/3 environment (for example, referential integrity functions of DB2 are not used).

- All columns (of SYSTABLES)
- Authorizations on the table
- Alias
- Data
- Database of the table
- Details on table/view (see Figure 19)
- Columns
- Column distribution statistics
- Foreign keys
- Packages on table
- Partition statistics
- Plans on table
- Primary key
- Referential integrity (show child tables, parent tables, parent relations)
- Referential integrity, show child relations
- Table check constraints
- Tablespace of the table
- Tables on view
- Views on the table

Note: Change the parameter of rows to be displayed to 0 (no limit). Otherwise the maximum number of rows is 1000 (default value).

You can find more examples in 6.1, “How to Find Growing Tablespaces, Index Spaces or Tables” on page 163. An explanation of the SYSIBM tables is in *DB2 for OS/390 V5 Application Programming and SQL Guide*.

2.4.7.2 Statistics

In order to monitor the table growth, we had to develop a solution that provided the information shown in Figure 20.

```

-- * DISPLAY TABLES GROWN LESS THAN AVERAGE (ABSOLUTE) *
-----+-----+-----+-----+-----+-----+-----+
TABLE                                     KB TABLESPACE
-----+-----+-----+-----+-----+-----+-----+
ACCTIT                                  6024.0000000000 SBTAB00
EKPO                                    3408.0000000000 SBTAB04
BSIS                                    3088.0000000000 SBTAB01

-- * DISPLAY TABLES GROWN LESS THAN AVERAGE (ABSOLUTE) *
-----+-----+-----+-----+-----+-----+-----+
TABLE                                     KB TABLESPACE
-----+-----+-----+-----+-----+-----+-----+
D010L                                  896.0000000000 BEL30F00
EKET                                    364.0000000000 SBTAB04
S031                                   -372.0000000000 SBTAB09
PROJ                                   -396.0000000000 SBTAB10

-- * DISPLAY TABLES WITH GROWING RATIO MORE THAN AVERAGE (IN %) *
-----+-----+-----+-----+-----+-----+-----+
TABLE                                     RATIO TABLESPACE
-----+-----+-----+-----+-----+-----+-----+
EBAN                                   9100.0000000000 SBTAB03
EKPO                                    852.0000000000 SBTAB04
EKBE                                    369.0000000000 SBTAB04

-- * DISPLAY TABLES WITH GROWING RATIO LESS THAN AVERAGE (IN %) *
-----+-----+-----+-----+-----+-----+-----+
TABLE                                     RATIO TABLESPACE
-----+-----+-----+-----+-----+-----+-----+
BSAD                                   147.0000000000 SBTAB01
S031                                   -93.0000000000 SBTAB09
PROJ                                   -99.0000000000 SBTAB10

```

Figure 20. Table Growth (Partial List, Created with SPUFI)

In this figure, KB is the difference between the table size in kBytes (stored in a statistics table after executing RUNSTATS) and the current size (NPAGES * PGSIZE). RATIO is this difference divided by the value in the statistics table (in percent), that is, a value of 900 means that the table is 10 times larger than at the time when the statistics were stored.

The SQL statements producing the lists shown in Figure 20 are in B.1, “Monitoring Table Growth” on page 215. There are also statements for querying tablespace sizes.

2.4.8 Monitoring Indexes

R/3 has more than 19,000 indexes which are separately stored in their own VSAM data sets (one or more). There are *no* tablespaces for indexes as there are for Oracle; instead, DB2 stores an index in an index space.

The status of the indexes is stored in the DB2 catalog tables SYSINDEXES (non-partitioned indexes) and SYSINDEXPART (partitioned indexes).

2.4.8.1 Status

The DB2 Administration Tool (Figure 21) shows you the status of R/3 indexes, selected by owner SAPR3.

```

DB2 Admin ----- DB2R Indexes ----- Row 965 from 1000
Command ==>>>                               Scroll ==>> PAGE

Valid line commands are:
T - Tables  D - Database  G - Storage group  P - Plans  C - Columns
DIS - Display database  STA - Start database  STO - Stop database
? - Show all line commands

Select Index Name          Index      Table      Table      C  C  C
      *                   Owner      Name      Owner      U  Co1s G  D  L  T
-----
i   CCPP_____0         SAPR3     CCPP       SAPR3     P   13  N  N  N  2
    CCPPE_____0         SAPR3     CCPPE      SAPR3     P   15  N  N  N  2
    GB922B____0          SAPR3     GB922B     SAPR3     P    7  N  N  N  2
  
```

Figure 21. Overview of R/3 Indexes (with DB2 Administration Tool)

The *i* in the first column says that the status about index CCPP_____0 is desired.

```
DB2 Admin ----- DB2R Interpretation of an Object in SYSINDEXES ----- 12:22
Option ==>
```

```
Details for index : CCPP_____0      On table : CCPP

Auth ID of index owner   : SAPR3      Auth ID of table owner   : SAPR3
Created by               : ICLIRUN     Name of DB holding index : BTAB01
Object ID of index (OBID): 319        Database ID (DBID)      : 270
Index space name         : CCPPRRRR    Buffer pool used         : BP2
Index space ID (ISOBID)  : 320        Index type               : Type 2 index
Index subpage size(bytes): 4096

Number of columns in key : 13          Clustering ratio        : 0
Is it a clustering index : NO          Is it actually clustered : NO
Index type               : Primary index
Close rule for data set  : N - The data set remains open after use
Erase rule for data set  : N - Data set is NOT erased when dropped

Statistical data : RUNSTATS timestamp: 1997-04-30-15.27.16.082577
Allocated space (KB)    : 48
First key column count  : 0
Number of distinct keys : 0
Number of leaf pages    : 0
Number of index levels  : 0
```

Figure 22. Detailed Status of Index CCPP_____0 (with DB2 Administration Tool)

The following display actions are available in the DB2 Admin Tool:

- Columns on index
- Database
- Index space status
- Information about allocated pagesets
- Information about SQL claimers
- Information about locks
- Information about restrict use
- Information about current use
- Storage group
- Details on index
- Packages using the index
- Plans using the index
- Index parts
- Tables on view
- Index parts

2.4.8.2 Statistics

DB2AUG accumulates LISTCAT and DB2 catalog data for index data sets (as described for tablespaces in Figure 26 on page 45 and Figure 27 on page 45). You can find more examples for monitoring indexes in Chapter 6, "Planning for Growth" on page 163.

2.4.9 Monitoring Volumes, Data Sets, and DASD

There are several utilities and tools for managing volumes, data sets and DASD. You can use DFSMS utilities for managing storage in batch or ISMF for interactive management (refer to Table 4 on page 17).

2.4.9.1 Status

The following JCL invokes the IEHLIST (List System Data) program and LISTVTOC and delivers the contents of a volume.

```
//VTOCLIST JOB PETERA
//STEP1   EXEC PGM=IEHLIST
//SYSPRINT DD SYSOUT=A
//DD2     DD UNIT=DISK,VOLUME=SER=111111,DISP=OLD
//SYSIN   DD *
          LISTVTOC FORMAT,VOL=DISK=111111
/*
```

IEHLIST is described in *DFSMS/MVS V1R3 Utilities*. It provides the utilization of the disk volume defined in the JCL (in this example, disk 111111).

If you want to use generic names, then ISMF and DFSMS can be used. Figure 23 shows the utilization of our SAP volumes (the first 8 columns of 40).

Panel List Utilities Scroll Help							

Command ==>				VOLUME LIST			
				Scroll ==> HALF			
Enter Line Operators below:				Entries 1-5 of 5			
				Data Columns 3-8 of 40			
LINE	VOLUME	FREE	%	ALLOC	FRAG	LARGEST	FREE
OPERATOR	SERIAL	SPACE	FREE	SPACE	INDEX	EXTENT	EXTENTS
---(1)---	-(2)--	--(3)--	(4)-	--(5)--	-(6)-	--(7)--	--(8)--
	SAP001	26451	<<<	2745049	305	10348	12
	SAP002	635755	23	2135745	122	390948	13
	SAP003	309992	11	2461508	204	176798	76
	SAP004	362838	13	2408662	80	248292	2
	SAP005	227265	8	2544235	147	117036	6

BOTTOM OF DATA							

Figure 23. Volume Contents (with ISMF)

Figure 24 on page 43 shows the space utilization of the application table MARA (including data sets for the DB2 tables and indexes), which is stored in the data sets DSN510.DSNDBC.STAB06.MARA*.* (column 1 to 6).

```

Panel List Dataset Utilities Scroll Help
-----
                        DATA SET LIST
Command ==>                               Scroll ==> HALF
                                           Entries 1-8 of 8
Enter Line Operators below:                Data Columns 3-6 of 39

LINE      ALLOC  ALLOC  % NOT  COMPRESSED
OPERATOR  DATA SET NAME  SPACE  USED  USED  FORMAT
---(1)--- --- (2) --- --- (3) --- --- (4) --- --- (5) --- --- (6) ---
DSN510.DSNDBC.STAB06.
MARARRRR.I0001.A001
DSN510.DSNDBC.STAB06.
MARA1@G$.I0001.A001
DSN510.DSNDBC.STAB06.
MARA1UZG.I0001.A001
DSN510.DSNDBC.STAB06.
MARA13QD.I0001.A001
DSN510.DSNDBD.STAB06.
MARARRRR.I0001.A001
DSN510.DSNDBD.STAB06.
MARA1@G$.I0001.A001
DSN510.DSNDBD.STAB06.
MARA1UZG.I0001.A001
DSN510.DSNDBD.STAB06.
MARA13QD.I0001.A001
-----
                BOTTOM OF DATA
-----

```

Figure 24. Data Set Contents (with ISMF)

ISMF shows the allocated space for the data sets. The first four entries belong to the clustering information and the last four to the data.

Note: You should not use the “% NOT USED” columns since only DB2 knows how much is really used. If you define search criteria for the columns; for example all data sets with more than three extents (displayed in column 8), ISMF shows the data sets as seen in Figure 25 on page 44.

DATA SET LIST						
Command ==>			Scroll ==> HALF			
			Entries 1-9 of 13			
Enter Line Operators below:			Data Columns 5-8 of 39			
FILTERED LIST						
LINE OPERATOR	DATA SET NAME	% NOT USED	COMPRESSED FORMAT	% USER DATA REDUCTION	NUM EXT	
---(1)---	------(2)-----	-(5)-	---(6)---	-----(7)----	(8)	
	DSN510.DSNDBD.BTAB07. MSEGRRRR.I0001.A001	0	---		--	7
	DSN510.DSNDBD.BTAB10. SNAPRRRR.I0001.A001	15	---		--	4
	DSN510.DSNDBD.DSNDB04. TBDIFF.I0001.A001	0	---		--	7
	DSN510.DSNDBD.DSNDB04.TB1. I0001.A001	0	---		--	9
	DSN510.DSNDBD.DSNDB06. DSNDXX03.I0001.A001	0	---		--	5
	DSN510.DSNDBD.DSNDB06. PMSY1A5P.I0001.A001	0	---		--	17
	DSN510.DSNDBD.DSNDB06. PMSY1UR4.I0001.A001	0	---		--	5
	DSN510.DSNDBD.DSNDB07. DSN4K01.I0001.A001	1	---		--	17
	DSN510.DSNDBD.DSNDB07. DSN4K02.I0001.A001	<<<	---		--	44

Figure 25. Data Sets with More Than One Extent (with ISMF)

2.4.9.2 Statistics

Figure 26 on page 45 and Figure 27 on page 45 show the DB2AUG detail states of tablespace SSTAB00; they contain DB2 catalog and LISTCAT information.

```

*** Ver 1.2 ***** DB2 Automated Utility Generator *****
Command ==>                                     Row 1 of 1
Data Set Statistics Table: DATASET_STATS         Panel 1 of 2

Statistics Date ==> 1997-05-21-14.27.13.571984
Database Name   ==> STAB00
Space Name      ==> SSTAB00
Partition Number ==> 0           0 <= X <= 64

Space Type      ==> T           I=Index Space T=Table Space
Application Name ==> STAB
Page Size       ==> 4096

DB2 Catalog Information
Row Count       ==> 182
Cluster Request ==> N           N=No Y=Yes Blank if no Index on Tspc
Clustered Index ==> Y           E=Empty M=Multi-Table N=No Y=Yes Blank-No Indx
Cluster Ratio   ==> 0           0 <= X <= 100
Frag Level      ==> 0
Table Count     ==> 100        PCT Drop       ==> 0
PCT Active      ==> 0          PCT Free        ==> 100
DDL Free Pct    ==> 5          DDL Free Page   ==> 0

```

Figure 26. DB2AUG Data Set Statistics for Tablespaces (Panel 1 of 2)

DB2AUG accumulates data for volumes that contain DB2 data. This can be used for historical reporting.

```

*** Ver 1.2 ***** DB2 Automated Utility Generator *****
Command ==>                                     Row 1 of 1
Data Set Statistics Table: DATASET_STATS         Panel 2 of 2

Statistics Date ==> 1997-05-21-14.27.13.571984
Database Name   ==> STAB00
Space Name      ==> SSTAB00
Partition Number ==> 0           0 <= X <= 64

Listcat Information
High-Alloc-RBA ==> 14.40        MEG
High-Used-RBA  ==> 12.05        MEG
Primary Alloc  ==> 0.00         MEG           ==> 20          Units
Secondary Alloc ==> 0.00         MEG           ==> 183          Units

Allocation Units ==> C           C = Cylinders B = Blocks T = Tracks
PCT Used         ==> 83          0 <= X <= 100
Extent Count     ==> 1           0 <= X <= 119
Volume Count     ==> 1

```

Figure 27. DB2AUG Data Set Statistics for Tablespaces (Panel 2 of 2)

Figure 28 on page 46 shows the state of a specific DASD.

```

*** Ver 1.2 ***** DB2 Automated Utility Generator *****
Command ==>                                     Row 1 of 1
DASD Statistics Table: DASD_STATS                Panel 1 of 1

Statistics Date  ==> 1997-05-21-14.27.13.571984
Volume Serial   ==> SAP001

Device Type     ==> 3390
Device Address  ==>
Mount Type     ==> PRIVATE

Physical        Bytes      Tracks      Cylinders   4K Blocks
Characteristics Track      Cylinder   Volume      per Track
=> 58786       => 15      => 3340     => 12

Total Free Cyls ==> 305
Total Free Trks ==> 197
Largest Free Cyls ==> 102
Largest Free Trks ==> 0
PCT Free        ==> 10          0 <= X <= 100
Extent Count    ==> 32
Frag Index      ==> 234

```

Figure 28. DASD State

You may compare different time periods since DB2AUG accumulates this information in its database.

For more information see *DFSMS/MVS V1R3 Utilities*, SC26-4926; *ISMF User's Guide*, SC26-4508; and *DFSMS/MVS V1R2 DFSMSHsm Storage Administration Guide*, SH21-1076.

2.4.10 Monitoring Database Buffers

You can see the status of the DB2 buffers in transaction ST04. For information about DB2 buffers, see "Performance Monitoring and Tuning" in *DB2 for OS/390 V5 Administration Guide, Volumes I and II*, and also refer to *DB2 PM for OS/390 V5 Online Monitor User's Guide*.

2.5 Reorganization

DB2 allows reorganization of tablespaces and indexes. Since standard R/3 now uses clustering indexes, there are performance benefits to performing reorganization in addition to the re-establishment of disk free space. Forcing the tables to allocations with the new values can be done through a reorganization. A new SECQTY value will be used (even without a reorganization) if an index or a tablespace requires a new extent after the new SECQTY value is defined. See Chapter 5, "Reorganization of Tablespaces" on page 157 for more information.

Reorganization may not be necessary when a tablespace reaches the limit of 119 VSAM extents, but if availability is important, online reorganization may be the preferred technique for reclaiming free space.

2.6 Exporting and Importing

Export and import functions are used to move parts of an R/3 database (for example, tables, indexes and definitions) to another R/3 database.

In SAPDBA, export and import functions are available because that is a prerequisite for the reorganization of Oracle tables, indexes, and tablespaces. DB2 has a LOAD utility and a sample program DSNTIAUL that you may adapt according to your load and unload purposes. A description of this program is in *DB2 for OS/390 V5 Installation Guide*.

A APAR (PQ19897) now exists that provides for REORG UNLOAD EXTERNAL; this function is easier to use than DSNTIAUL.

You can also use the DB2 Administration tool to LOAD and UNLOAD. Mark the table (Figure 29) to be unloaded with option **UT** (utilities) and choose **U** for unload on the following screen.

```

DB2 Admin ----- DB2R Tables, Views, and Aliases ---- Row 1427 from 10491
Command ==>                                         Scroll ==> PAGE

Valid line commands are:
C - Columns  A - Auth  L - List  X - Indexes  S - Table space  D - Database
V - Views    T - Tables P - Plans  Y - Synonyms  SEL - Select prototyping
? - Show all line commands

Sel  Name          Owner   T DB Name  TS Name   Cols      Rows Checks
-----
MAR*
-----
MARAP          SAPR3   V STAB06  SSTAB06   5         -1      0
MARAV          SAPR3   V STAB06  SSTAB06  100        -1      0
MARA1         SAPR3   V STAB06  SSTAB06   8         -1      0
MARC_DISP     SAPR3   V STAB06  SSTAB06   6         -1      0
MARCE         SAPR3   V STAB06  SSTAB06   3         -1      0
MARCP         SAPR3   V STAB06  SSTAB06   4         -1      0
MARDE         SAPR3   V STAB06  SSTAB06   4         -1      0
MARC01        SAPR3   T BTAB06  SBTAB06  16          0      0
ut MAR01         SAPR3   T BTAB06  SBTAB06  23          0      0
MARA          SAPR3   T STAB06  SSTAB06  104        4104   0
MARC          SAPR3   T STAB06  SSTAB06  161        4104   0
MARD          SAPR3   T STAB06  SSTAB06   44        2758   0
MARM          SAPR3   T STAB06  SSTAB06   16          1      0
MARV          SAPR3   T POOL02  SPOOL02  10          3      0
***** END OF DB2 DATA *****

```

Figure 29. Invoking the UNLOAD Table Function in DB2 Administration Tool

JCL is created that you can adapt and submit. In the same way, you can load a table previously unloaded with DB2 Administration Tool.

Note that export and import must not be used into production systems. For transportation of objects, it is recommended that only the R/3 Correction and Transport System (CTS) be used. Due to the complexity of R/3 and dependencies between tables, this requires appropriate DDIC and CTS coordination.

2.7 Changing the Database Layout

Sometimes it is necessary to change the DB configuration in order to enhance performance or enlarge capacity. *DB2 for OS/390 V5 Administration Guide, Volumes I and II*, and *BC SAP Database Administration Guide: DB2 for OS/390*, as well as the product guides (for example of DFSMS and ISMF) contain information about when and how to change certain components. Chapter 6, "Planning for Growth" on page 163 contains suggestions and examples concerning this topic.

The DB2 Administration Tool is suitable for interactively changing the DB2 configuration (see Figure 30).

```

DB2 Admin ----- DB2R Alter Table Space ----- 13:36
Command ==> SHOW

ALTER TABLESPACE

Database      ==> BTAB01
Table space   ==> SBTAB01

Primary qty   ==>          Buffer pool ==> BP2
Secondary qty ==>          Close rule  ==> NO
Partition     ==>          Erase rule  ==> NO
Free page     ==>          Lock size   ==> ROW
Percent free  ==>          Compress    ==>
Storage group ==>          Lock max    ==> 0
VSAM catalog  ==>

Enter SHOW on command line to see the remaining current values.

```

Figure 30. Alter Tablespace with DB2 Administration Tool

You can see the space available by entering SHOW, which leads you to the tablespace parts and then to the storage group (see Figure 31).

```

DB2 Admin ----- DB2R Storage Groups ----- Row 1 to 1 of 1
Command ==>                                     Scroll ==> PAGE

Valid line commands are:
D - Databases  S - Table spaces  X - Indexes  VOL - Volumes  I - Interpret
GR - Grant    DROP - Drop        CRE - Create  AL - Alter    UT - Utility  A - Auth

                                SP
Select Name      Owner      VCAT      *      Space Date
      *          *          *          *          *
-----
      DBTAB01   SAPR3     DSN510     103680  97134

```

Figure 31. Free Space for a Tablespace

Notes:

1. For some parameter changes to take effect, the tablespace has to be stopped or reorganized.
2. There is no requirement to stop or reorganize a tablespace in order to add a volume to a storage group, but you must reorganize the tablespace after removing a volume.
3. It could cause problems (with earlier releases of SAP R/3) to move objects into tablespaces if those objects did not use SAP R/3 naming conventions; this is *not* true with release 4.5 of SAP R/3.
4. DDIC functions in R/3 (SE11) can also be used to *isolate* tables.

Chapter 3. Database Administration with SAP R/3 Transactions

Release 4.5A of SAP R/3 contains extensive database administration transactions; these transactions allow a DBA to use DB2 for OS/390 functions and OS/390 functions from within SAP R/3. Future expansion of these SAP R/3 facilities could be an exciting area. It is possible that at some time in the future *all* operating system and RDMS functionality could be driven from SAP R/3, thus allowing the possibility of SAP R/3 database administrators who need no knowledge or consideration of the underlying support software.

Much of the information in this chapter is also explained in *BC SAP Database Administration Guide: DB2 for OS/390*, SAP Material Number 51003810. You should refer to the chapters titled "Monitoring and CCMS Topics", "Database Management", and "Database Layout", where you will find further explanations of the administrative transactions.

You should recognize that there are several ways of reaching the screens illustrated in this chapter:

- You may enter one of the transaction codes (see "Transaction Codes" in *BC SAP Database Administration Guide: DB2 for OS/390*) that produces the screen.
- You may follow a menu-button path from the menu functions at the top of an SAPGUI.
- You may use the **Menu** button to create a tree-display of SAP R/3 functions and open the leaves of the tree to administrative tools and reach the screens.
- You may place some of the functions in your **Favorites** selections and reach them without a long path search.

Our illustrations use the first or second of these methods, but an administrator may choose a different procedure.

The path you use to arrive at a given output screen may be different than ours. The functionality you find with one of the screens and the choices you have when you reach it should be similar (there is maintenance expected in this area) to our illustrations.

Attention

The screen captures in this chapter, while extensive, are *not* meant to illustrate all possible SAP R/3 administrative outputs you may receive. Our objectives in this chapter are:

- To show more possible uses of the functions than you find in other documents
- To show some of the screens you receive during usage
- To stimulate the expanded usage of these functions

3.1 Outputs We Reached from Menus

In this section are screen captures of items we reached from the SAP R/3 main menu, primarily by way of the **Tools** selections on the menu bar of SAPGUI.

Before we performed any of the activities, we selected **System** and then **Status** to see the screen shown in Figure 32.

The screenshot displays the 'System Status' window in SAP GUI. It is organized into several sections:

- Usage data:** Client (000), User (SAPRES5), Language (EN), Previous logon (18.11.1998 14:20:46), Logon (14:31:20), System time (15:11:13), Time zone (CET), and a system time of 21:11:13.
- SAP data:**
 - Repository data:** Transaction (ST04), Program (screen) (RSDB3001), Screen number (100), Program (subscreen) (RSDB3001), Screen number (110), Program (GUI) (RSDB3001), GUI status (SUSY).
 - SAP System data:** SAP Release (45A), Installation number (INITIAL), License expiry date (12.12.1998).
- Host data:** Operating system (AIX), Machine type (000195584C), Server name (riscsap_RED_0), Platform ID (320), Codepage (1100).
- Database data:** System (DB2), Release (5.1.0), Name (RED), Host (redsap), Owner (SAPR3).

At the bottom, there are navigation buttons: a checkmark, 'Navigate', a right arrow, and an 'X'.

Figure 32. SAP R/3 System Status

We did this just to be certain the system was available, but the screen also shows some basic system information, such as the SAP R/3 release and the DB2 for OS/390 release.

3.1.1 Administrator Scheduling

The activity we show is what a DBA might do in scheduling jobs. The path you follow is to select these items (beginning with SAPGUI at login):

Tools
CCMS
DB Administration
DBA Scheduling

The resulting screen is shown in Figure 33.

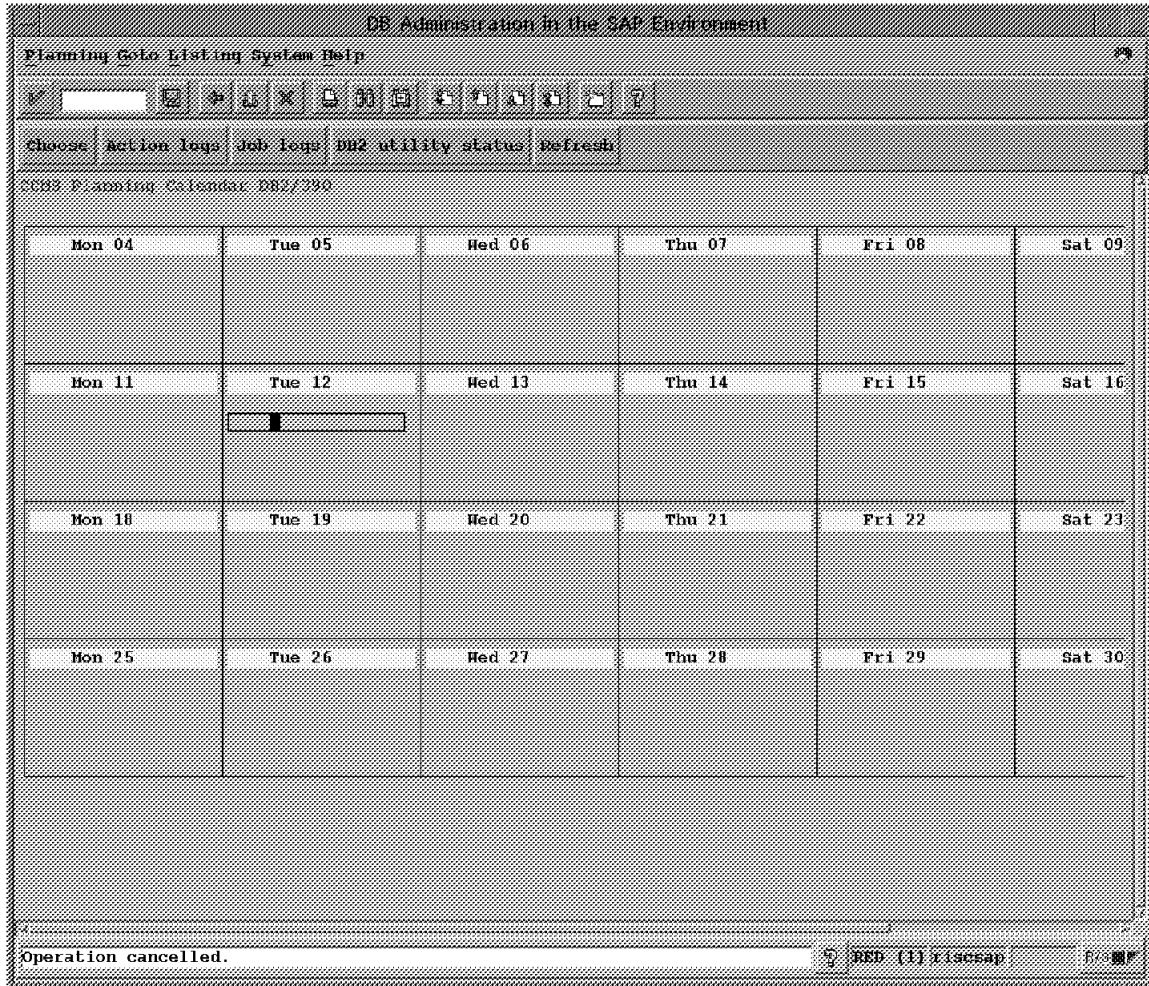


Figure 33. DBA Planning Calendar

Double-clicking on the header for a day (in the future) brings up the choices shown in Figure 34 on page 54, which allows the submission of one of the jobs shown along with the time it should be scheduled.

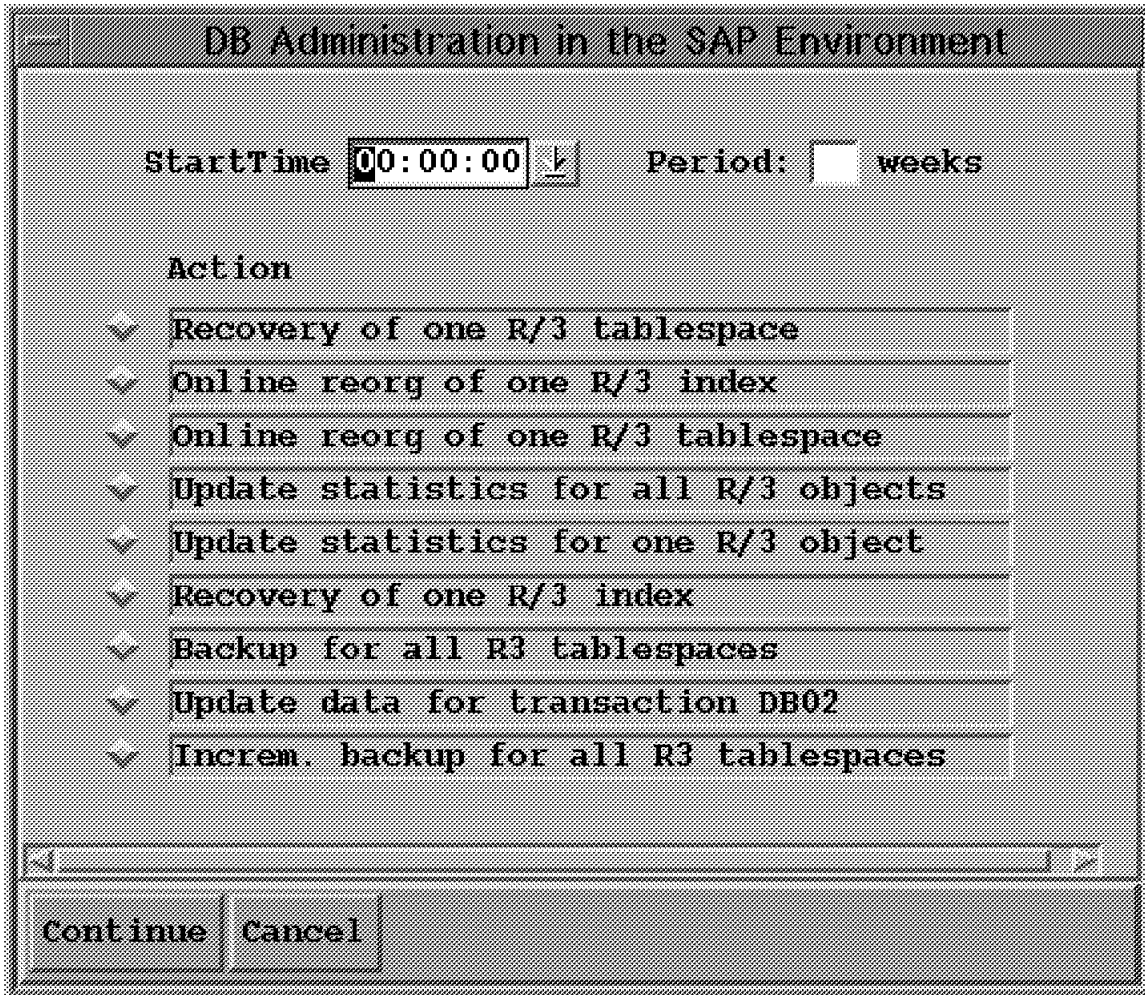


Figure 34. Job Submission Choices

If the day chosen is today, an additional choice "Start Immediately" is given. Choosing a day in the past is not allowed; however a job from a past day could be chosen, resulting in a display of the JCL that was submitted. Possible choices for additional information then include job status and the JES job output from the job.

A DBA might be interested in what backups are available. The backup status can be shown by following the menu path:

Tools
CCMS
DB Administration
Backup Logs

The resulting output is shown in Figure 35.

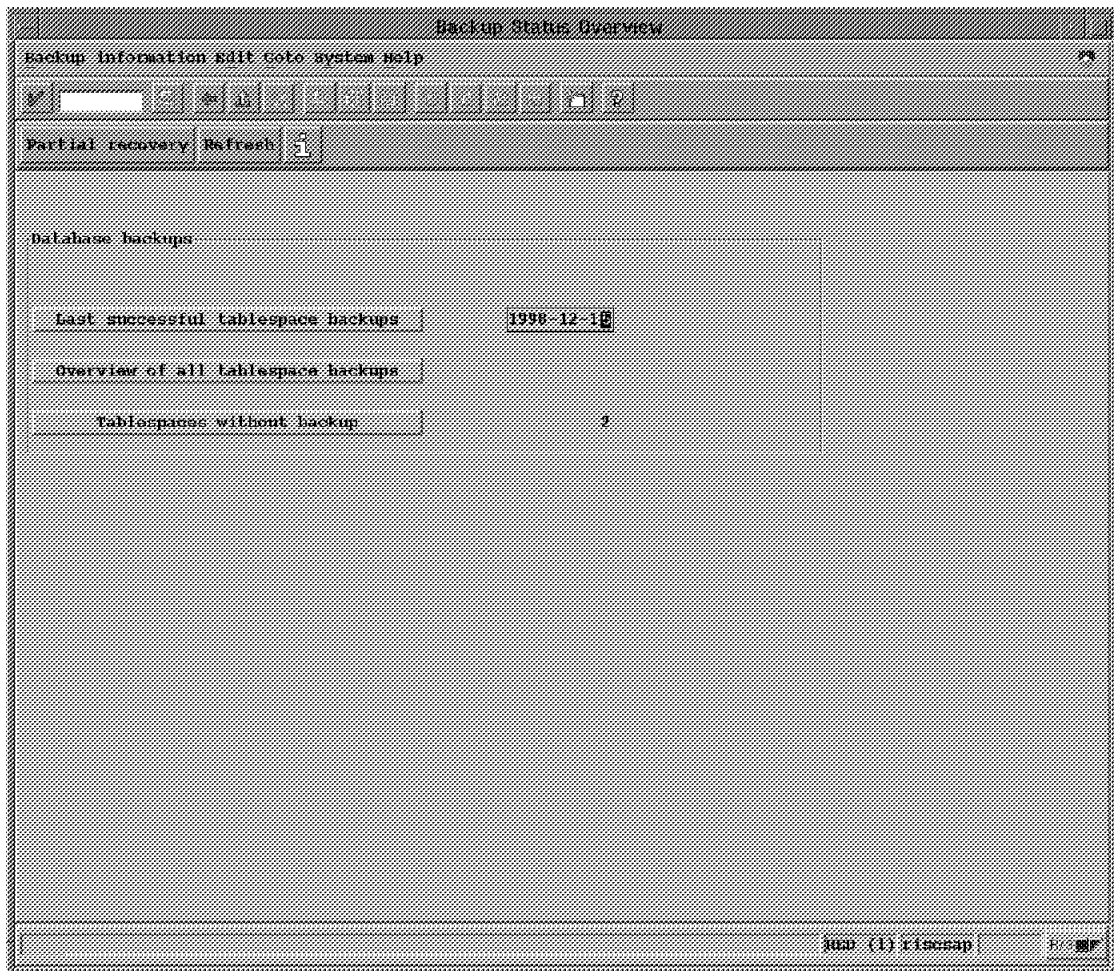


Figure 35. Backup Status Choices

The choice of **Tablespaces without backup** shows the screen in Figure 36 on page 56; in our case there are two such tablespaces, one is the dummy tablespace created for point-in-time recovery.

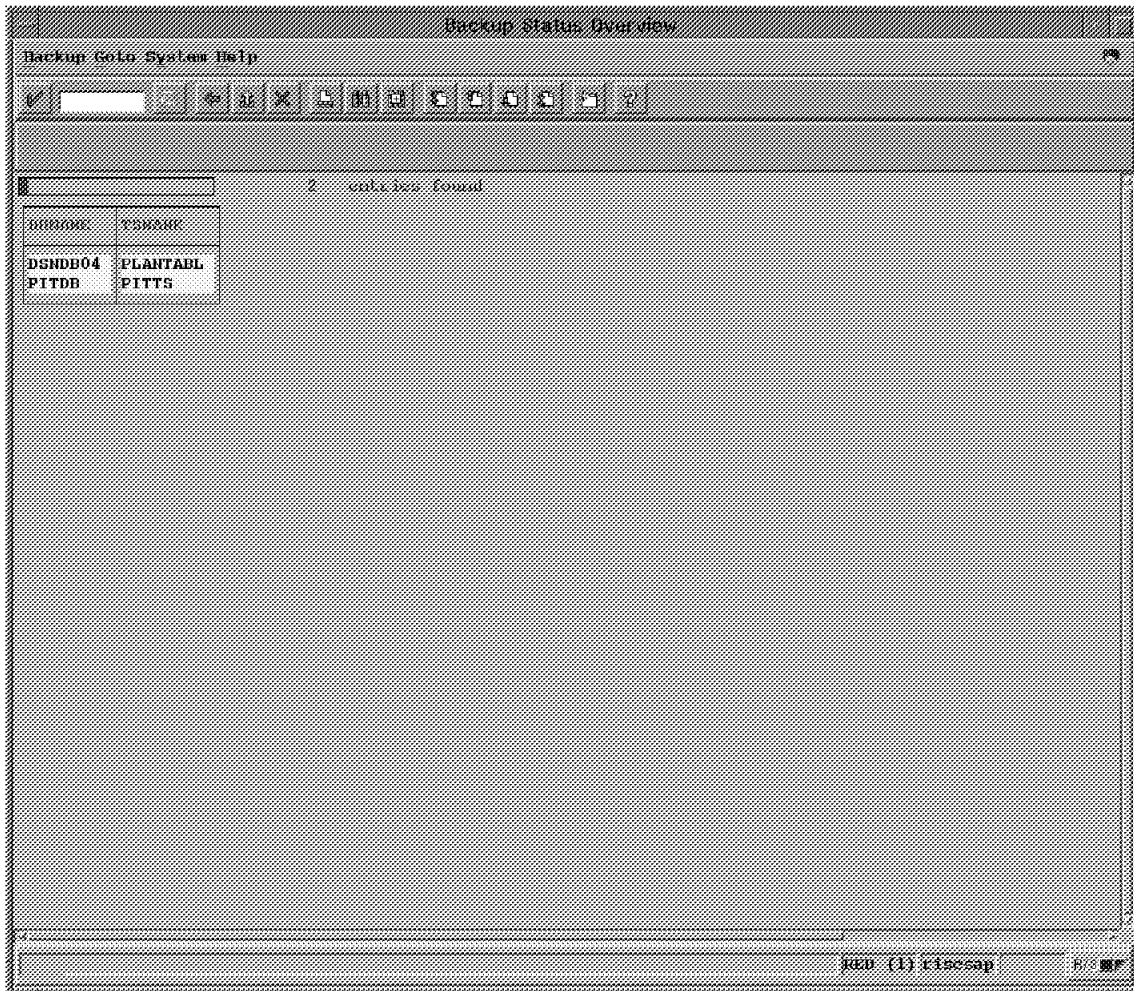


Figure 36. Tablespaces without Backup

This display should be valuable to a DBA; it might lead to the scheduling of backup creation. This scheduling could be done through the procedure illustrated in Figure 33 on page 53.

The choice of **Last successful tablespace backup** from the screen shown in Figure 35 on page 55 shows the screen in Figure 37, a listing by tablespace of the last successful backup.

The screenshot shows a window titled "Last Successful Tablespace Backups" with a menu bar (History, Edit, Goto, System, Help) and a toolbar. Below the toolbar, it indicates "7,153 entries found". The main area contains a table with the following columns: DBNAME, TABNAME, ICTYPE, TIME/TAPP, DSDM/D, and DSRM/D. The table lists various tablespaces such as A000+AAK, A000+AD6, A000+AFE, etc., with their respective backup types (FULL COPY) and timestamps.

DBNAME	TABNAME	ICTYPE	TIME/TAPP	DSDM/D	DSRM/D
A000+AAK	VIEA02	FULL COPY	1998-12-16-09.41.18	0	DB2V5100.A000+AAK.VIEA02.RUN1
A000+AD6	BTXAUTH	FULL COPY	1998-12-15-15.46.55	0	DB2V5100.A000+AD6.BTXAUTH.RUN1
A000+AFE	ERUSEL	FULL COPY	1998-12-18-20.50.54	0	DB2V5100.A000+AFE.ERUSEL.RUN1
A000+AGB	ADR10	FULL COPY	1998-12-18-18.24.20	0	DB2V5100.A000+AGB.ADR10.RUN1
A000+AGX	TLSEYE	FULL COPY	1998-12-18-17.42.47	0	DB2V5100.A000+AGX.TLSEYE.RUN1
A000+AHT	MCRSV+US	FULL COPY	1998-12-16-09.41.19	0	DB2V5100.A000+AHT.MCRSV+US.RUN1
A000+ALA	VINEGB	FULL COPY	1998-12-17-11.45.12	0	DB2V5100.A000+ALA.VINEGB.RUN1
A000+AKS	T260H	FULL COPY	1998-12-17-15.55.03	0	DB2V5100.A000+AKS.T260H.RUN1
A000+ALN	ADR12S	FULL COPY	1998-12-18-20.50.56	0	DB2V5100.A000+ALN.ADR12S.RUN1
A000+ALU	TCME	FULL COPY	1998-12-18-18.24.22	0	DB2V5100.A000+ALU.TCME.RUN1
A000+ALX	VZSORT	FULL COPY	1998-12-18-17.42.49	0	DB2V5100.A000+ALX.VZSORT.RUN1
A000+AM5	VSPRPS+C	FULL COPY	1998-12-16-09.41.21	0	DB2V5100.A000+AM5.VSPRPS+C.RUN1
A000+AM2	TCUSGENI	FULL COPY	1998-12-17-11.45.14	0	DB2V5100.A000+AM2.TCUSGENI.RUN1
A000+AM5	TSTATPP	FULL COPY	1998-12-17-15.55.05	0	DB2V5100.A000+AM5.TSTATPP.RUN1
A000+AOG	MYT4	FULL COPY	1998-12-18-18.24.25	0	DB2V5100.A000+AOG.MYT4.RUN1
A000+AOM	TTREETYP	FULL COPY	1998-12-18-17.42.52	0	DB2V5100.A000+AOM.TTREETYP.RUN1
A000+API	SCPLANE	FULL COPY	1998-12-16-09.41.24	0	DB2V5100.A000+API.SCPLANE.RUN1
A000+AQT	CKML2	FULL COPY	1998-12-17-11.45.17	0	DB2V5100.A000+AQT.CKML2.RUN1
A000+AS7	VIH123	FULL COPY	1998-12-17-15.55.09	0	DB2V5100.A000+AS7.VIH123.RUN1
A000+AT9	TTXM	FULL COPY	1998-12-18-20.51.01	0	DB2V5100.A000+AT9.TTXM.RUN1
A000+AUJ	CUOB	FULL COPY	1998-12-18-18.24.27	0	DB2V5100.A000+AUJ.CUOB.RUN1
A000+AVI	TZ31	FULL COPY	1998-12-18-17.42.53	0	DB2V5100.A000+AVI.TZ31.RUN1
A000+ANS	TTREE+EX	FULL COPY	1998-12-16-09.41.23	0	DB2V5100.A000+ANS.TTREE+EX.RUN1
A000+AXT	TTXFPT	FULL COPY	1998-12-17-11.45.15	0	DB2V5100.A000+AXT.TTXFPT.RUN1
A000+A2D	COTPLPT	FULL COPY	1998-12-17-15.55.06	0	DB2V5100.A000+A2D.COTPLPT.RUN1
A000+A49	SCARR	FULL COPY	1998-12-18-20.51.09	0	DB2V5100.A000+A49.SCARR.RUN1
A000+A5V	MSSSPVER	FULL COPY	1998-12-18-17.43.05	0	DB2V5100.A000+A5V.MSSSPVER.RUN1
A000+A51	TTDIRT	FULL COPY	1998-12-18-18.24.35	0	DB2V5100.A000+A51.TTDIRT.RUN1
A000+A7Y	T7BR0F	FULL COPY	1998-12-16-09.41.34	0	DB2V5100.A000+A7Y.T7BR0F.RUN1
A000+A8B	STERM+DW	FULL COPY	1998-12-17-11.45.28	0	DB2V5100.A000+A8B.STERM+DW.RUN1
A000+ABY	TRMFDIR	FULL COPY	1998-12-17-11.45.10	0	DB2V5100.A000+ABY.TRMFDIR.RUN1
A000+A9S	IMPU	FULL COPY	1998-12-17-15.55.01	0	DB2V5100.A000+A9S.IMPU.RUN1
A000+BDA	SCEPRTDE	FULL COPY	1998-12-16-09.39.24	0	DB2V5100.A000+BDA.SCEPRTDE.RUN1

Figure 37. Tablespace - Last Successful Backup

This information is valuable for scheduling backups on tables whose existing backup has become stale. The information is also a check on whether a table backup was regarded as successful by SAP R/3.

To see a screen showing much DB2 performance information, follow the menu path:

Tools
Administration
Monitor
Performance
Workload
Analysis

The screen shown is illustrated in Figure 38. (Most DBAs would use SAP R/3 transaction ST04 rather than the menus to reach this display).

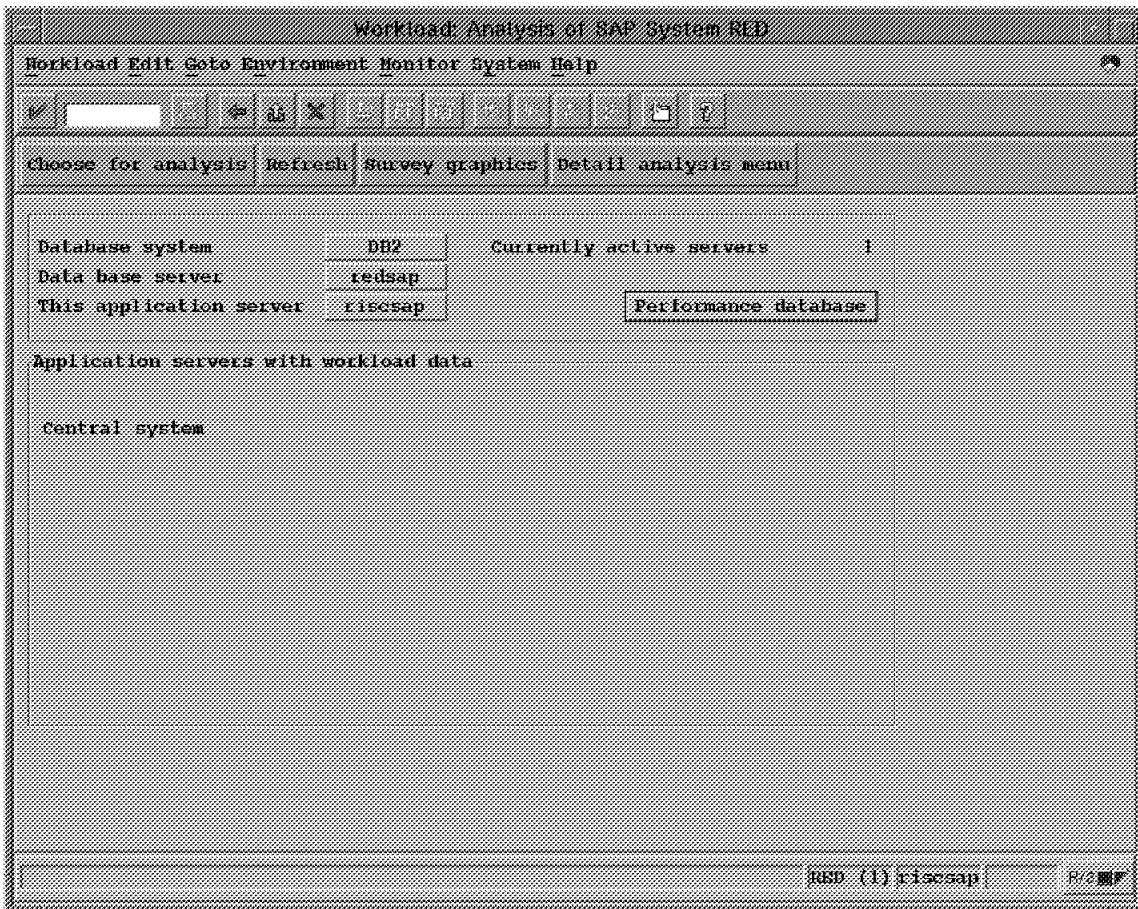


Figure 38. Workload Analysis

Choosing **DB2** produces the screen shown in Figure 39 on page 59, which allows the choice of a variety of data regarding DB2 performance.

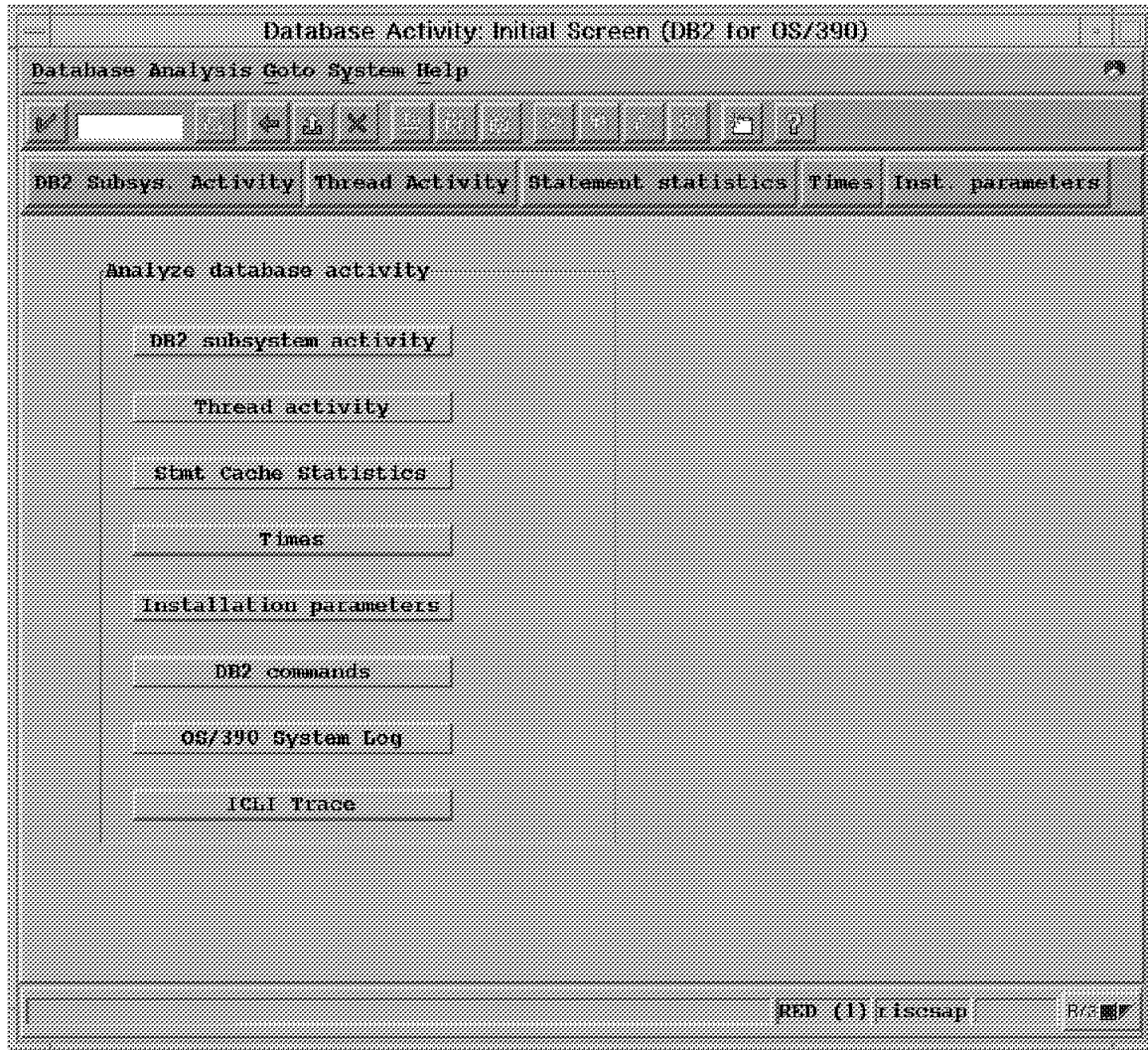


Figure 39. Database Activity Initial Screen

The choice of **DB2 subsystem activity** produces a screen shown in Figure 40 on page 60 and Figure 41 on page 61. (We broke this into two parts for convenience). This could be the starting point for DB2 analysis.

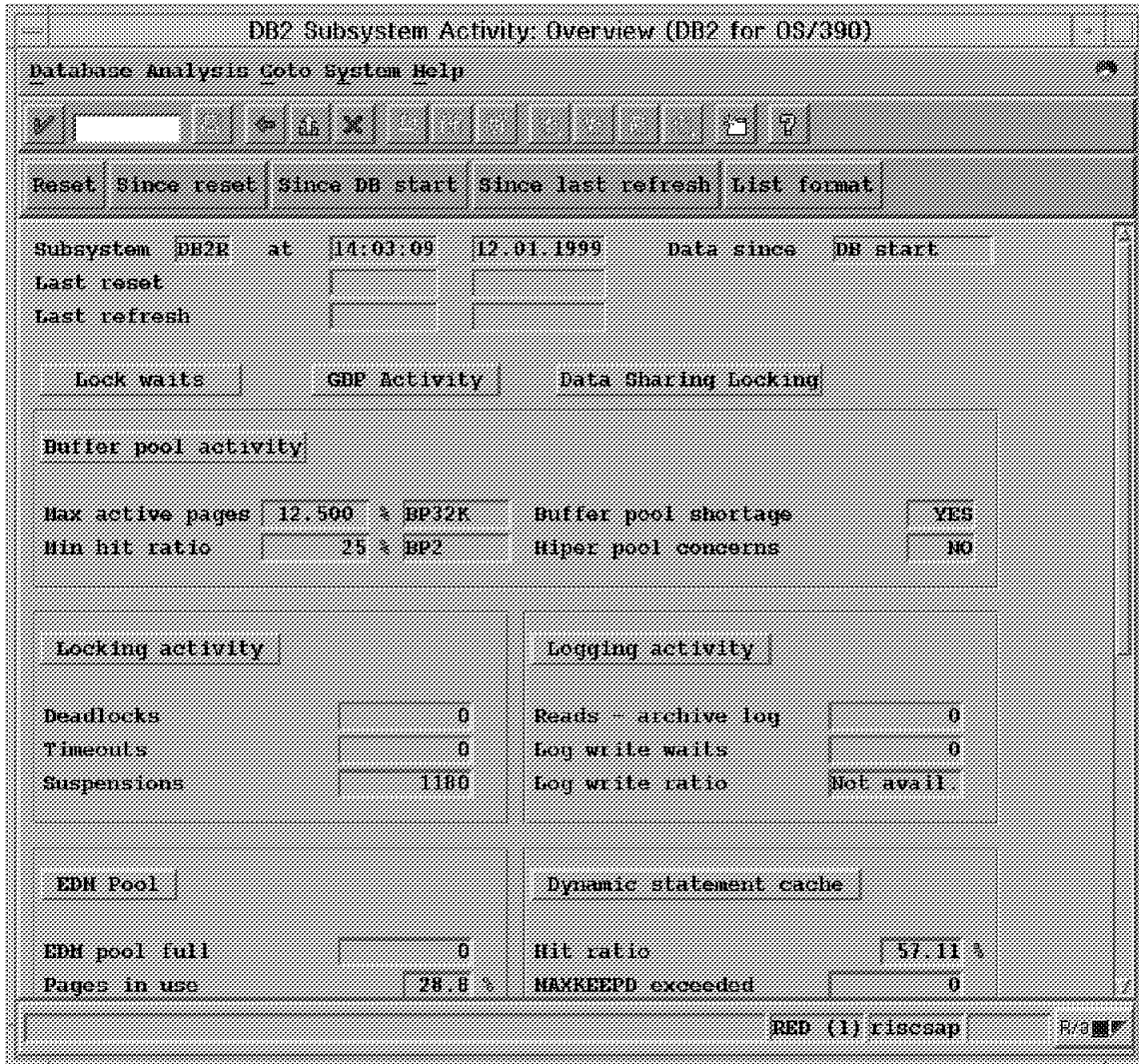


Figure 40. DB2 Subsystem Activity Overview (Part 1 of 2)

The screen shown in Figure 40 and Figure 41 on page 61 might indicate a performance problem at a very high level. Making one of the detail choices causes more specific data in the chosen area to be displayed.

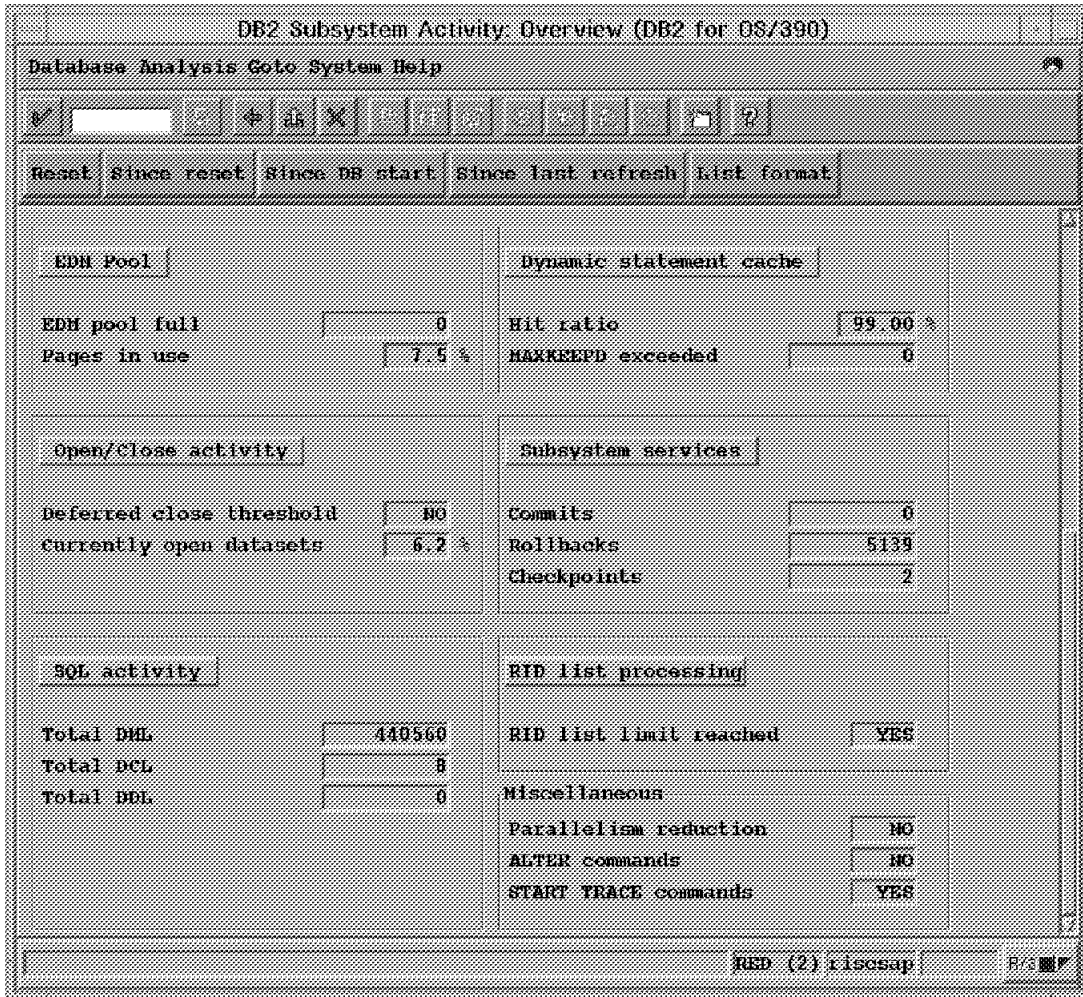


Figure 41. DB2 Subsystem Activity Overview (Part 2 of 2)

Choosing **Lock Waits** from the screen shown in Figure 40 on page 60 produces this message:

No locking conflicts in the DB2 subsystem

This is due to the very light workload on our system.

Choosing **GBP Activity** from the screen shown in Figure 40 on page 60 produces the screen shown in Figure 42.

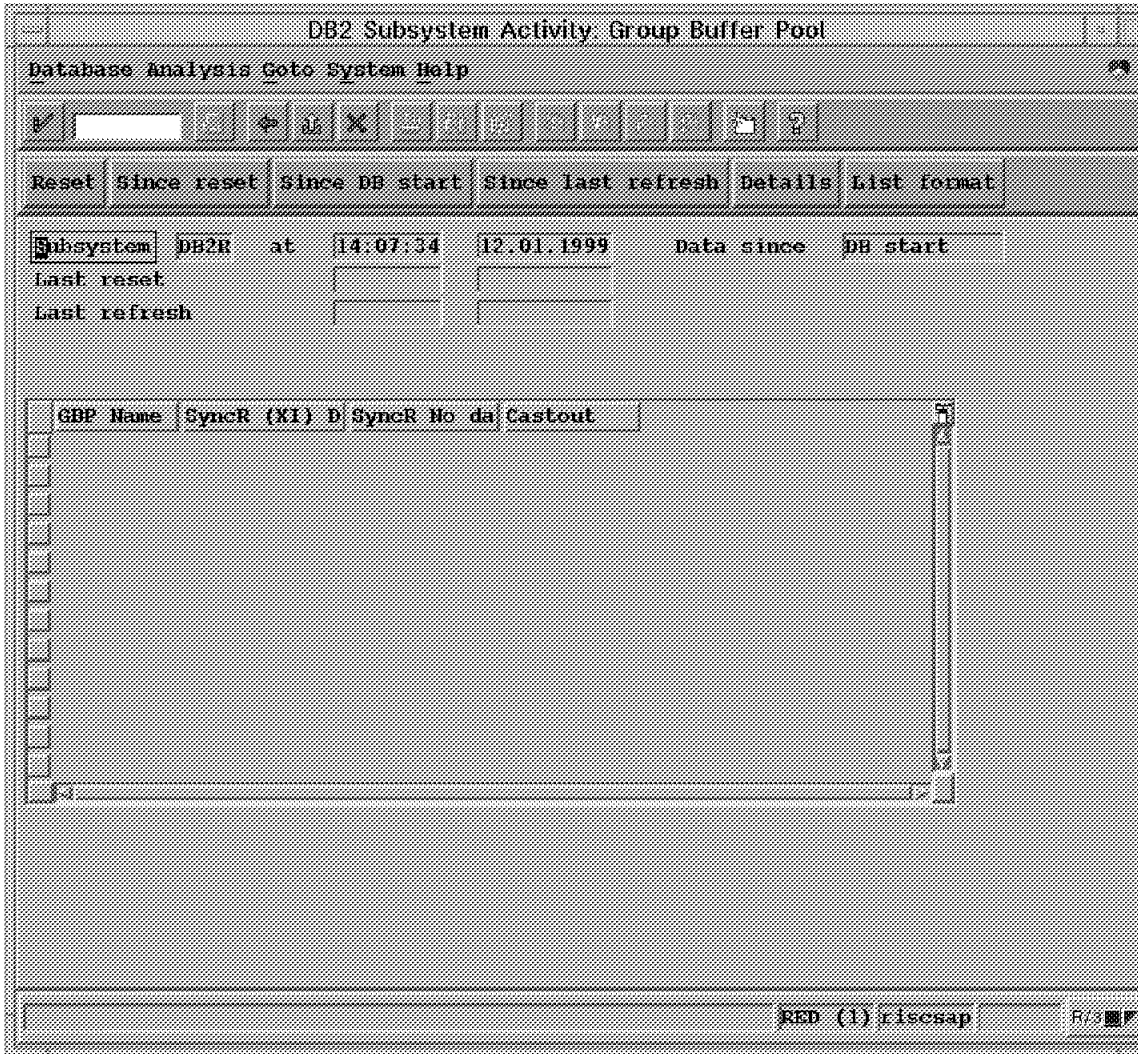


Figure 42. DB2 Subsystem Activity: Group Buffer Pool

Choosing **List format** from this screen produces information about *all* buffer pools, we show this output in Figure 43 on page 63 thru Figure 51 on page 67. The amount of data here is generally sent to a printed report. Individual buffer pool data is seen through the choice of **Buffer Pool Activity**; see Figure 54 on page 70.

DB2 Subsystem Activity Summary List

Database analysis tool System Help

Reset Since reset Since DB start Since last refresh

General information about buffer pool for subsystem DB2K at 14:40:37 12.01.1999
 Last reset time: Last refresh time: Data since: Last reset

Maximum active pages *	BP2	4.400	Buffer pool shortage	YES
Minimum hit ratio	BP32K	26	Hiperpool concern	NO

Buffer pool name	Current active buffers	Buffer pool full	Virtual storage unavailable	Successful dataset opens	DFHSM migrated datasets	DFHSM recall timers
BP0	16	0	0	30	0	0
BP2	88	0	0	3861	0	0
BP3	21	0	0	11836	0	0
BP32K	0	0	0	53	0	0

Buffer pool name	Buffers allocated hiperpool	Buffers allocated virtual bp	Hiperpool expansions and contractions	Virtual buffer pool expansion and contract.	Hiperpool buffers backed
BP0	0	2000	0	0	0
BP2	0	2000	0	0	0
BP3	0	2000	0	0	0
BP32K	0	24	0	0	0

DB2 (1) Sinesap

Figure 43. DB2 Activity Summary List (1 of 9)

DB2 Subsystem Activity Summary List

Database analysis tool System Help

Reset Since reset Since DB start Since last refresh

Read operations per buffer pools for subsystem DB2K at 14:43:43 12.01.1999
 Last reset time: Last refresh time: Data since: Last reset

Buffer pool name	Buffer hit ratio (%)	Getpage request total	Getpage request seq. access only	Synchronous reads total	Synchronous reads seq. access	Sequential prefetch requested	Normal sequential prefetch reads
BP0	77.2307320	550892	93016	61470	45421	3371	63707
BP2	25.8274657	263878	162876	18991	8436	3673	172399
BP3	98.034602	945052	2236	15571	83	87	2461
BP32K	76.0780456	12198	8186	1992	44	1800	7026

Buffer pool name	List prefetch requested	List prefetch reads	List prefetch pages read	Dynamic prefetch requested	Dynamic prefetch reads	Dynamic prefetch pages read	Prefetch disabled no buffers
BP0	52	0	0	61	7	125	0
BP2	225	48	562	1474	168	3773	0
BP3	0	0	0	742	16	557	0
BP32K	0	0	0	6	0	0	65

Buffer pool name	Synchronous hiperpool reads	Asynch. hiperpool reads		Unsuccessful asynch. hiperpool reads		Page img required + read I/O
		Without asynch. data mover facility	With asynch. data mover facility	Without asynch. data mover facility	With asynch. data mover facility	
BP0	0	0	0	0	0	19

DB2 (1) Sinesap

Figure 44. DB2 Activity Summary List (2 of 9)

DB2 subsystem Activity Summary List

Database analysis Goto System Help

Reset Since reset Since DB start Since last refresh

Write operations per buffer pool for subsystem DB2R at 14:43:43 12.01.1999
 Last reset time: Last refresh time: Data since: Last reset

Buffer pool name	Buffer updates	Pages written	Synchronous writes	Asynchronous writes	Write engine not available	Deferred write threshold reached	Vertical deferred writes thres reached
BP0	119908	3141	305	1115	0	0	0
BP2	82130	11600	1178	1474	0	0	6
BP3	1082965	287204	11669	17932	0	0	3256
BP32K	2190	1622	72	811	0	142	789

Buffer pool name	Synchronous hipool writes	Asynch. hipool writes without asynch. data mover facility	With asynch. data mover facility	Unsuccessful asynch. Without asynch. data mover facility	With asynch. data mover facility	Pages req'd / write I/O
BP0	0	0	0	0	0	0
BP2	0	0	0	0	0	0
BP3	0	0	0	0	0	0
BP32K	0	0	0	0	0	0

Query parallelism per buffer pool for subsystem DB2R at 14:43:43 12.01.1999
 Last reset time: Last refresh time: Data since: Last reset

Buffer pool name	Concurrent prefetch I/O stream	Prefetch I/O streams reduced	Parallel query	Reduced parallel	Prefetch quantity	Prefetch quantity
BP0	0	0	0	0	0	0
BP2	0	0	0	0	0	0
BP3	0	0	0	0	0	0
BP32K	0	0	0	0	0	0

RED (1) Signap

Figure 45. DB2 Activity Summary List (3 of 9)

DB2 subsystem Activity Summary List

Database analysis Goto System Help

Reset Since reset Since DB start Since last refresh

Query parallelism per buffer pool for subsystem DB2R at 14:43:43 12.01.1999
 Last reset time: Last refresh time: Data since: Last reset

Buffer pool name	Concurrent prefetch I/O stream high water mark	Prefetch I/O streams reduced buffer shortage	Parallel query requests	Reduced parallel query requests	Prefetch quantity reduced to 1/2	Prefetch quantity reduced to 1/4
BP0	0	0	0	0	0	0
BP2	0	0	0	0	0	0
BP3	0	0	0	0	0	0
BP32K	0	0	0	0	0	0

sort/merge work file operations per buffer pool for subsystem DB2R at 14:43:43 12.01.1999
 Last refresh time: Last refresh time: Data since: Last reset

Buffer pool name	Maximum concurrent work files	Requested for all merge passes	Not created or buffer	Prefetch not scheduled zero quantity	Pages marked to destruct	Pages not written	Merge passes requested
BP0	8	298	0	0	430	430	149
BP2	0	0	0	0	0	0	0
BP3	0	0	0	0	0	0	0
BP32K	0	0	0	0	236	2	0

Locking activity (systemwide data) for subsystem DB2R at 14:43:43 12.01.1999
 Last reset time: Last refresh time: Data since: Last reset

RED (1) Signap

Figure 46. DB2 Activity Summary List (4 of 9)

DB2 Subsystem Activity Summary List			
Database analysis data system help			
Reset Since reset Since DB start Since last refresh			
Locking activity (systemwide data) for subsystem DB2R at 14:43:43 12.01.1999			
Last reset time: Last refresh time: Data since: Last reset			
Timeouts	0	Suspension - latch	131
Deadlocks	0	Suspension - other	201
Lock requests	1261412	Lock escalation - shared	0
Unlock requests	814972	Lock escalation - exclusive	0
Query requests	200	claim requests	331931
Change requests	144122	Unsuccessful claim requests	0
Other requests	2	Drain requests	16271
Suspension - lock	1048	Unsuccessful drain requests	0
Logging activity (systemwide data) for subsystem DB2R at 14:43:43 12.01.1999			
Last reset time: Last refresh time: Data since: Last reset			
Reads archive log	0	Writes no-wait	576512
Log write waits	0	Write output log buffers	79874
Log write ratio	0.86	Total BIDS access request	354
Reads satisfied - output buffer	15	Unavailable output log buffers	0
Reads satisfied - active log	228	Active log - control intervals created	45706
Reads satisfied - archive log	0	Archive log - read allocations	0
Reads delayed - tape volume contention	0	Archive log - write allocations	0
Reads delayed - unavailable resource	0	Archive log - control interval offload	180000
Look ahead amounts attempted	0	Output log buffer write per active log interval created	1.7475605
Look ahead amounts successful	0		

Figure 47. DB2 Activity Summary List (5 of 9)

DB2 Subsystem Activity Summary List			
Database analysis data system help			
Reset Since reset Since DB start Since last refresh			
EDM pool (systemwide data) for subsystem DB2R at 14:43:43 12.01.1999			
Last reset time: Last refresh time: Data since: Last reset			
EDM Pool full	0	DBD section not found in EDM pool	3945
Pages in use %	29.05	DBD requests/DBD not in EDM Pool	21.0463878
Requests for CT section	27	Pages in EDM Pool	20000
CT section not found in EDM pool	2	Free pages in free chain	14191
CT requests/CT not in EDM pool	13.5	Pages used for CT	25
Requests for PT section	56	Pages used for SKCT	2
PT section not found in EDM pool	3	Pages used for PT	375
PT requests/PT not in EDM pool	18.6666667	Pages used for SKPT	18
Requests for DBD section	83028	Pages used for DBD	4664
Dynamic statement cache (systemwide data) for subsystem DB2R at 14:43:43 12.01.1999			
Last reset time: Last refresh time: Data since: Last reset			
Hit ratio %	58.589	Implicit prepares	0
Prepares	879	Avoided prepares	43934
Short prepares	515	MAXREPU exceeded	0
Full prepares	364	Statement invalidated	0
Open/Close activity (systemwide data) for subsystem DB2R at 14:43:43 12.01.1999			
Last reset time: Last refresh time: Data since: Last reset			

Figure 48. DB2 Activity Summary List (6 of 9)

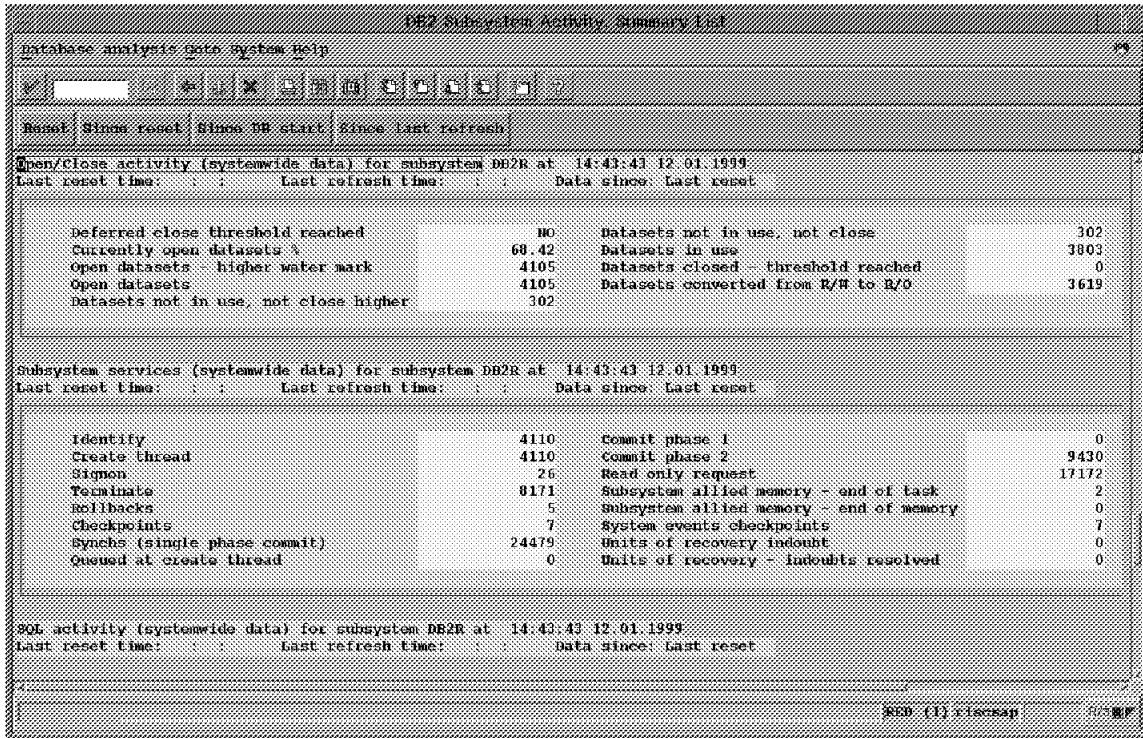


Figure 49. DB2 Activity Summary List (7 of 9)

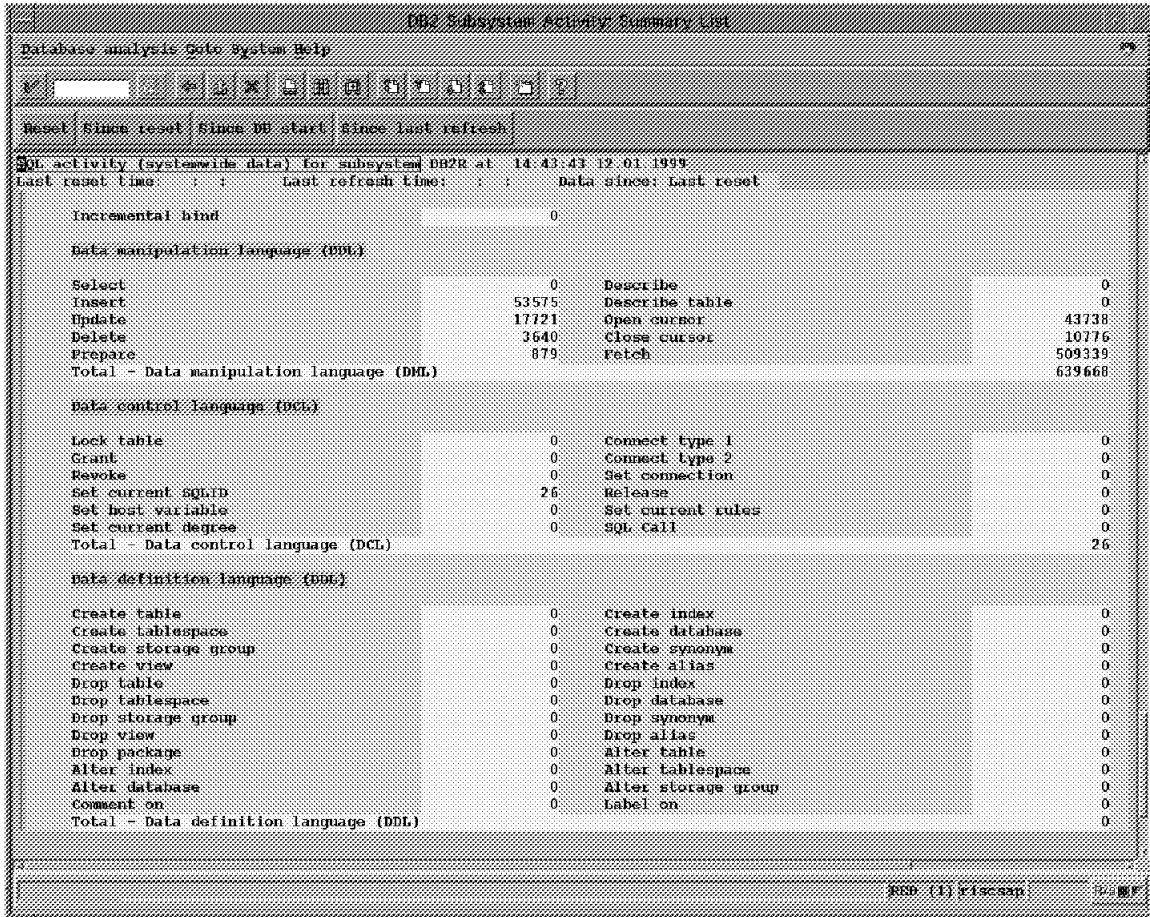


Figure 50. DB2 Activity Summary List (8 of 9)

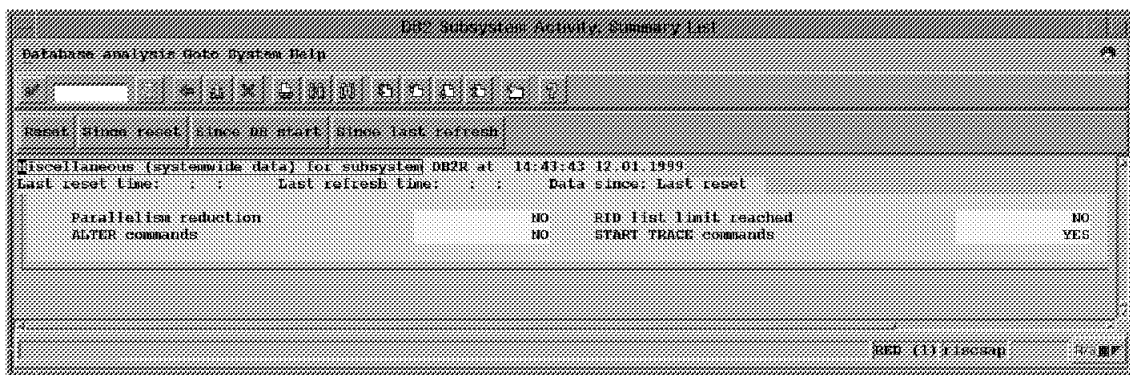


Figure 51. DB2 Activity Summary List (9 of 9)

Choosing **Data Sharing Locking** from the screen shown in Figure 40 on page 60 produces the output that appears as shown in Figure 52 and Figure 53 on page 69 (broken into two figures for convenience).

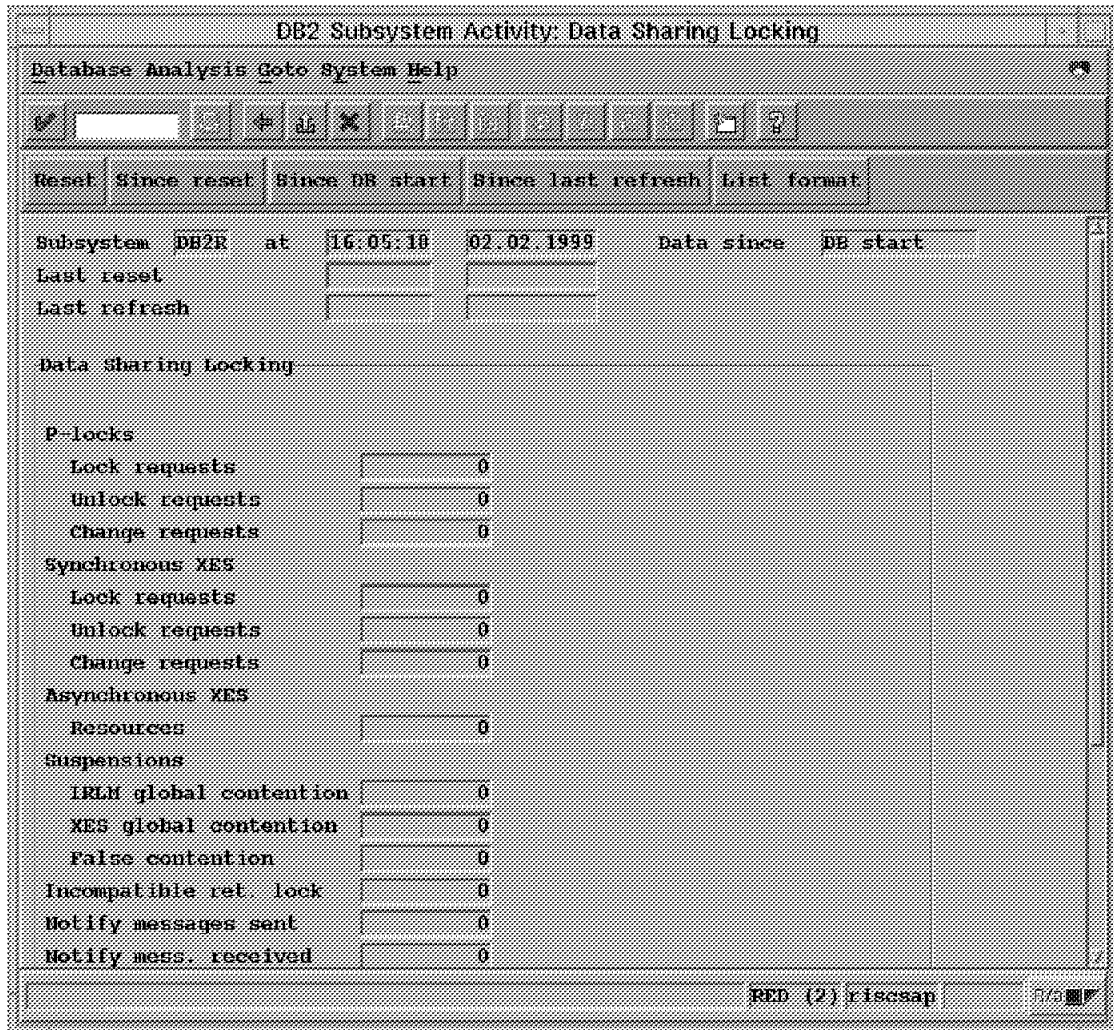


Figure 52. Data Sharing Locking (Part 1 of 2)

The data shown is zeros because our SAP R/3 system does not use data sharing. This information is valuable for a DBA in an DB2 for OS/390 data sharing environment. This is especially true in an OS/390 Sysplex installation.

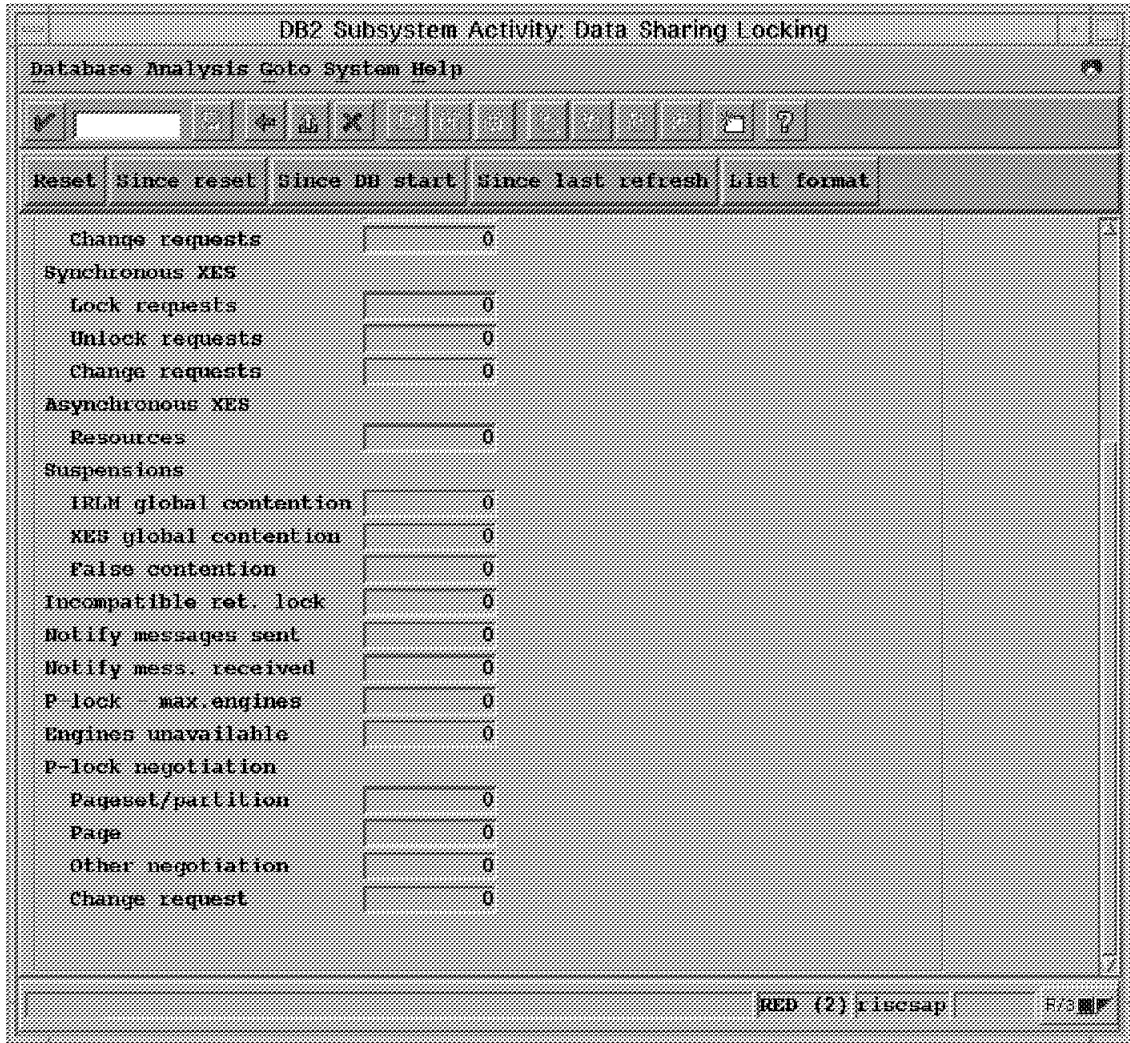


Figure 53. Data Sharing Locking (Part 2 of 2)

Choosing **Buffer pool activity** from the screen shown in Figure 40 on page 60 produces the screen shown in Figure 54.

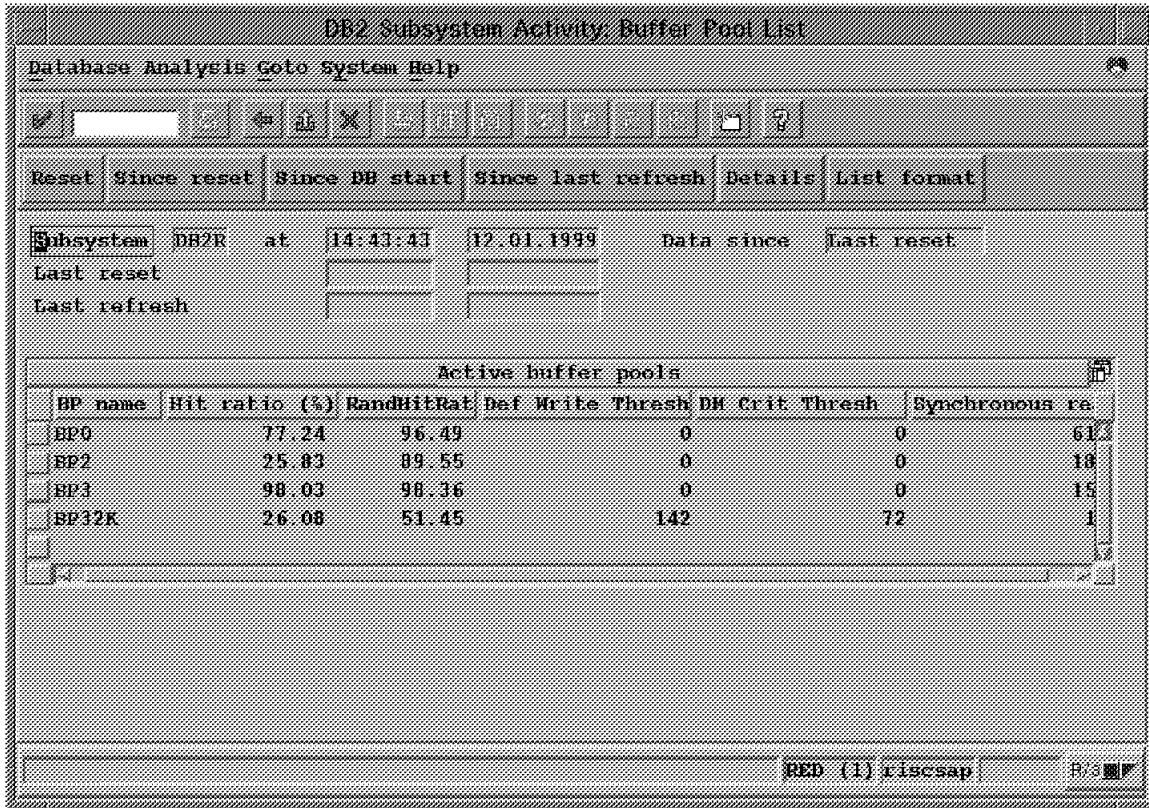


Figure 54. Buffer Pool List

This summary information might lead a DBA to allocate more resources to buffer pools. However, the DBA would more likely be interested in individual buffer pool data. The DBA could obtain the individual data by choosing a buffer pool (by clicking on the button to the left of the buffer pool), and then choosing **Details**, which produces the screen shown in Figure 55 on page 71.

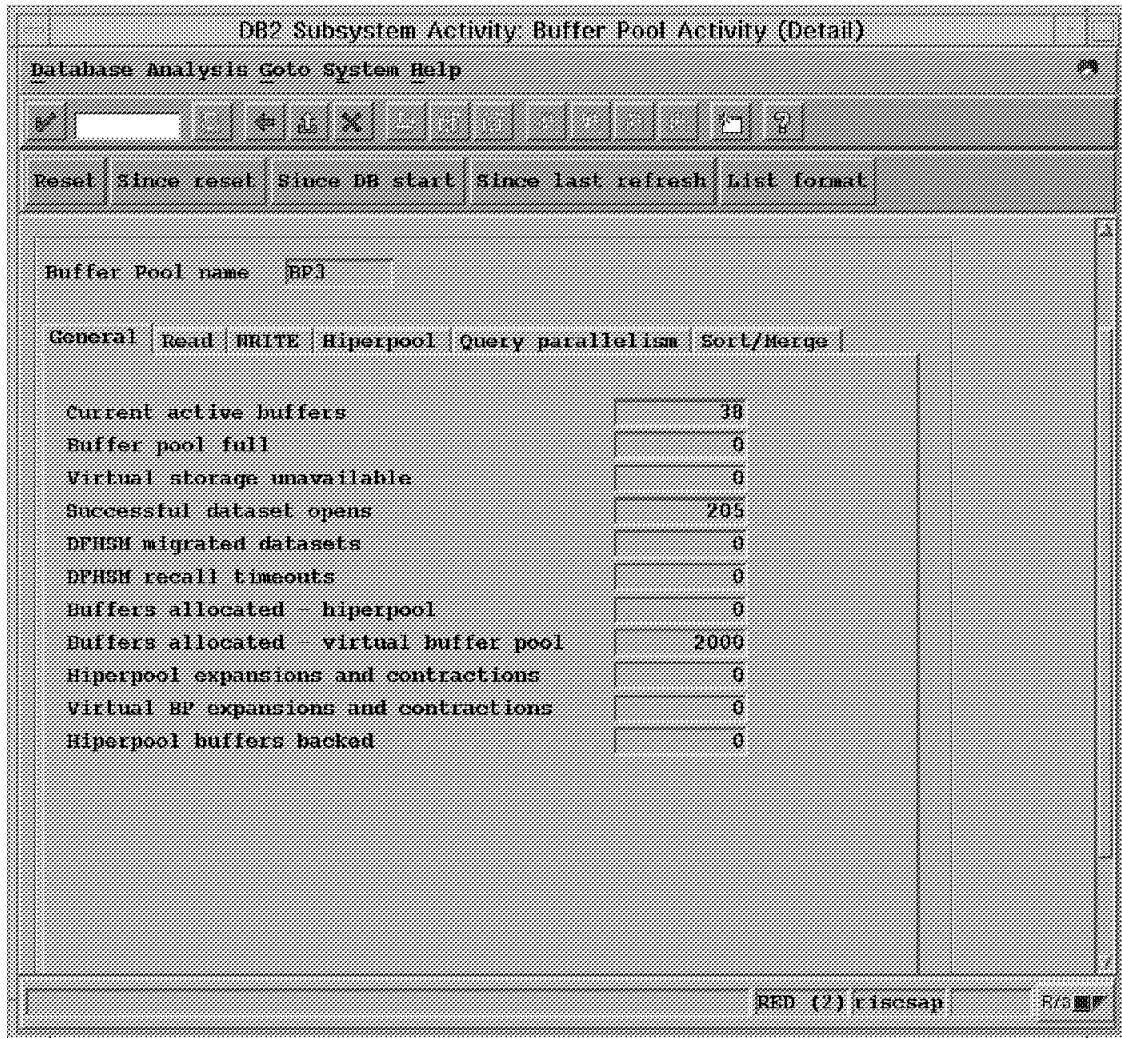


Figure 55. Buffer Pool Activity (Detail)

This information might lead a DBA to change buffer pool allocations, or this might be information to review when new applications are placed in production (to see if buffer pool performance remains satisfactory).

Choosing **Locking activity** from the screen shown in Figure 40 on page 60 produces the screen shown in Figure 56.

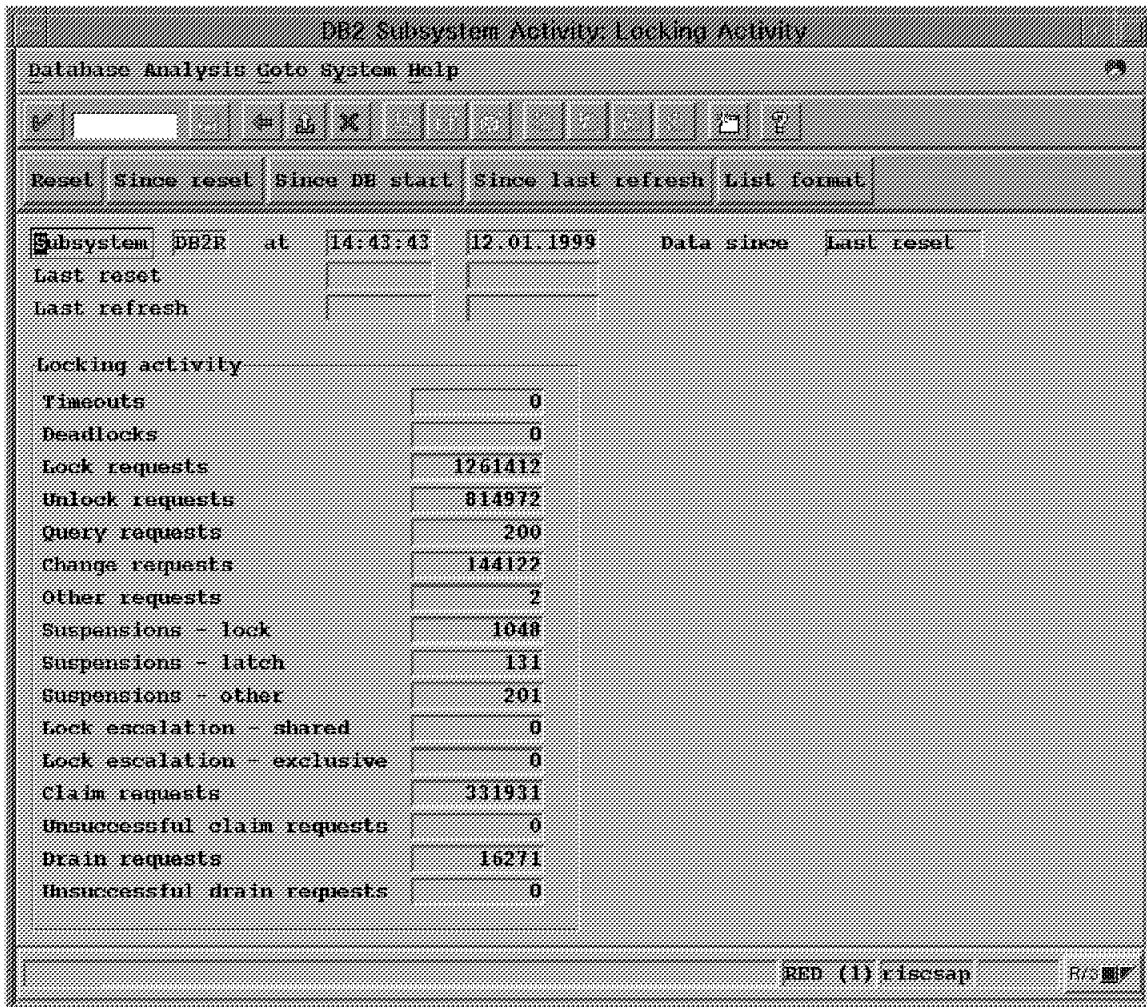


Figure 56. Locking Activity

This information can be important if long-running transactions exist that do not perform commits. Such transactions typically cause dramatic increases in locking activity.

Choosing **Logging activity** from the screen shown in Figure 40 on page 60 produces the screen shown in Figure 57.

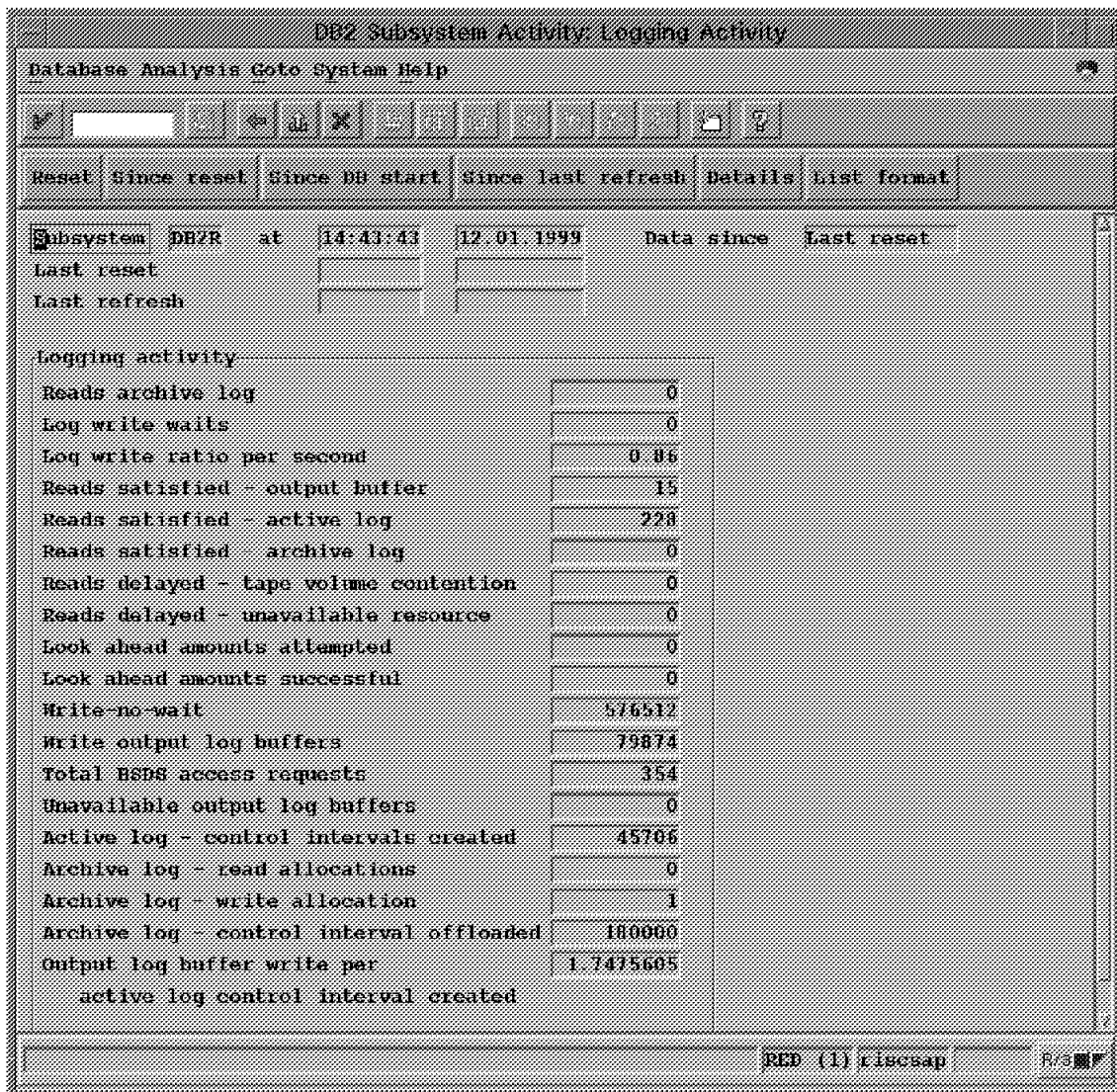


Figure 57. Logging Activity

Logging activity is one way of measuring DB2 activity. The data from this screen can also indicate whether logging resources (disk, memory, or block sizes) are adequate.

Choosing **EDM Pool** from the screen shown in Figure 40 on page 60 produces the screen shown in Figure 58.

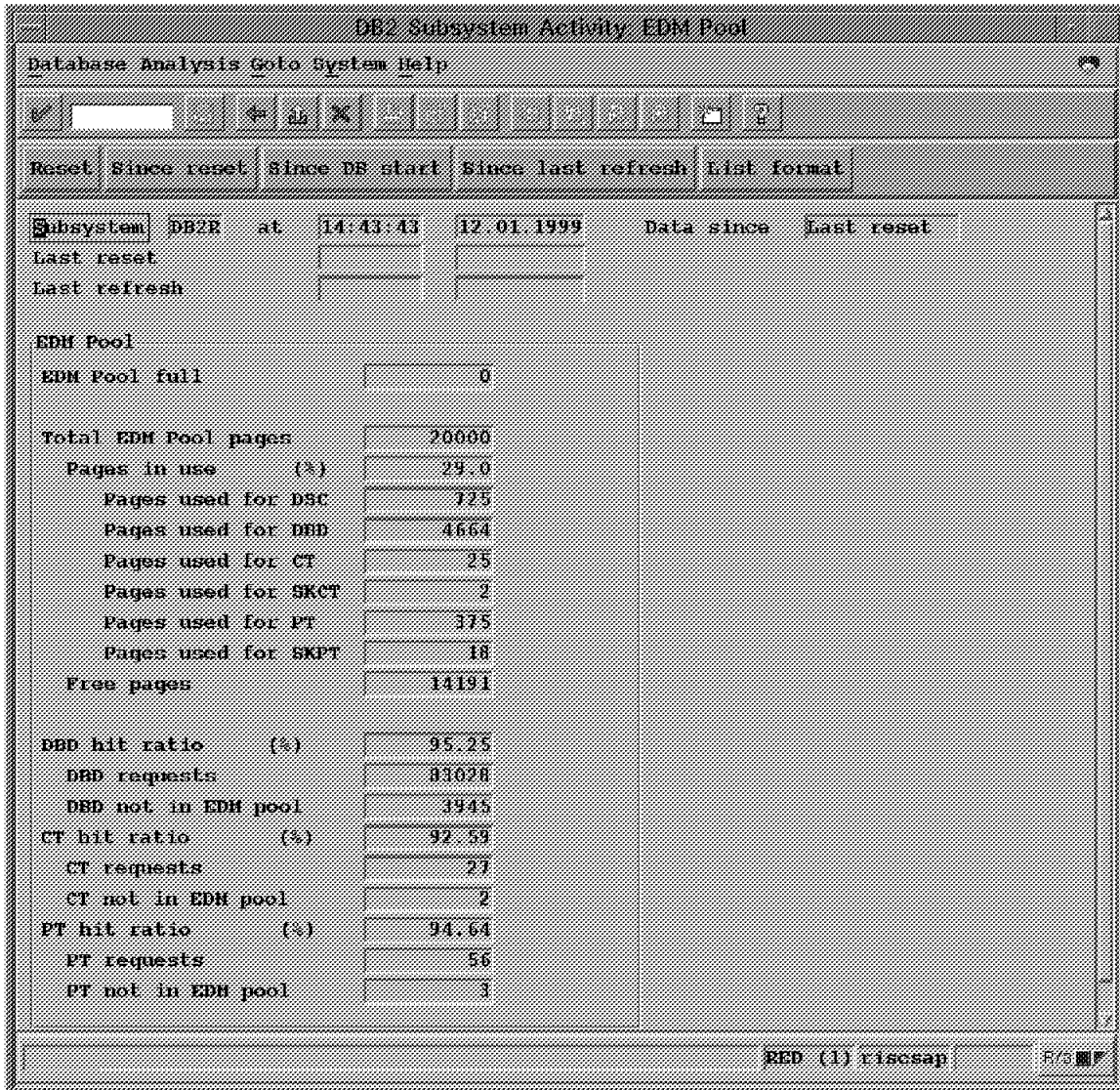


Figure 58. EDM Pool

The environmental descriptor manager (EDM) pool contains internal DB2 for OS/390 control information. The data from Figure 58 can be used to determine whether the EDM pool allocation should be modified.

Choosing **Dynamic statement cache** from the screen shown in Figure 40 on page 60 produces the screen shown in Figure 59.

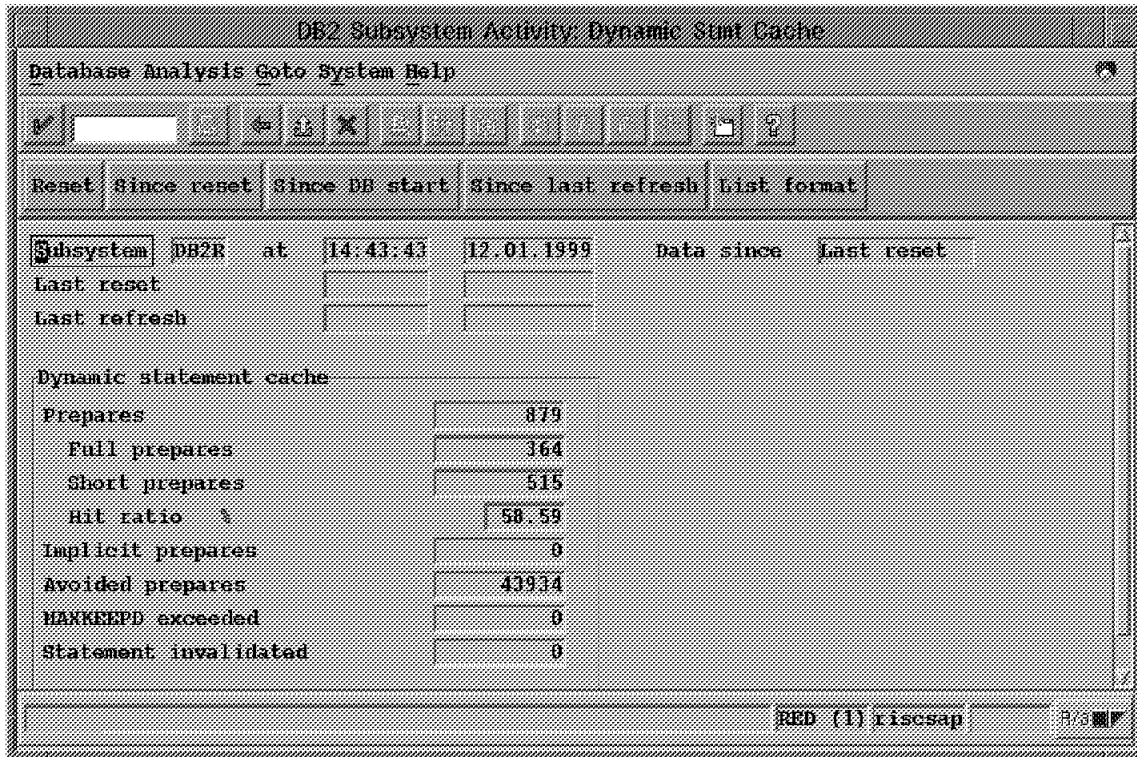


Figure 59. Dynamic Statement Cache

Dynamic statement cache statistics indicate the effectiveness of this resource in reducing DB2 for OS/390 "Prepares". *Prepare* is the process of determining the access path to use to reach specific data. The information shown in this screen can lead to increasing or decreasing memory allocated to the cache.

Choosing **Open/Close activity** from the screen shown in Figure 41 on page 61 produces the screen shown in Figure 60.

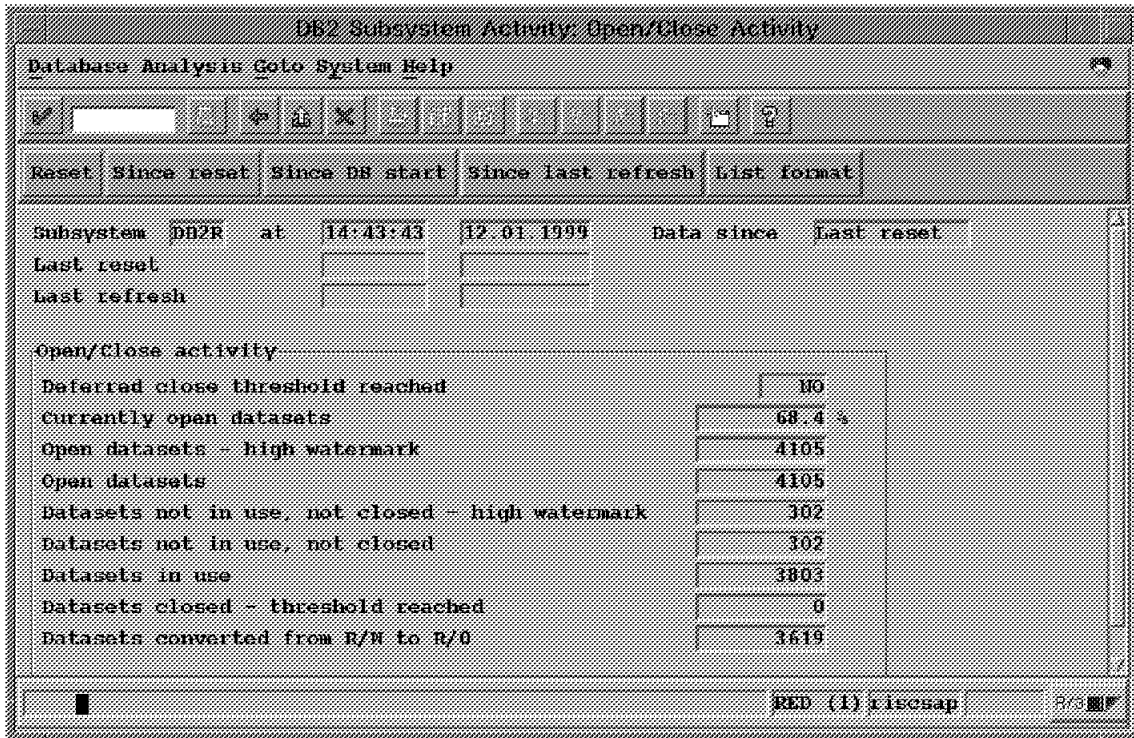


Figure 60. Open/Close Activity

This data indicates whether DB2 for OS/390 is performing OS/390 closes of data sets in order to free resources to enable opening of other data sets.

Choosing **Subsystem services** from the screen shown in Figure 41 on page 61 produces the screen shown in Figure 61.

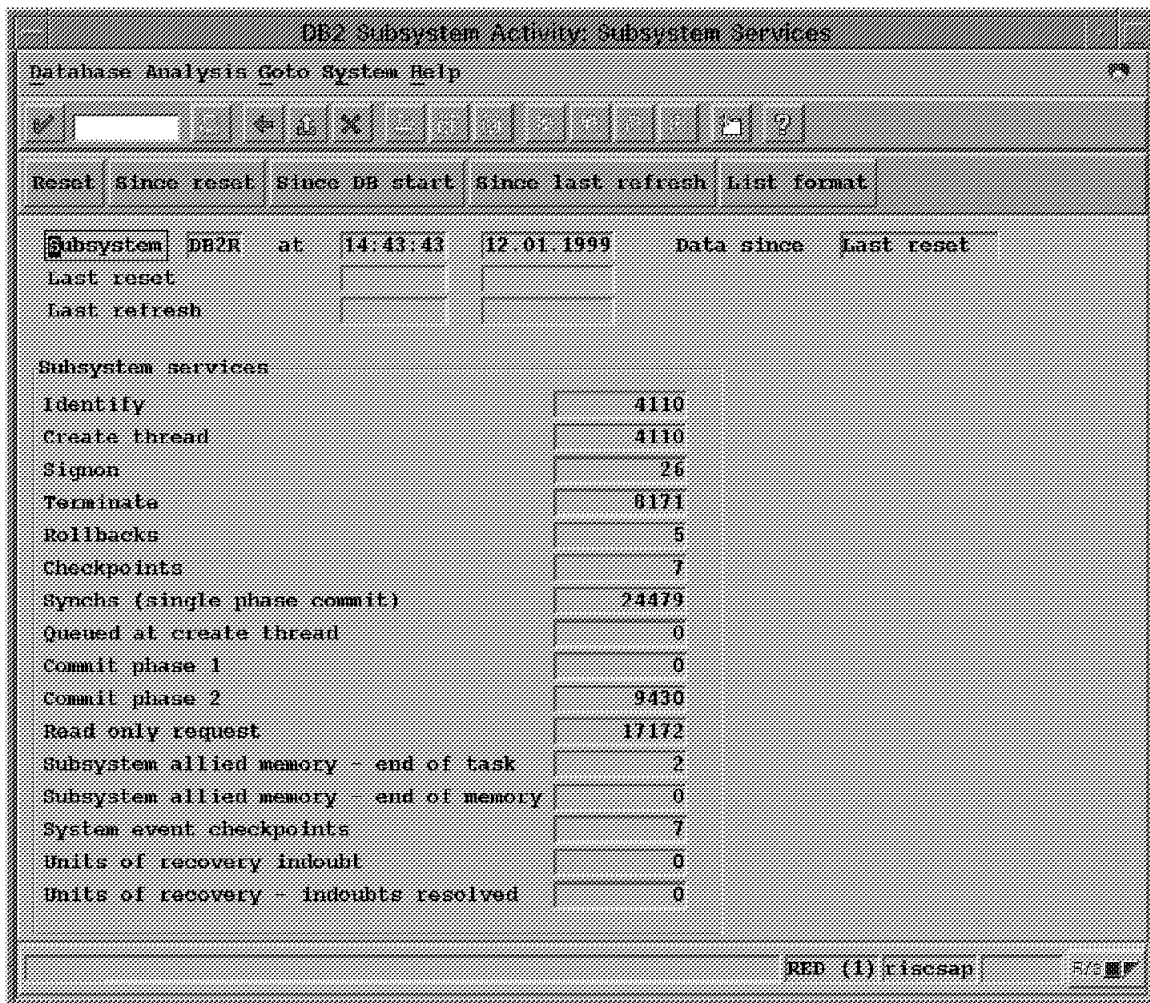


Figure 61. Subsystem Services

The data on this screen indicates the number of executions of DB2 operational functions.

Choosing **SQL activity** from the screen shown in Figure 41 on page 61 produces the screen shown in Figure 62.

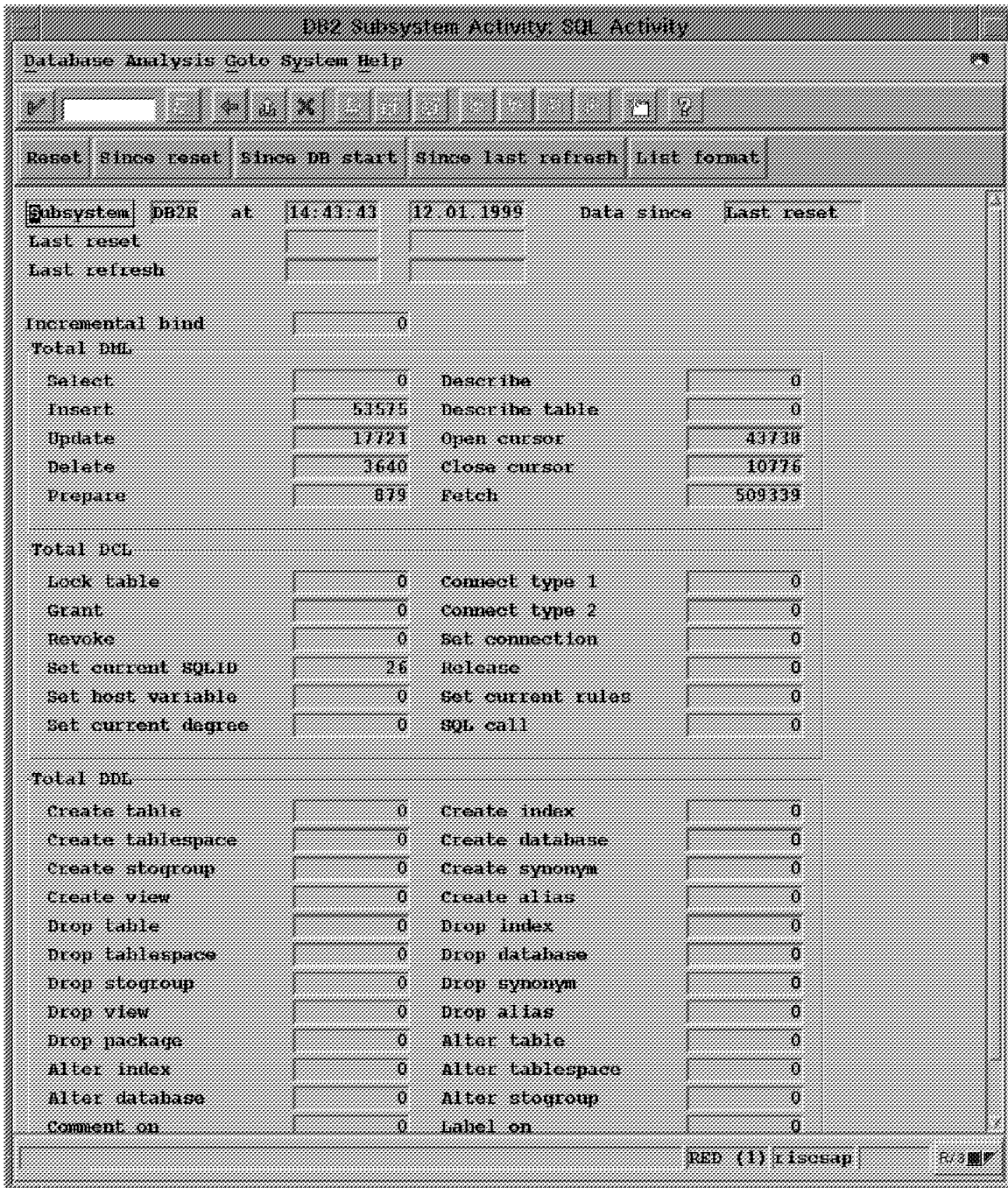


Figure 62. SQL Activity

This information can be valuable in determining the usage of SQL in an application.

Choosing **RID list processing** from the screen shown in Figure 41 on page 61 produces the screen shown in Figure 63.

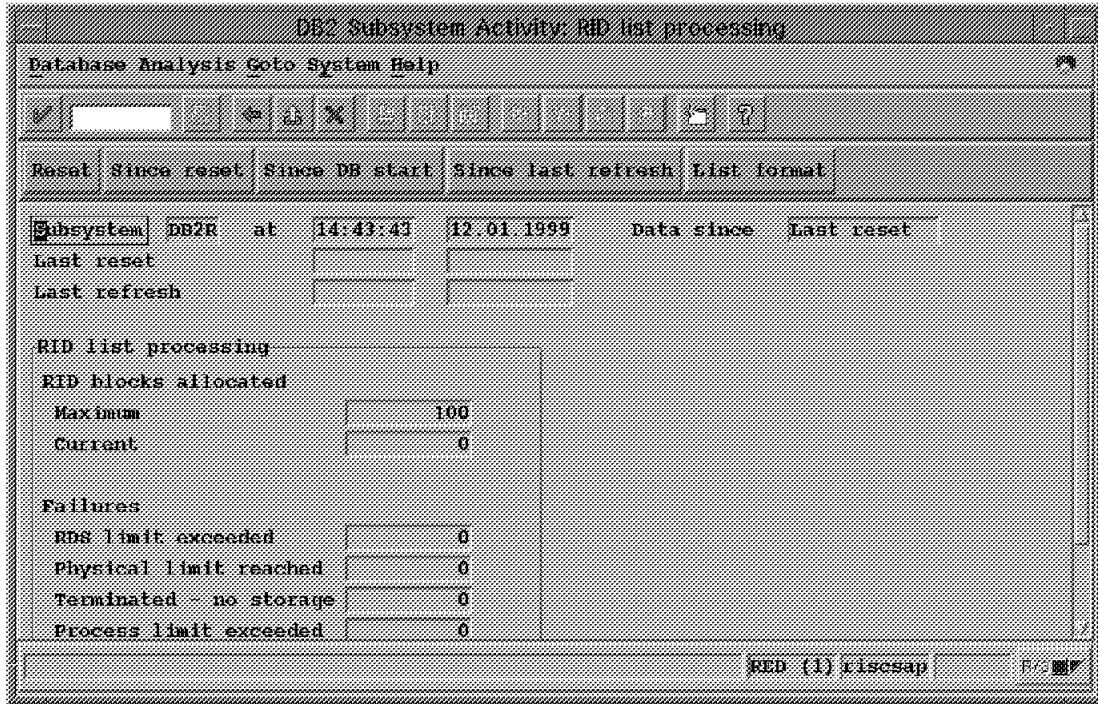


Figure 63. RID List Processing

DB2 for OS/390 record identifier (RID) lists are used to hold a series of RIDs for accessing DB2 data, as are obtained from an index (in DB2 this is called *list sequential prefetch* processing). The data from this screen can be used in allocating more or less memory to this resource.

The choice of **Thread activity** from the screen in Figure 39 on page 59 produces the screen shown in Figure 64.

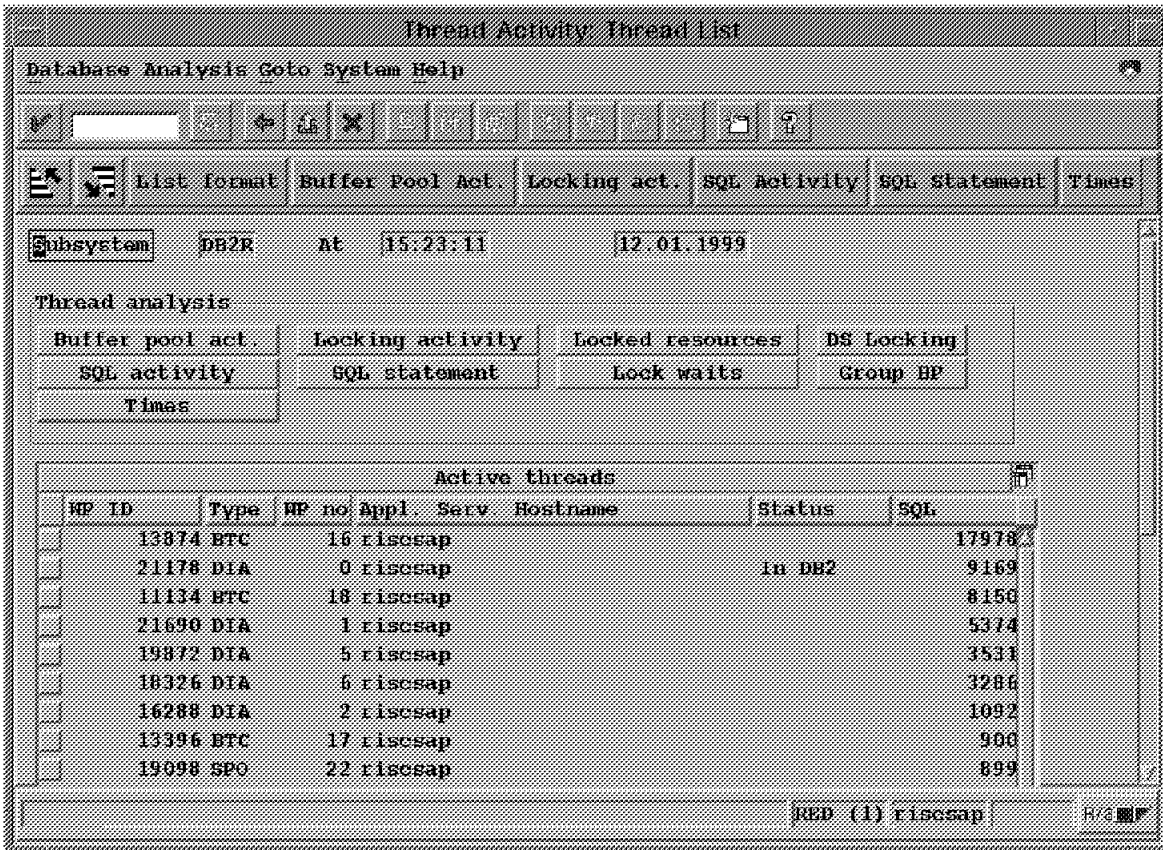


Figure 64. Thread Activity: Thread List

The information on this screen indicates the activity performed by DB2 threads; it is an indirect measure of application server activity since a thread is associated with an application server process.

Choosing a thread by clicking on the button to the left of the thread name (this is shown in Figure 65 on page 81) and then choosing one of the buttons in the Thread Analysis section produces a screen such as the one shown in Figure 66 on page 82, specific statistics for a single thread.

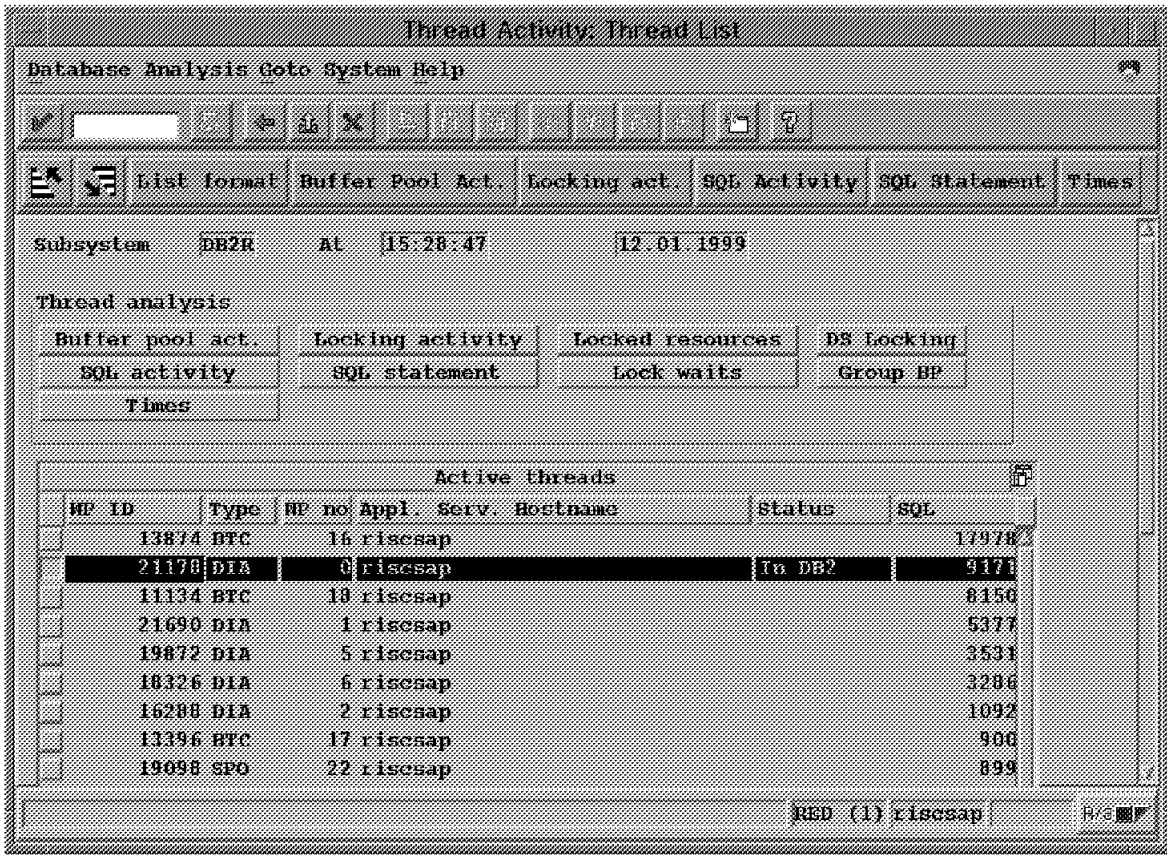


Figure 65. Choosing a Specific Thread

Note that on this screen only one thread may be chosen, since making a choice turns off all other choices.

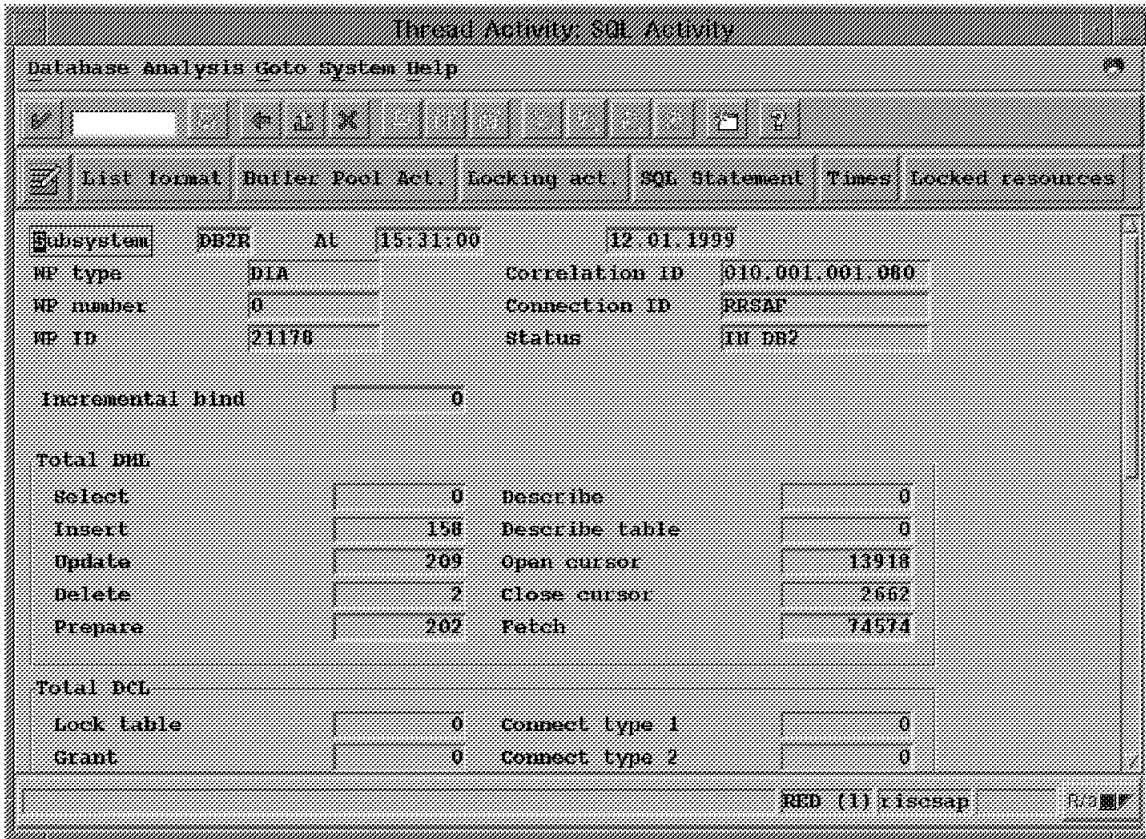


Figure 66. SQL Activity for a Thread

As noted in the text for Figure 64 on page 80, the individual thread activity is on behalf of individual work processes on an application server. These work processes may (depending on how application server activity is organized) indicate the performance of individual SAP R/3 applications.

The choice of **Stmt Cache Statistics** from the screen in Figure 39 on page 59 produces the screen shown in Figure 67, which allows you to filter the SQL statements that are to be displayed.

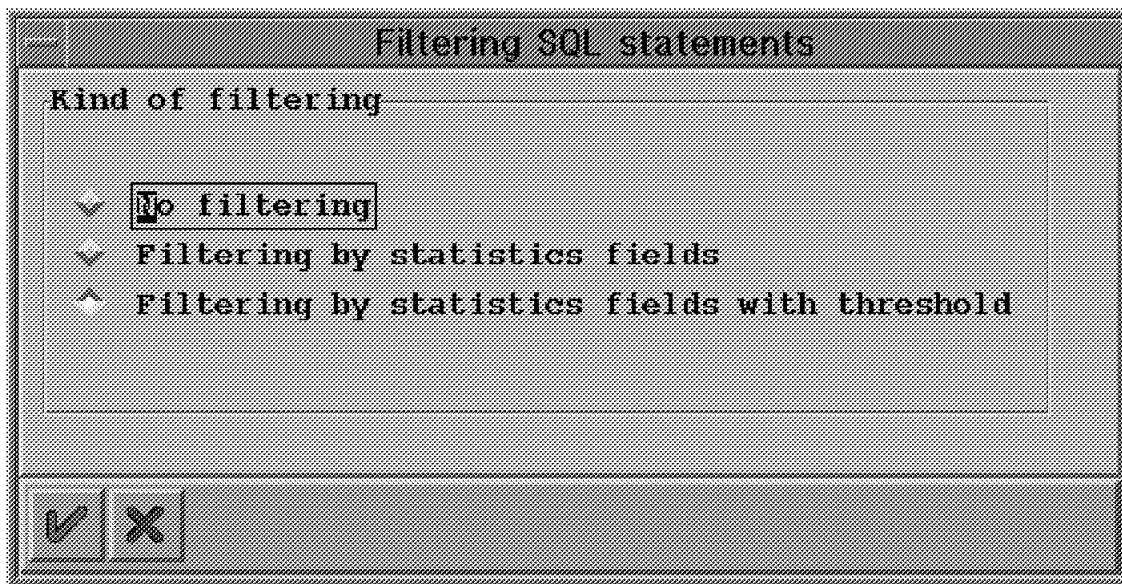


Figure 67. Choosing SQL Statement Filters

Choosing **No filtering** on this screen produces the screen shown in Figure 68.

Executions	Rows examined	Rows processed	Accumulated elapsed time	Rows exam. / secs	Rows proc. / secs	Rows proc. / examined	Elap. time / secs	Statement text
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *RFC
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *SQLX
0	0	0	0.000000	0.000	0.000	0.000	0.000	INSERT INTO
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT COUNT
3	0	0	0.000121	0.000	0.000	0.000	0.040	SELECT *SQLX
1	0	0	0.000048	0.000	0.000	0.000	0.048	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *
0	0	0	0.000000	0.000	0.000	0.000	0.000	SELECT *

Figure 68. Statement Cache Statistics Details

As can be seen by the vertical scroll bar, there is much more data produced than is shown. This data can lead to finding inefficient SQL statements, in turn leading to optimizing activity. (See note following Figure 69 on page 84).

The choice of **Times** from the screen in Figure 39 on page 59 produces the screen shown in Figure 69.

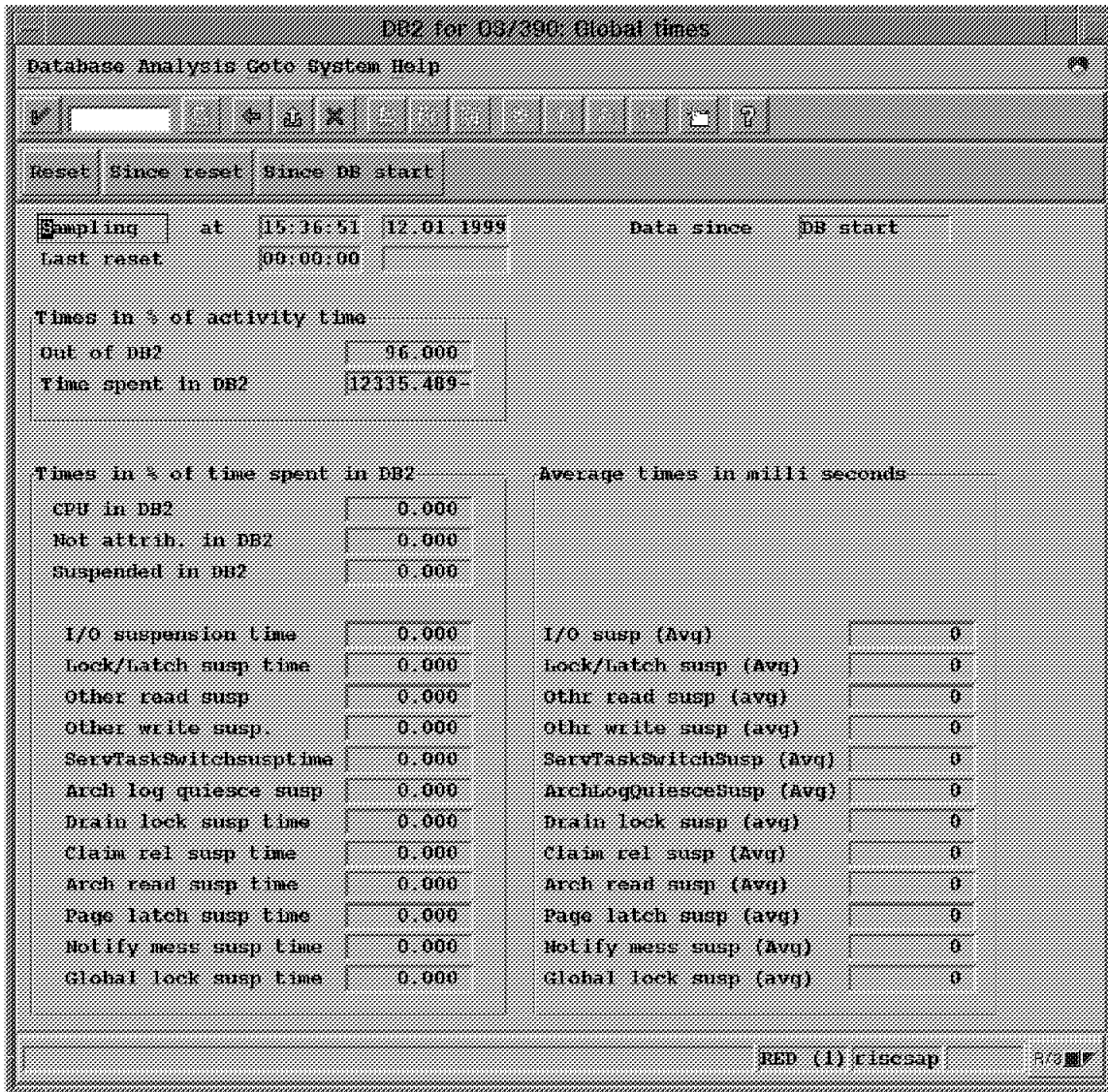


Figure 69. Global Times

The time data can highlight those DB2 functions that are using the most time, thus leading to resource allocation changes or other DBA activity that will reduce time in the function.

Important

The data in Figure 68 on page 83 and Figure 69 is extremely important in performance activity. Unfortunately, our laboratory setup did not activate the accounting records and DB2 trace information that allow these counters to contain meaningful information.

The choice of **Installation Parameters** from the screen in Figure 39 on page 59 produces the screen shown in Figure 70.

Database Analysis Goto System Help

List format

Important | Data Sharing | Connections | Trace | Locking | Protect/Data Def | Logging

Most important installation parameters

Dynamic statement cache	Yes	Max open data sets	6000
Max kept dyn statements	16000	Pseudo-close frequency	5
Max size EDM pool (bytes)	81920000	Pseudo-close timer (min)	10
Max size RID pool (bytes)	102400000	Drain start (%)	1
Max size SORT pool (bytes)	29491200	Drain stop (%)	3
Max concurrent threads	80	Archive log copies	Single
Max TSO connections	20	Active log copies	Dual Act.
Max batch connections	40	Input log buffer (KB)	20
Resource Timeout (sec)	600	Output log buffer (KB)	4000
Max locks per tablespace	6	Write threshold	20
Max locks per user	6	Checkpoint frequency	100000
UPDATE lock for RR/RS	Yes	Quiesce period (sec)	565
ICF catalog qualifier	DB2V5100	Start global trace	No
EBCDIC SBCS CCSID	500	Start SMF accounting	Yes
ASCII SBCS CCSID	819	Start monitor trace	No
Decimal precision	Decimal 15	Start SMF statistics	Yes
Encoding scheme	ASCII	Statistics frequency	30
Default index type	2	Sequential cache	No

Buffer pools

BP name	VPsize	HPsize	VPSEQT	VPPSEQT	HPSEQT	DMQT	VDMQT
BP0	2 000	0	80	50	80	50	50
BP1	2 000	0	80	50	80	50	50
BP2	2 000	0	80	50	80	50	50
BP3	2 000	0	80	50	80	50	50
BP32K	24	0	80	50	80	50	50

RED (1) riscsap R/3

Figure 70. Installation Parameters

This is a useful screen for DBAs or specialists to obtain an overview of parameters in effect for an SAP R/3 installation. The screen may also be used to determine that a change in parameters has taken effect.

The choice of **DB2 Commands** from the screen in Figure 39 on page 59 produces the screen shown in Figure 71.

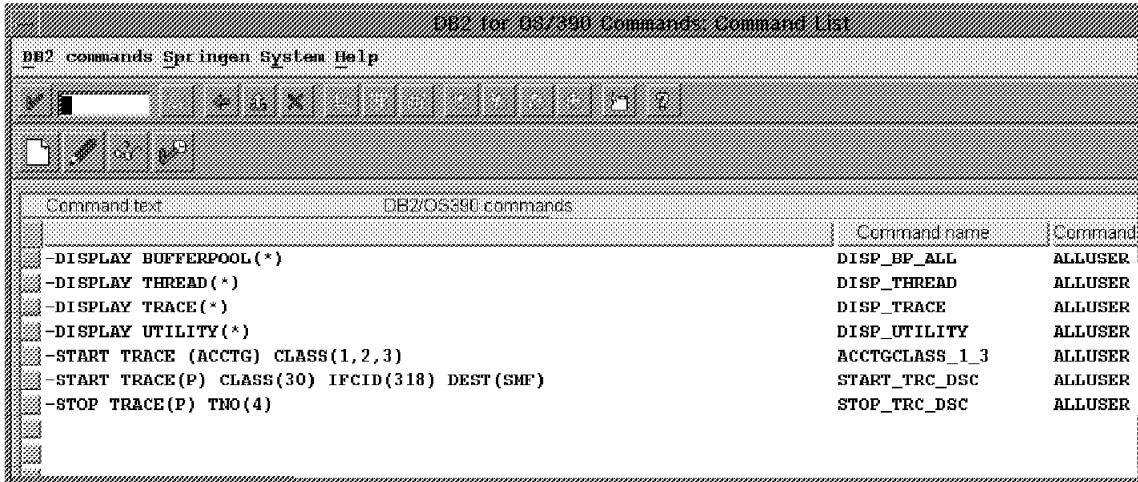


Figure 71. DB2 Command List

From this screen, you can choose a specific DB2 command and cause it to be executed. Choosing **Display Thread** and then clicking the Execute icon (the one with a small check and clock) produces the screen shown in Figure 72.

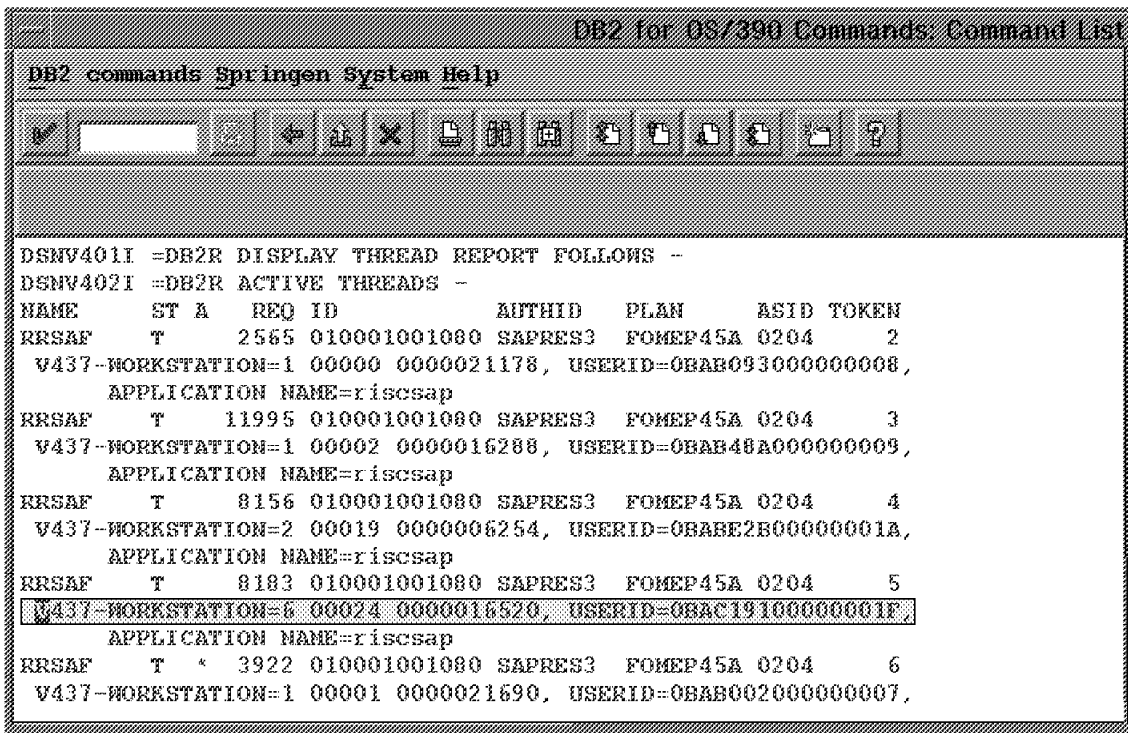


Figure 72. DB2 Display Thread Report

Using the **DB2 Commands** option allows a DBA to perform DB2 functions (such as obtaining traces or querying activity) *while remaining logged in to SAP R/3*.

The choice of **OS/390 System Log** from the screen in Figure 39 on page 59 produces the screen shown in Figure 73.

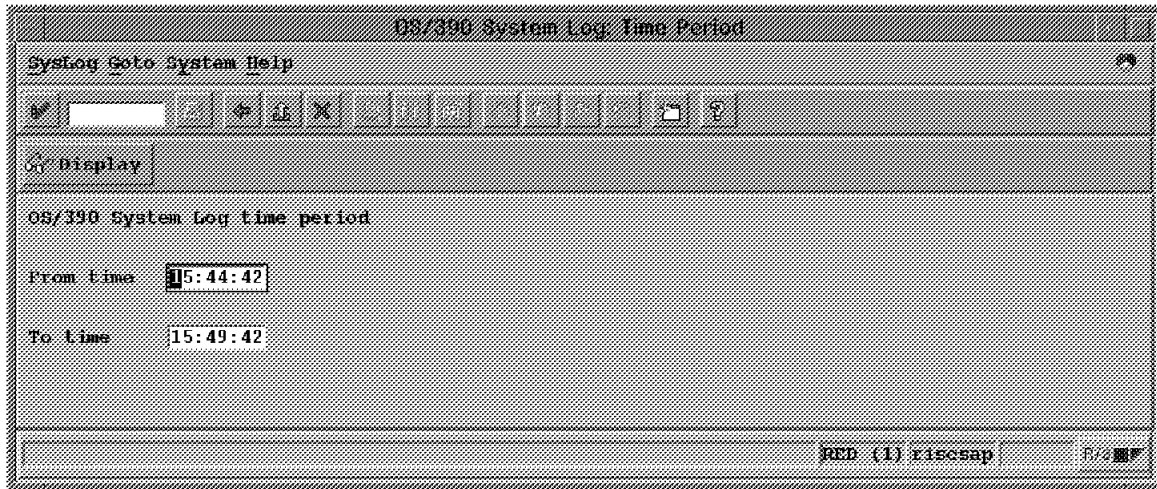


Figure 73. System Log Choice

From this screen you can choose a specific time period to be included in the log to be displayed.

Our activity does not include actually obtaining the system log; however, it should be recognized that this is a way a DBA may obtain OS/390 system administrator information.

The choice of **ICLI Trace** from the screen in Figure 39 on page 59 produces the screen shown in Figure 74.

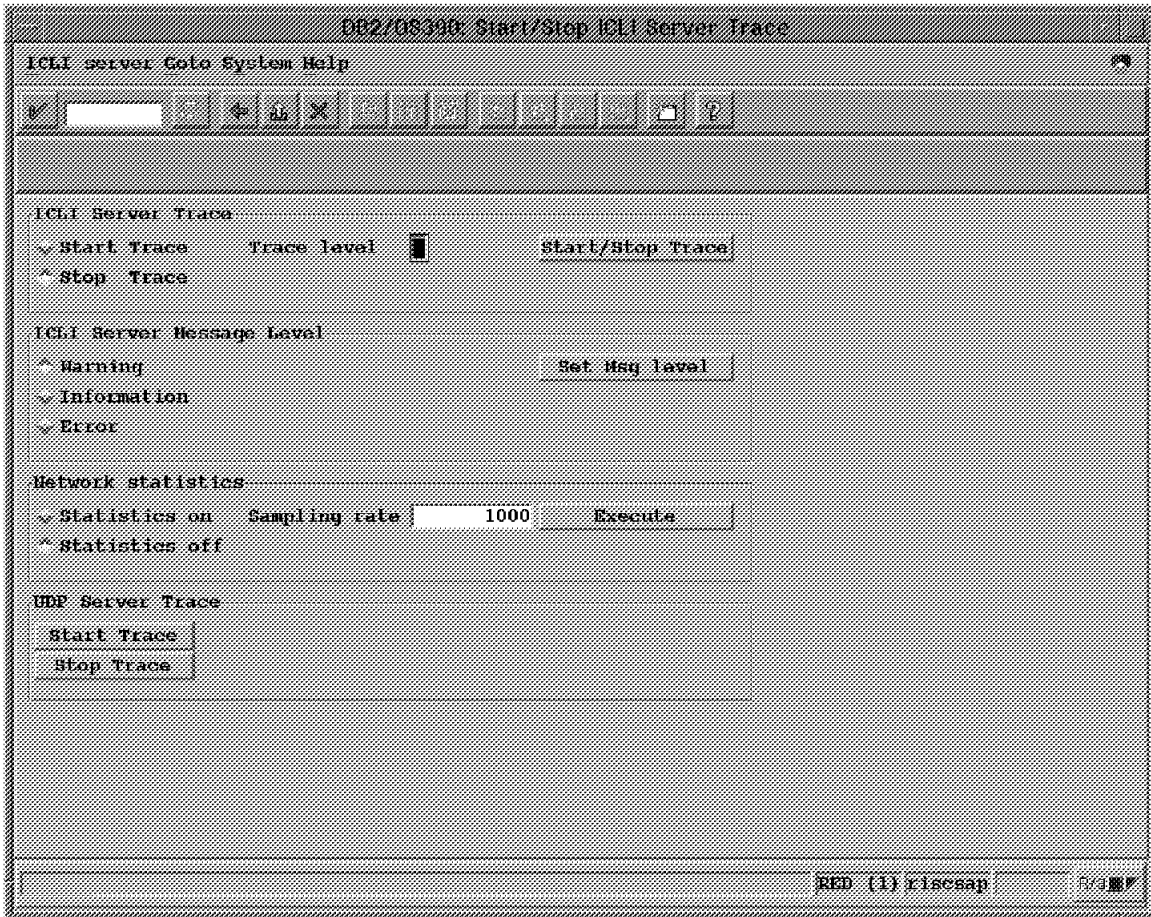


Figure 74. ICLI Trace Control

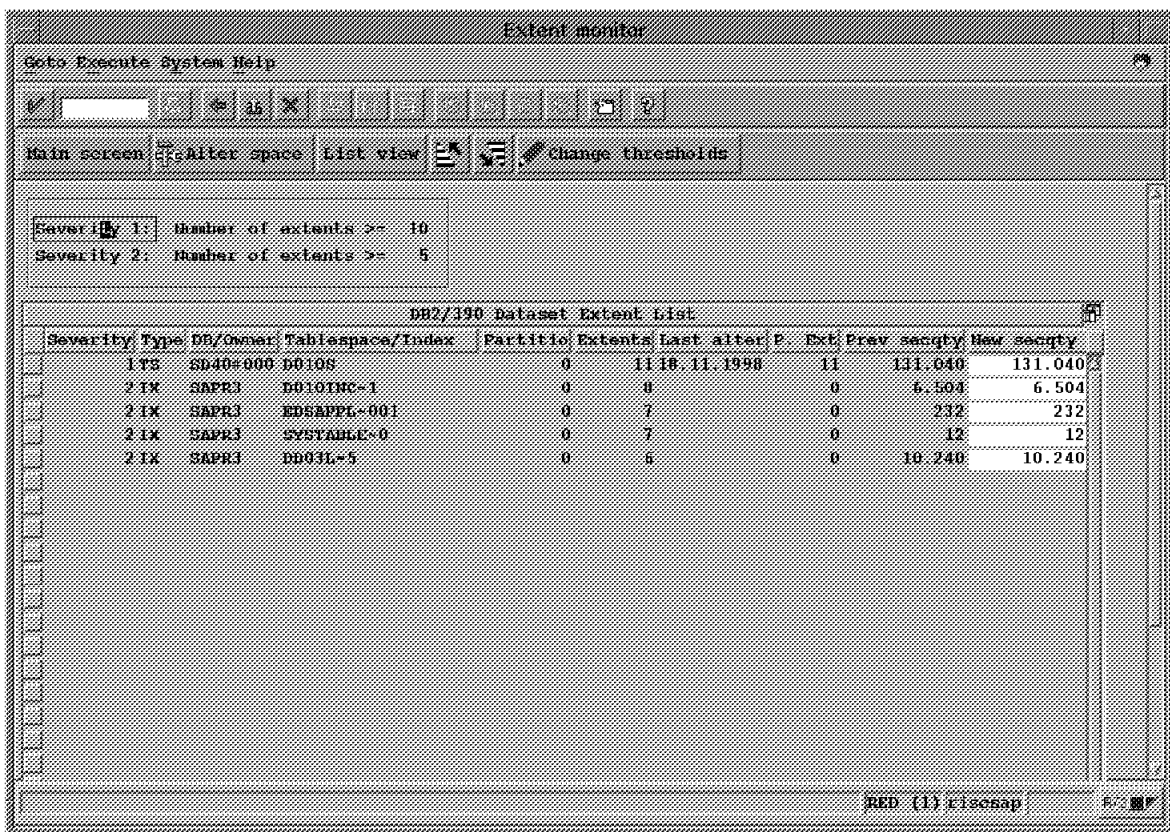
From this screen you can choose the parameters that control the execution of ICLI trace. Obtaining the trace information would allow the measurement of ICLI activity at specific times.

3.2 Outputs We Reached from Transaction Codes

In this section are screen captures of items we reached from the entry of SAP R/3 transactions. There are menu paths that arrive at these screens; in our testing we did not perform extensive menu searches to locate these. The same point should be observed regarding the screens shown in 3.1, “Outputs We Reached from Menus” on page 52; these may also be reached by entering transactions.

3.2.1 Transaction DB02

This transaction leads you to several screens used to control SAP R/3 data storage by DB2 for OS/390. Entering the transaction from SAPGUI produces the screen shown in Figure 75.



The screenshot shows the 'Extent monitor' window in SAP. At the top, there are menu options: 'Goto', 'Execute', 'System', and 'Help'. Below the menu is a toolbar with various icons. The main area contains a 'Main screen' section with buttons for 'Alter space', 'List view', and 'change thresholds'. Below this, there are two severity level settings: 'Severity 1: Number of extents >= 10' and 'Severity 2: Number of extents >= 5'. The central part of the screen displays a table titled 'DB2/390 Dataset Extent List'. The table has columns for Severity, Type, DB/Owner, Tablespace/Index, Partitio, Extents, Last alter, P, Ext, Prev, secqty, and New secqty. The data rows are as follows:

Severity	Type	DB/Owner	Tablespace/Index	Partitio	Extents	Last alter	P	Ext	Prev	secqty	New secqty
1TS		SD40*000	D010S	0	1118	11.1998	11	131.040		131.040	
2IX	SAPR3		D010INC-1	0	8		0	6.504		6.504	
2IX	SAPR3		EDSAPPL-001	0	7		0	232		232	
2IX	SAPR3		SVSYTABL-0	0	7		0	12		12	
2IX	SAPR3		DD03L-5	0	6		0	10.240		10.240	

At the bottom right of the screen, there is a status bar showing 'RED (1) rlsnap' and some system icons.

Figure 75. Extent Monitor

The screen shows extents in use on specific hardware volumes by the SAP R/3 database.

The choice of **Change thresholds** from the screen shown in Figure 75 produces the screen shown in Figure 76 on page 90,

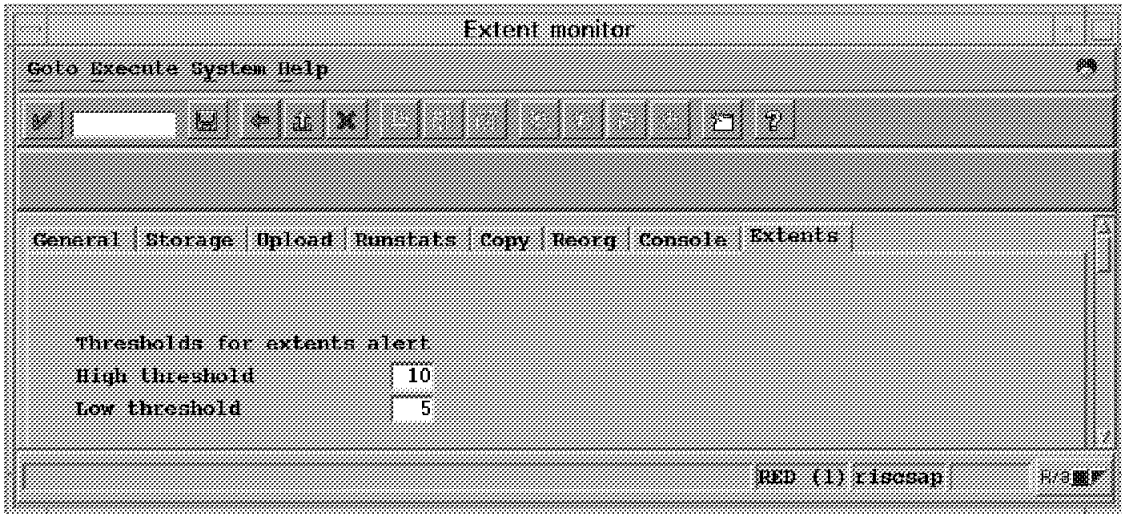


Figure 76. Extent Monitor: Change Thresholds

This allows you to set the number of extents that will be recognized as a severity one or severity two warning.

The choice of **Main screen** from the screen shown in Figure 75 on page 89 produces the screen shown in Figure 77, from which much valuable table data and index data may be obtained.



Figure 77. Database Performance: Tables and Indexes

The information displayed here shows the overall sizes of components in the SAP R/3 database.

Note the choice of **Extent monitor**, which takes you to the screen shown in Figure 75 on page 89, in case you reached this screen through another path.

The choice of **Checks** from the screen shown in Figure 77 produces the screen shown in Figure 78 on page 92.

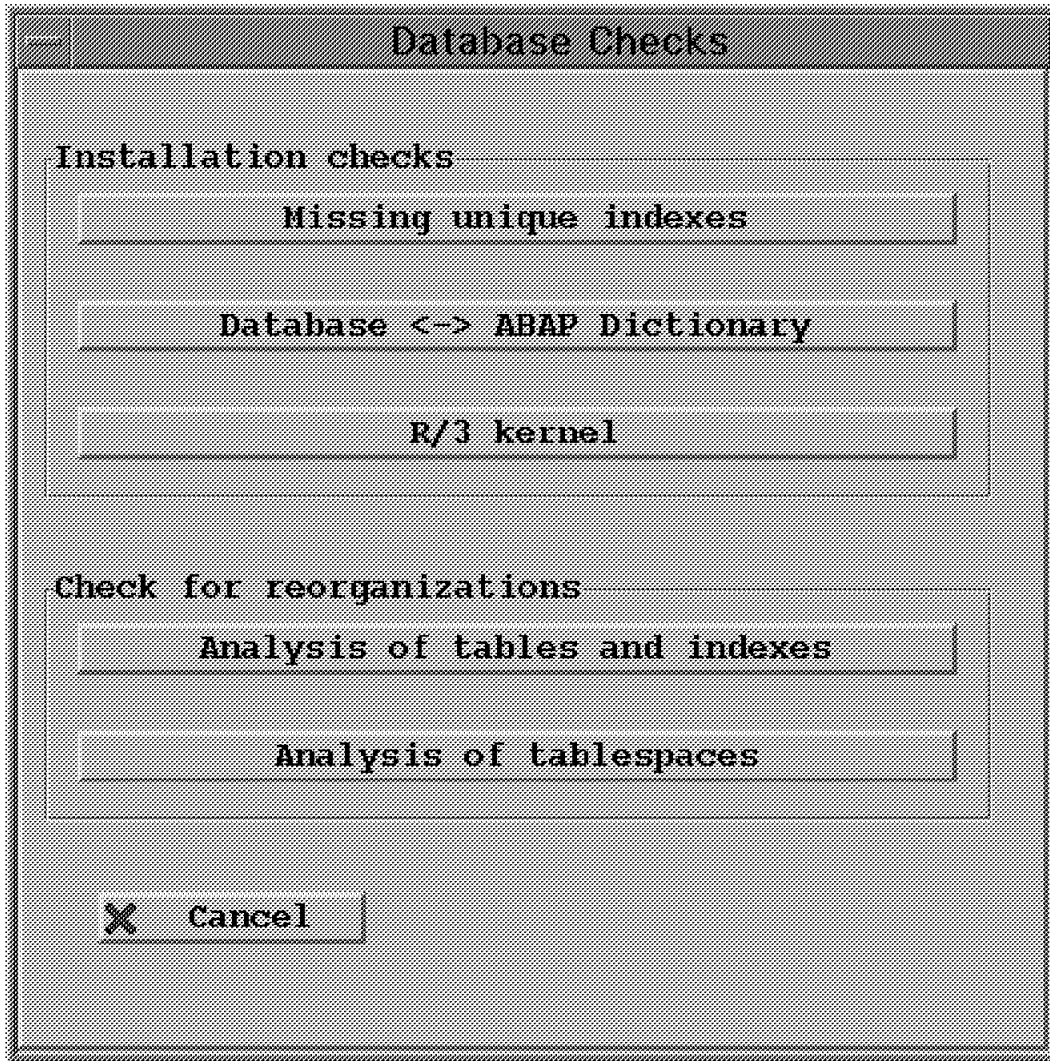


Figure 78. Database Checks

As can be seen, the choice of checks allows consistency and other internal checks to be performed, as well as checking whether reorganizations would be beneficial. To provide an example, we chose **Missing unique indexes** to produce the screen seen in Figure 79 on page 93.

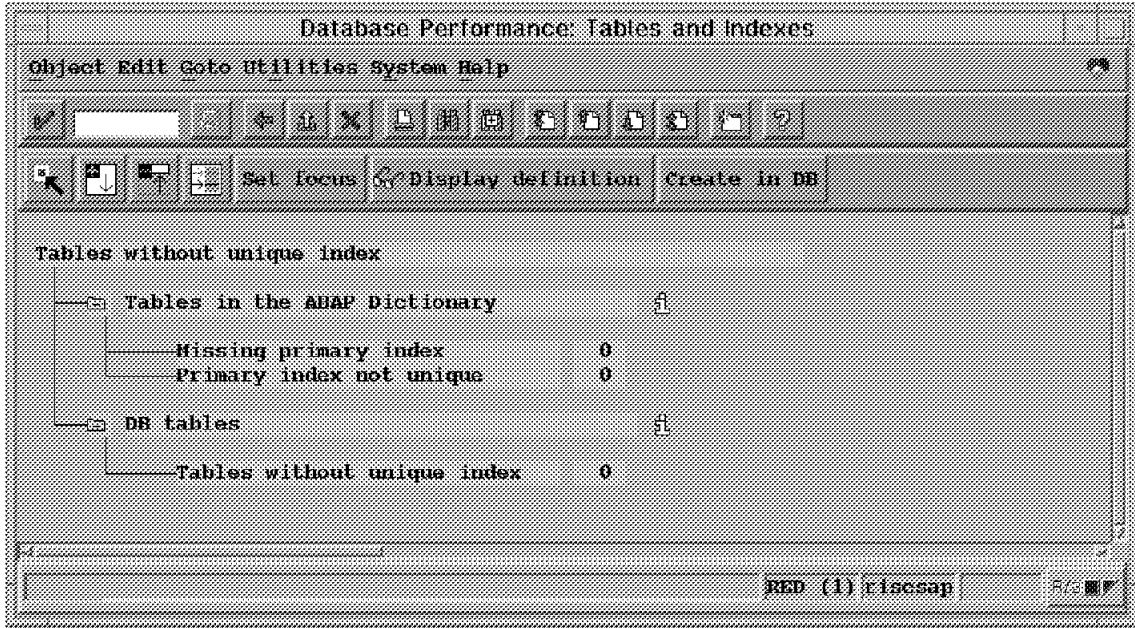


Figure 79. Tables without Unique Indexes

In the SAP R/3 system being used there are no missing indexes. This is the expected case for any SAP R/3 system.

The choice of **Volume freespace** from the screen shown in Figure 77 on page 91 produces the screen shown in Figure 80.

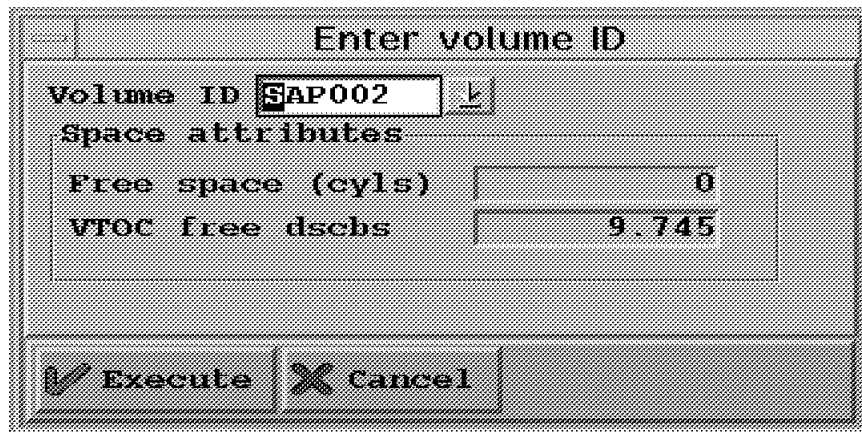


Figure 80. Volume Choice

This screen format is used as both input and output, since you choose a volume in the Volume ID box (note that SAP R/3 provides a list, displayed by using the down arrow icon); then choose the **Execute** button to cause the Free space and VTOC free dscbs data to be displayed.

The choice of **Space Statistics** from the screen shown in Figure 77 on page 91 produces the screen shown in Figure 81.

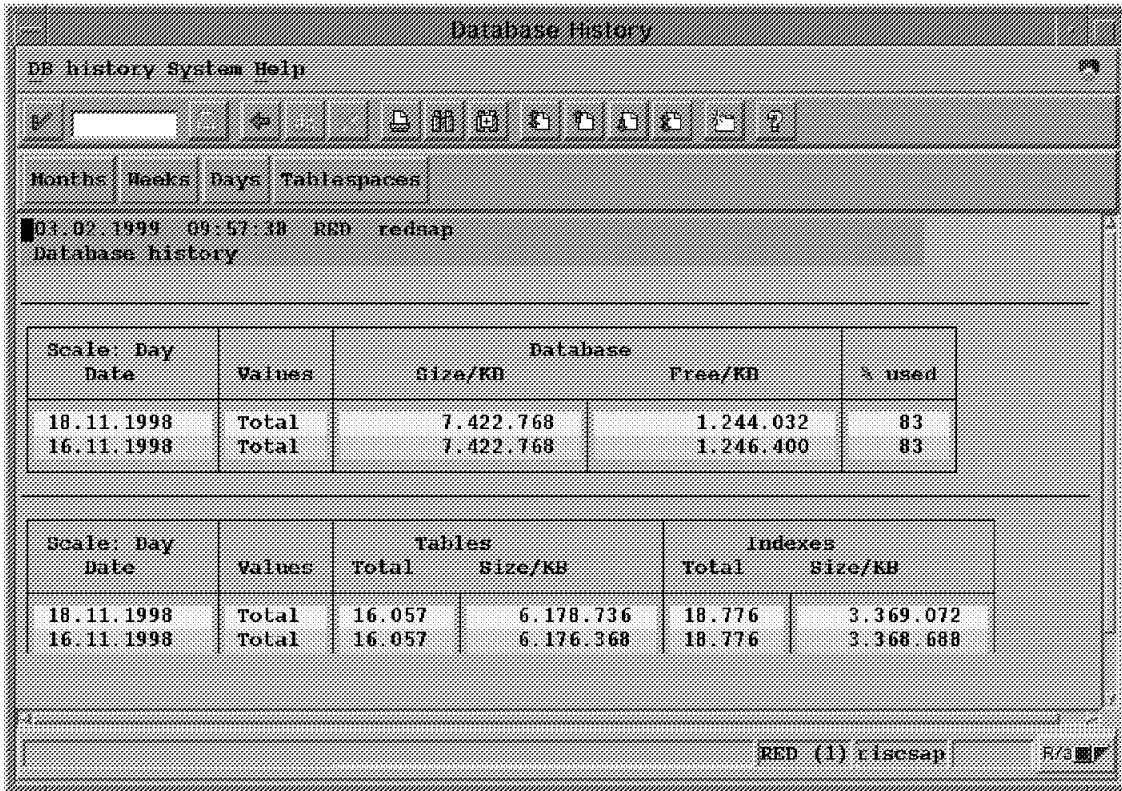


Figure 81. Database History

The system-wide size information shown has a variety of uses, one of which is to track SAP R/3 database growth.

You may choose **Tablespaces** from this screen to produce the screen shown in Figure 82 on page 95.

Tablespace History

History System Help

Select Months Weeks Days Sort

03.02.1999 10:03:00 RED redsap
Tablespace History

Interval: 16.11.1998 - 18.11.1998 Measurements: 2 Scale: Day

Tablespace	Database	Number of Partitions	Extents		Used size (KB)	
			Total	Chg/day	Total	Chg
D345T	SX30+KRS	0	2	0	2.880	
MONI	A140+EZF	0	2	0	10.560	
SNAP	A020+F26	0	2	0	960	
D010L	LD40+000	0	1	0	17.280	

RED (1) redsap

Figure 82. Tablespace History

This display shows size information and tablespace growth per day. The growth information may lead to DBA activity or to work by application designers.

The choice of **Detailed analysis** in the Tablespaces section of the screen shown in Figure 77 on page 91 produces the screen shown in Figure 83.

Tablespace	Database	Number of Partitions	Number of Extents	Used Size (KB)	Free Size (KB)
D010S	SD40+000	0	11	796.320	3.616
D010Q	LD40+7T4	0	2	12.960	8.736
D010Y	LD40+MHT	0	2	12.960	8.736
D020L	LD40+0A1	0	2	20.160	8.896
D342L	LX30+000	0	2	5.040	2.224
D345T	SX30+KRS	0	2	2.880	1.536
DB2TREQ\$	DI10+F07	0	2	288	96
DDXTF	SX30+HC7	0	2	2.880	2.544
MLI CHECK	LO10+ZZZ	0	2	432	240
MGMT	A140+EZF	0	2	10.560	8.832
SNAP	A020+F26	0	2	960	384
#SAP	A001+000	0	1	14.400	1.440
#SAP	A001+103	0	1	16.560	2.160
#SAP	A001+139	0	1	14.400	1.440
#SAP	A001+1SK	0	1	8.640	1.440
#SAP	A001+BF7	0	1	16.560	2.160
#SAP	A001+EBI	0	1	16.560	2.160
#SAP	A001+L2I	0	1	16.560	2.160
#SAP	A001+OUJ	0	1	14.400	1.440
#SAP	A002+000	0	1	18.000	2.160
#SAP	A002+4H9	0	1	14.400	1.440
#SAP	A002+9F8	0	1	16.560	2.160
#SAP	A002+1B5	0	1	10.080	1.440
#SAP	A003+000	0	1	16.560	2.160
#SAP	A011+000	0	1	19.440	2.160

Figure 83. Tablespace Analysis

The data shows specific tablespace sizes and allocations. A DBA may review this information in determining whether to make SAP R/3 tables buffered or unbuffered, although other screens (such as the one with SAP R/3 transaction ST10) may be more useful for this purpose. The screen is again retrieved to determine the effects of such a choice.

The choice of **Space Statistics** in the Tablespaces section of the screen shown in Figure 77 on page 91 produces the screen shown in Figure 82 on page 95; this is an example of reaching the same data screen through a different path.

The choice of **Detailed analysis** in the Tables and indexes section of the screen shown in Figure 77 on page 91 produces the screen shown in Figure 84.

The screenshot shows a dialog box titled "Analysis of Tables and Indexes". Inside the dialog, the text "Select for table/index analysis" is centered. Below this, there are three rows of input fields. The first row is labeled "Table" and has a small box containing an asterisk (*). The second row is labeled "Tablespace" and also has a small box containing an asterisk (*). The third row is labeled "Database" and has a small box containing an asterisk (*). At the bottom left of the dialog, there are two buttons: "OK" and "Cancel". The "Cancel" button has a small "X" icon next to it.

Figure 84. Analysis of Tables and Indexes: Choice

If you leave the * defaults in this screen and select **OK**, the screen shown in Figure 85 on page 98 is produced.

Analysis of Tables and Indexes

DB analysis Edit Goto Settings Monitor System Help

Detailed Analysis

03.02.1999 10:09:57 RED redsap
Analysis of tables 200 of 19501 table(s) displayed

Table	Created by	Database	Tablespace
A070	SAPR3	A001#000	#SAP
A071	SAPR3	A001#000	#SAP
A072	SAPR3	A001#000	#SAP
A073	SAPR3	A001#000	#SAP
A074	SAPR3	A001#000	#SAP
A075	SAPR3	A001#000	#SAP
A076	SAPR3	A001#000	#SAP
A077	SAPR3	A000#000	A077
A078	SAPR3	A001#000	#SAP
A079	SAPR3	A001#000	#SAP
A080	SAPR3	A001#000	#SAP
A081	SAPR3	A001#000	#SAP
A082	SAPR3	A001#000	#SAP
A083	SAPR3	A001#000	#SAP
A084	SAPR3	A001#000	#SAP
A085	SAPR3	A001#000	#SAP
A086	SAPR3	A001#000	#SAP
A087	SAPR3	A001#000	#SAP
A088	SAPR3	A001#000	#SAP
A089	SAPR3	A001#000	#SAP
A090	SAPR3	A001#000	#SAP
A091	SAPR3	A001#000	#SAP
A092	SAPR3	A001#000	#SAP

RED (1) ricsap

Figure 85. Analysis of Tables and Indexes: Table List

The data on this screen allows a DBA to relate a table to its containing tablespace. As can be seen by the vertical scroll bar, there is much more data produced than is shown.

Choosing a table (by clicking it), then selecting **Detailed Analysis** produces the screen shown in Figure 86 on page 99.

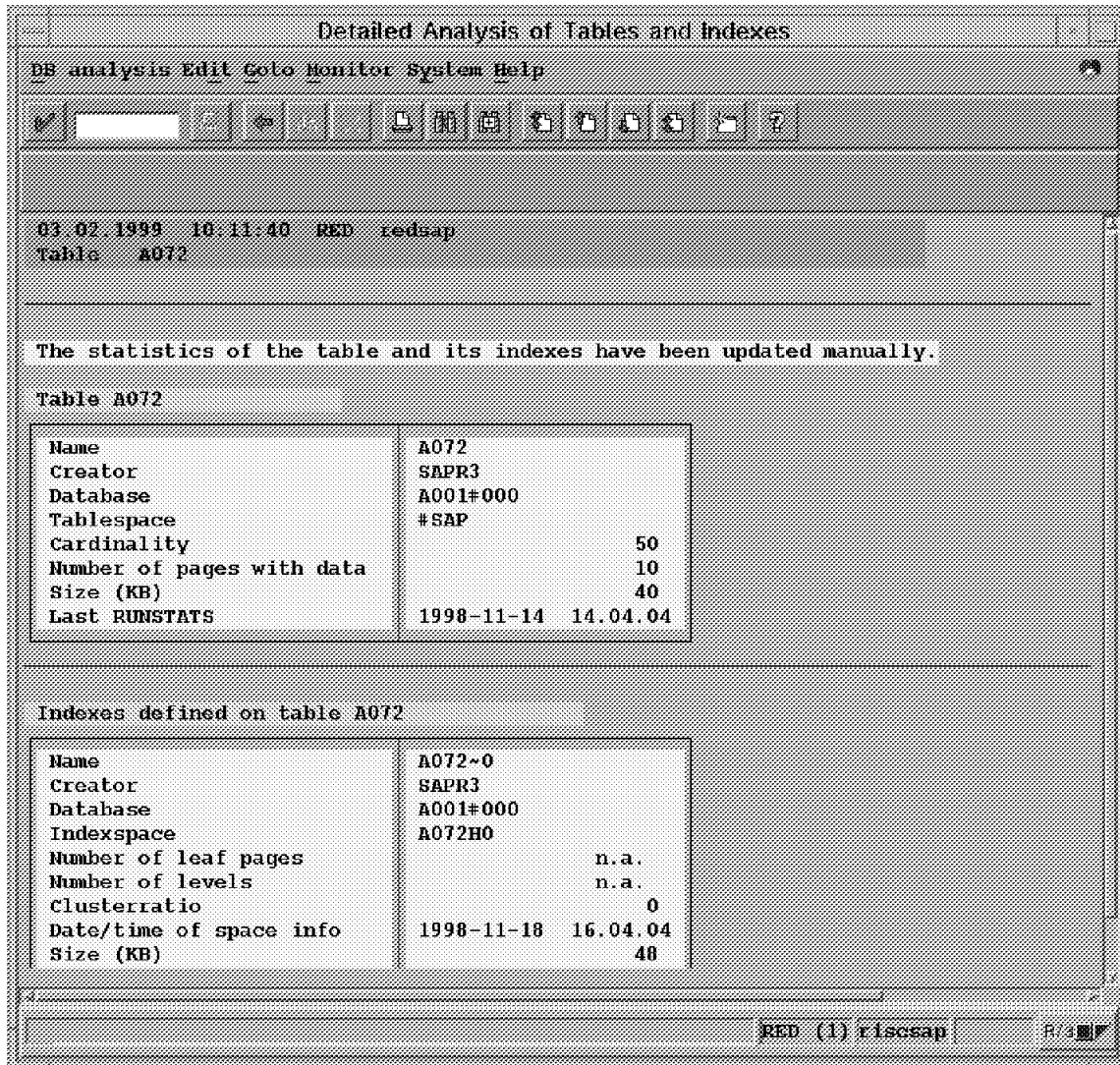


Figure 86. Analysis of Tables and Indexes: Data for a Table

The data for a specific table could lead to making the table buffered or unbuffered, to changing DB2 parameters in effect for the table, or to changing which volume is used to store the tablespace. The display is one of many a DBA might consult, SAP R/3 transaction ST10 is more often used.

The choice of **Missing indexes** in the “Tables and indexes” section of the screen shown in Figure 77 on page 91 produces the screen shown in Figure 87.

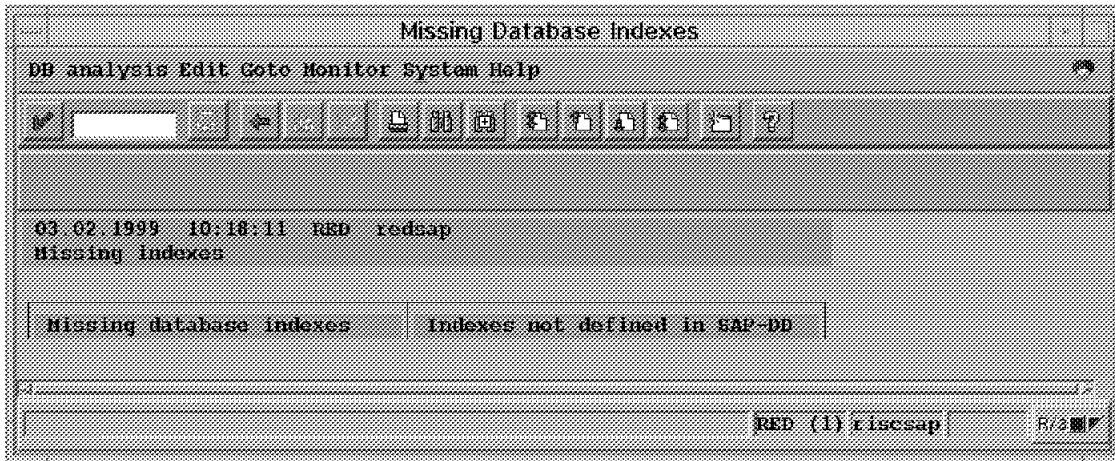


Figure 87. Missing Database Indexes

The SAP R/3 system in use has no missing indexes. This is the expected case for any SAP R/3 installation.

3.2.2 Transaction DB03

This transaction is very simple when compared to DB02. Entering the transaction from SAPGUI produces the screen shown in Figure 88.

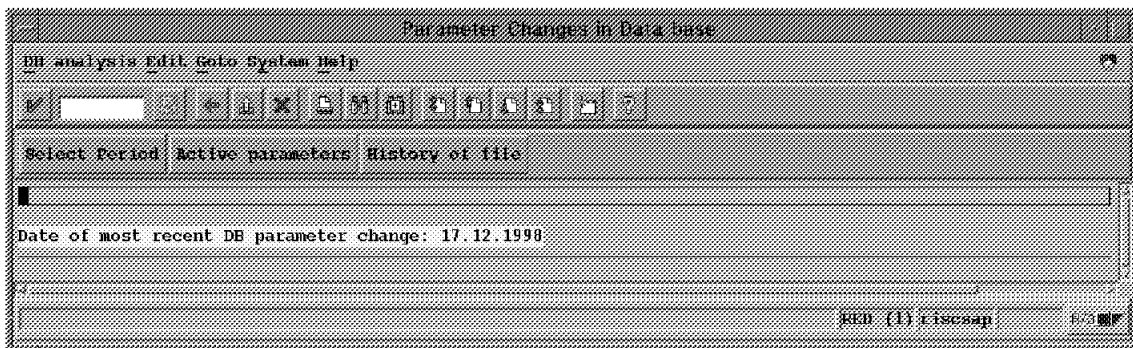


Figure 88. Parameter Changes in Database

From this screen you may choose **Active Parameters** to produce the screen seen in Figure 70 on page 85. You may choose **History of file** to see the date and time of parameter changes, or **Select Period** to see only those changes after a specific date.

3.2.3 Transaction DB05

Entering this transaction from SAPGUI produces the screen shown in Figure 89.

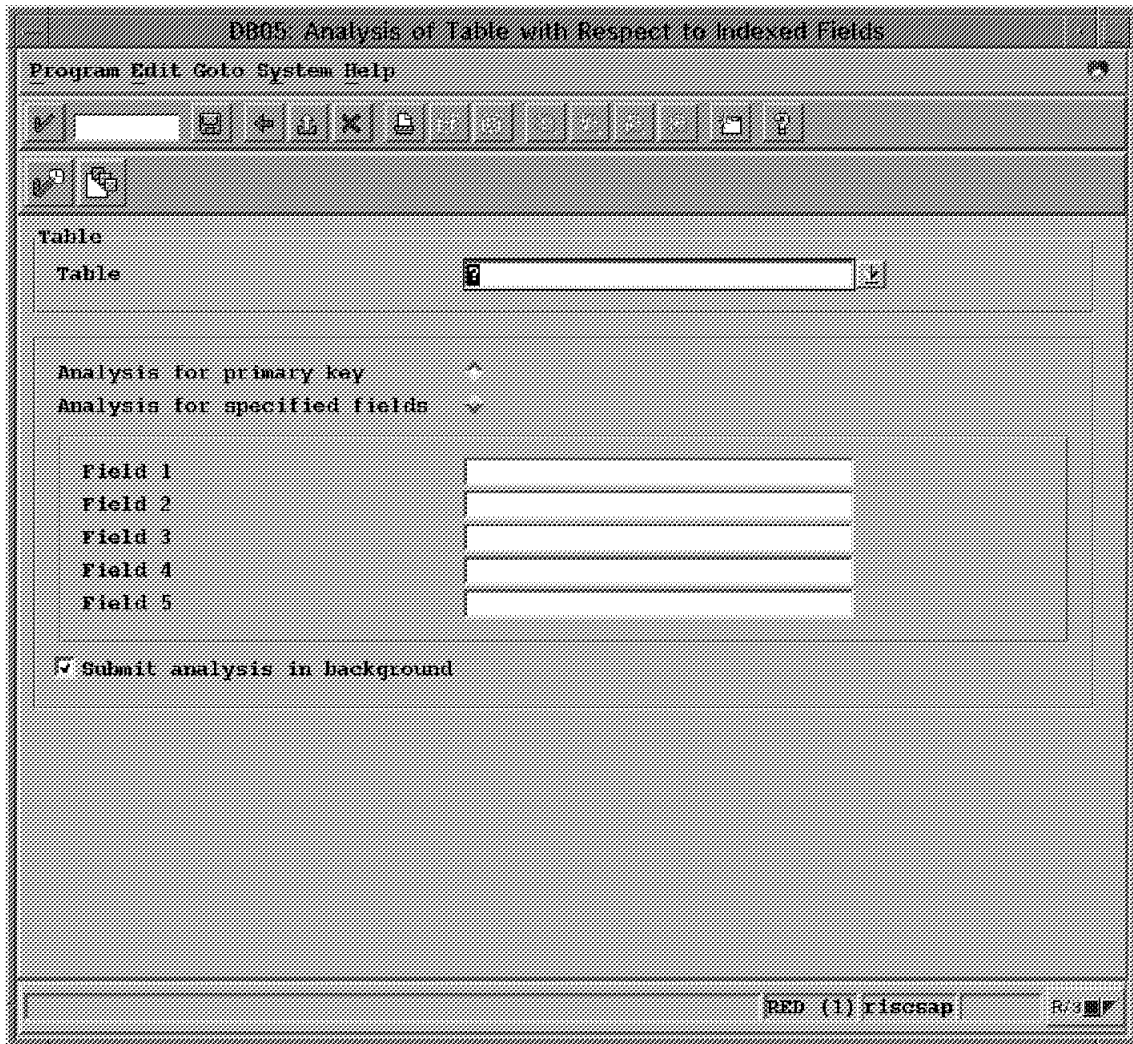


Figure 89. Analysis of Table with Respect to Indexes

Clicking the List icon (downward pointing arrow) in the table box causes the screen shown in Figure 90 on page 102 to be shown.



Figure 90. Input Help Personal Value List

This screen shows the last tables selected in your session. Choosing a table here fills in the choice box in the screen shown in Figure 89 on page 101. (If you knew a table you were interested in, you could have typed it directly in the screen). A "filled-in" screen with a chosen table is shown in Figure 91.

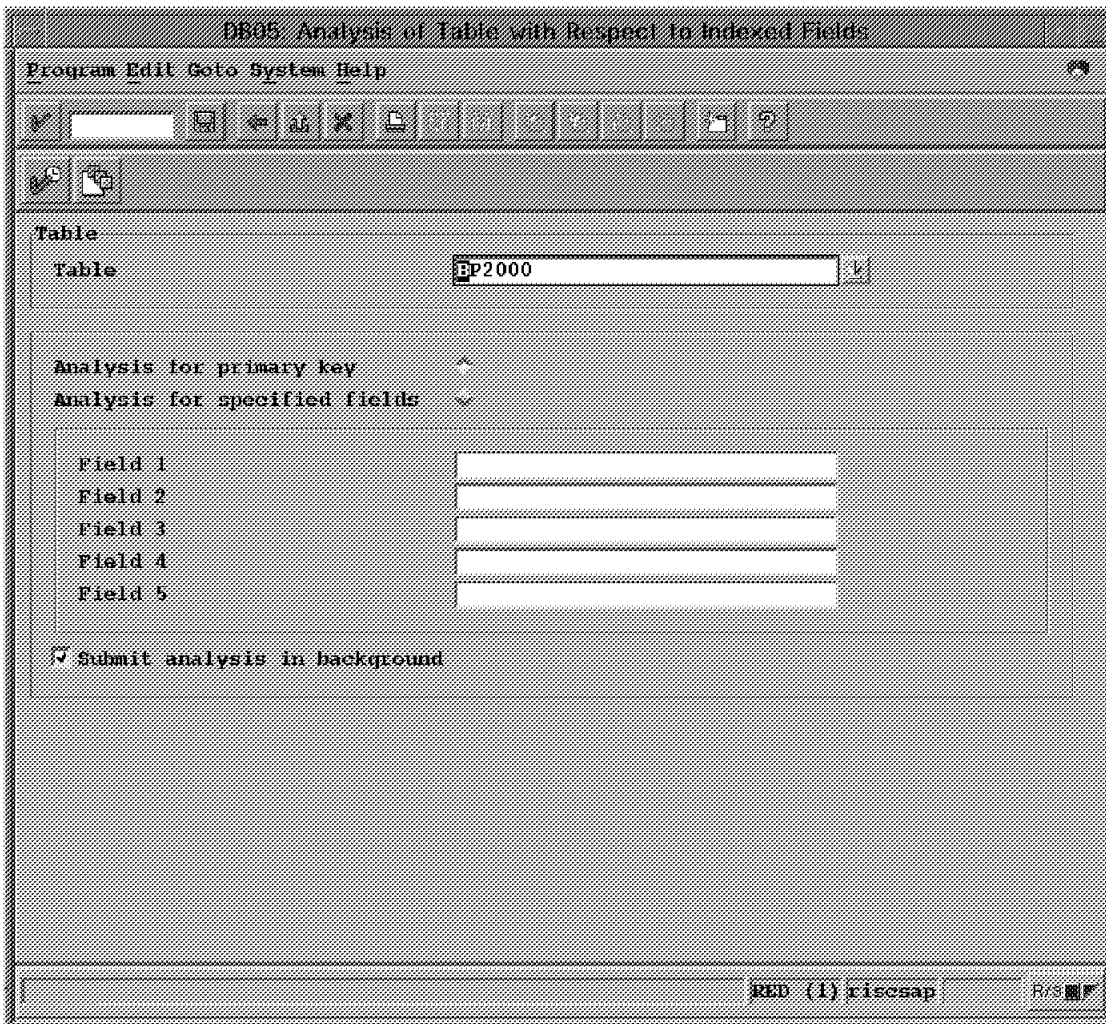


Figure 91. Table Choice: Analysis of Table with Respect to Indexes

Clicking the Execute icon (check mark with the small clock) submits the analysis request; the result is the screen shown in Figure 92 on page 103.



Figure 92. Index Analysis

This data shows the effectiveness of the indexes for a specific table.

3.2.4 Transaction DB2C

Entering this transaction allows a DBA to browse the DB2 catalog for control information. When the transaction is entered, an input screen is produced as seen in Figure 93.

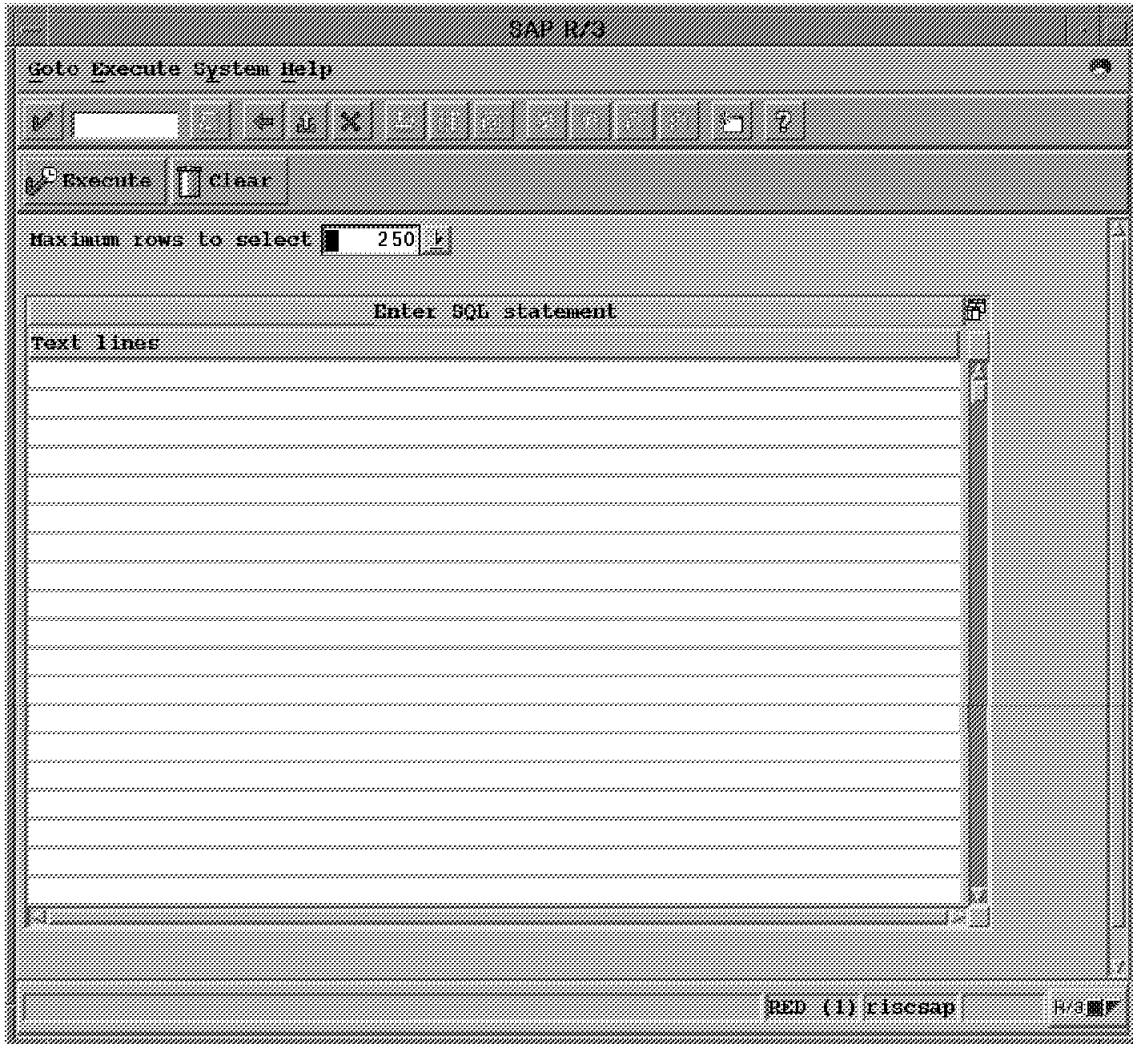


Figure 93. SQL Statement Entry

The statements entered are used to select data to be retrieved from the DB2 catalog *only*. This transaction does not perform *general* SQL queries.

3.2.5 Transaction DB2J

Transaction DB2J allows a DBA to create or modify the JCL for jobs that are submitted through SAP R/3. These jobs are used in transactions such as is seen in Figure 34 on page 54.

When the transaction is entered, an input screen is produced as seen in Figure 94.

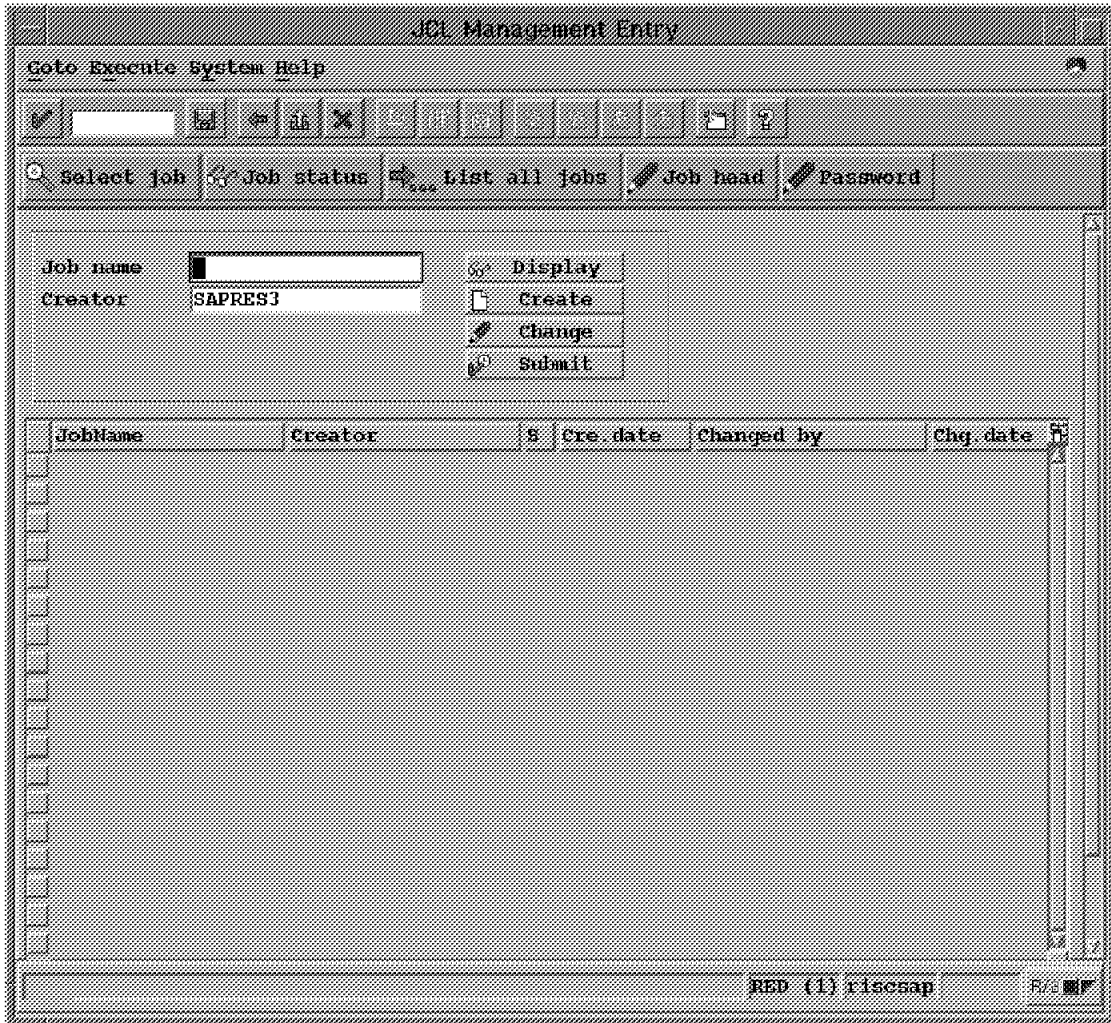


Figure 94. JCL Management Entry

You may choose **List all jobs** to see all the jobs known to the SAP R/3 system, as shown in Figure 95 on page 106.

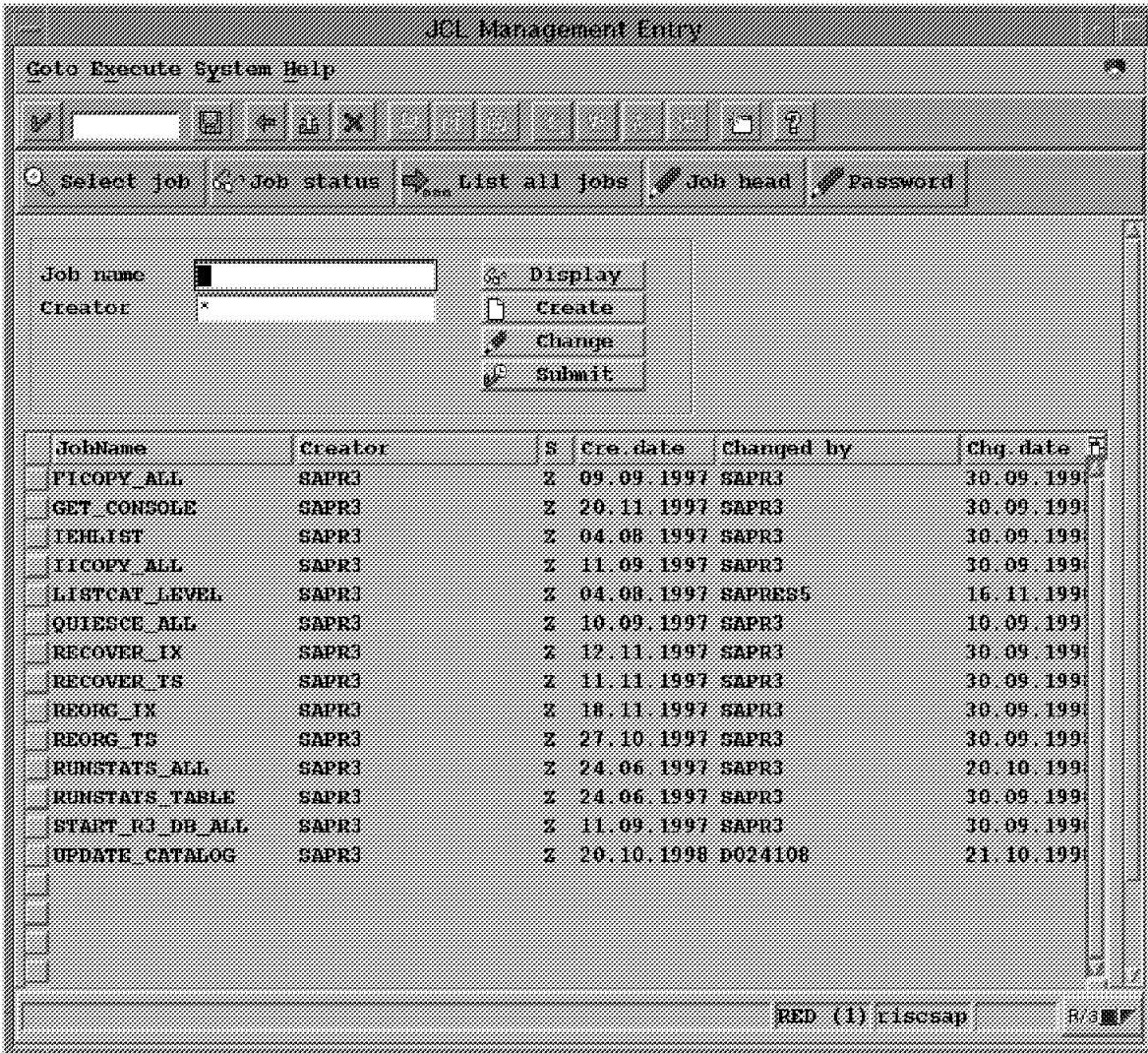


Figure 95. JCL Management Entry - All Jobs

You may then select one of the jobs to be displayed, modified or submitted. To create an example, we select is **LISTCAT_LEVEL** (by clicking the button to the left of the job name), then we click **Display** to create the screen seen in Figure 96 on page 107.

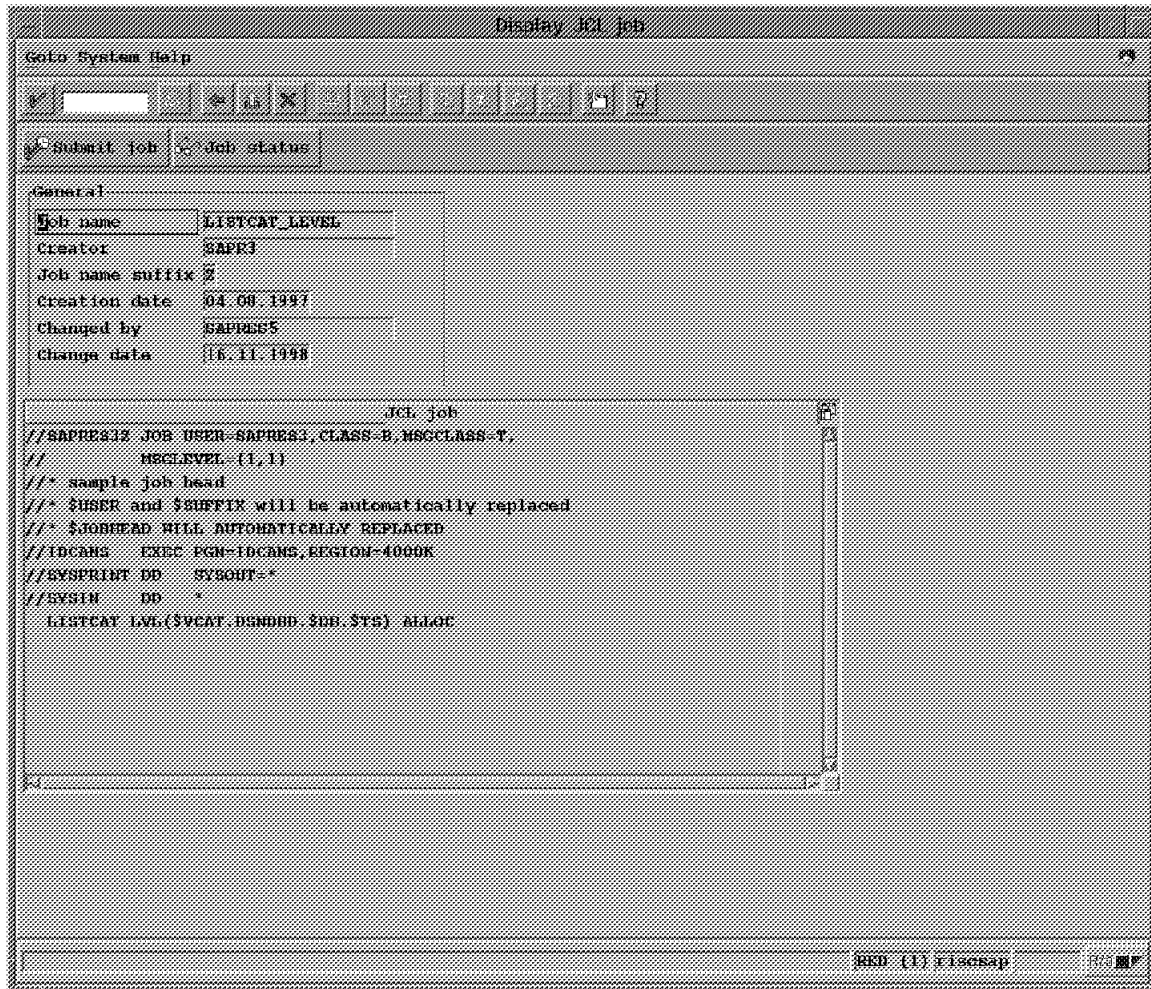


Figure 96. Display JCL Job

This shows the JCL that is to be used for the job. A DBA may modify this JCL in order to tailor it for use in a specific installation of OS/390. Another possible use is as a model in creating a different SAP R/3 job, using the **Create** button in Figure 95 on page 106.

3.2.6 ST Transactions

The SAP R/3 STx transactions contain much more than DB2 information. However, there is a great deal of general system information related to DB2 in the ST displays; this implies a DBA should be familiar with these transactions. One or more of the ST transactions could be the first step in investigating a problem or improving performance.

3.2.7 Transaction ST02

Entering transaction ST02 from SAPGUI produces the screen seen in Figure 97, from which you may investigate tuning actions.

Buffer	Hitratio [%]	Allocated [kB]	Free space [kB]	Free space [%]	Dir. size Entries	Free di Entries
Nametab (NTAB)						
Table definition	99,35	8.403	6.764	98,95	50.000	49.47
Field description	99,65	33.910	29.011	96,70	100.001	99.38
Short NTAB	99,50	6.410	2.475	99,00	100.001	99.82
Initial records	99,58	7.910	3.864	96,60	100.001	99.68
Program						
CUA	91,68	243.431	157.172	65,49	30.000	29.29
Screen	99,88	5.000	4.332	92,07	2.500	2.38
Calendar	99,82	15.625	14.877	97,18	4.500	4.34
	100,00	488	390	81,59	200	8
Tables						
Generic key	100,00	48.828	44.181	91,90	5.000	4.88
Single record	97,20	30.000	29.088	97,15	500	47
Export/import	15,38	4.096	3.743	99,84	2.000	1.99
SAP memory						
	Current use [%]	Max. use [kB]	In memory [kB]	On disk [kB]	SAP cursor	

Figure 97. Tuning Summary

Select **Current Parameters**; this will produce the screen seen in Figure 98 on page 109.

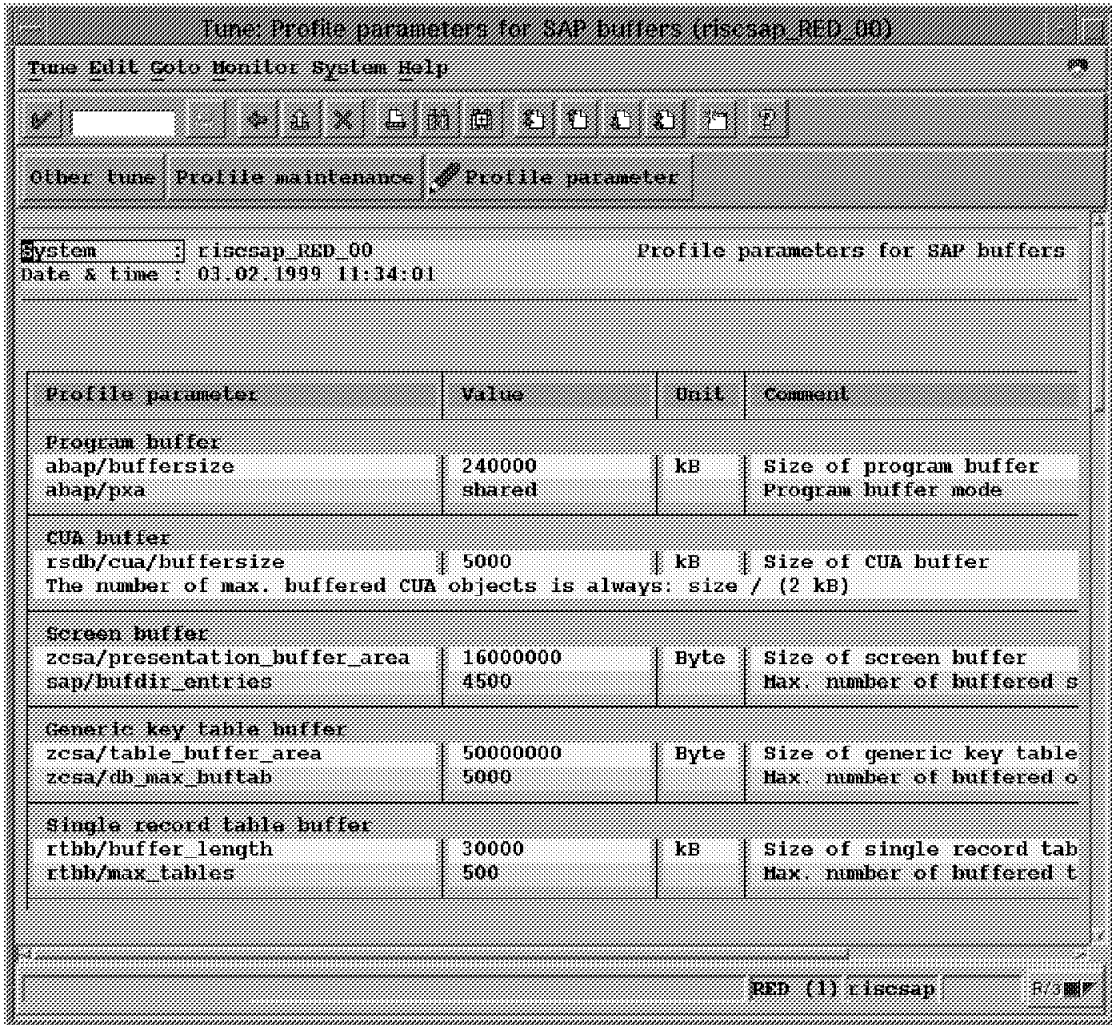


Figure 98. Tuning Profile Parameters

This is a starting point for attacking problems caused by allocating insufficient system resources to SAP R/3 functions.

3.2.8 Transaction ST03

Transaction ST03 is a powerful transaction for examining SAP R/3 workload. Entering the transaction produces the screen seen in Figure 38 on page 58.

Choosing **Performance database** from this screen produces the choice screen seen in Figure 99.

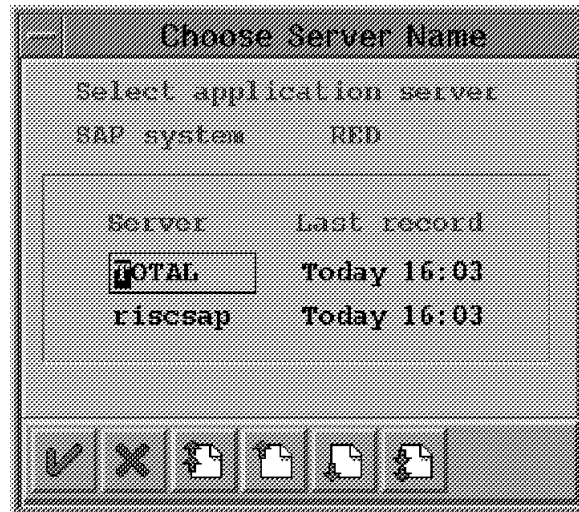


Figure 99. Choose Server Name

In our limited environment (a single SAP R/3 application server) we always choose **riscsap** to see application server data. This produces the screen seen in Figure 100 on page 111.



Figure 100. Choose Time Period

The choice of **Today** produces the workload overview seen in Figure 101 on page 112.

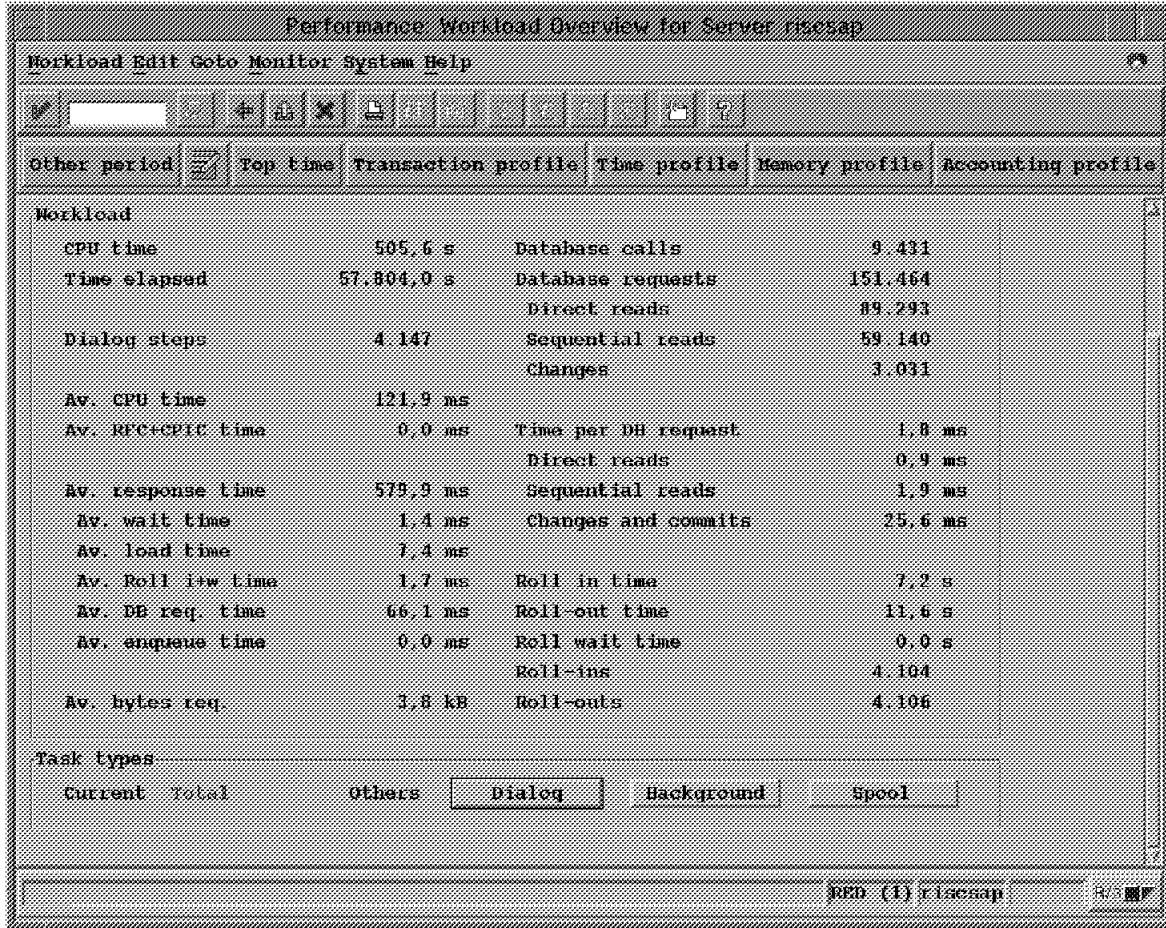


Figure 101. Workload Overview

There are many choices on this screen for looking at the data with more granularity. To create an example, our choice is **Top time**; this produces the screen seen in Figure 102 on page 113.

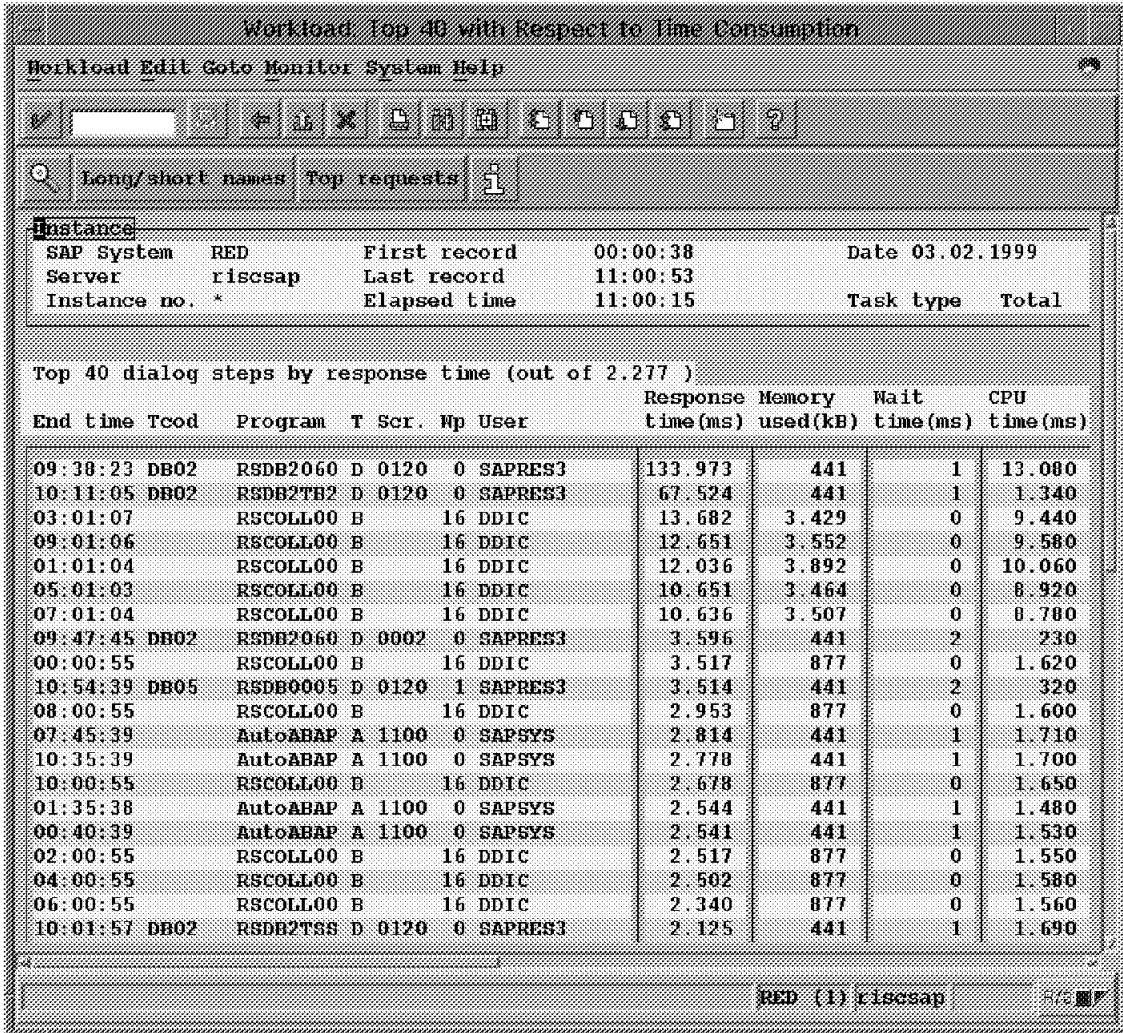


Figure 102. Workload Top 40 (Time Consumption)

This shows the dialog steps that consumed the most time during the period chosen. These are usually the candidates for tuning activities.

Another choice you may make from the screen seen in Figure 38 on page 58 is the application server name; if we select **riscsap** we see the screen shown in Figure 103.



Figure 103. Local Workload Data Choice

If we choose **Single stat. records** the selection screen shown in Figure 104 on page 115 is produced.

Single statistics records

Select statistical records
for this application server

User	<input type="text"/>
Transaction	* <input type="text"/>
Program	* <input type="text"/>
Task type	* <input type="text"/>
Work process	* <input type="text"/>
Start date	03.02.1999
Start time	11:00:00
End date	03.02.1999
End time	12:00:11
Number of recs	500
Resp. time >=	<input type="text"/> ms
DB req.time >=	<input type="text"/> ms
CPU time >=	<input type="text"/> ms
Bytes req. >=	<input type="text"/> KB
DB changes >=	<input type="text"/>

Figure 104. Statistics Records Choice

When the defaults shown in this screen are accepted, the screen shown in Figure 105 on page 116 is displayed.

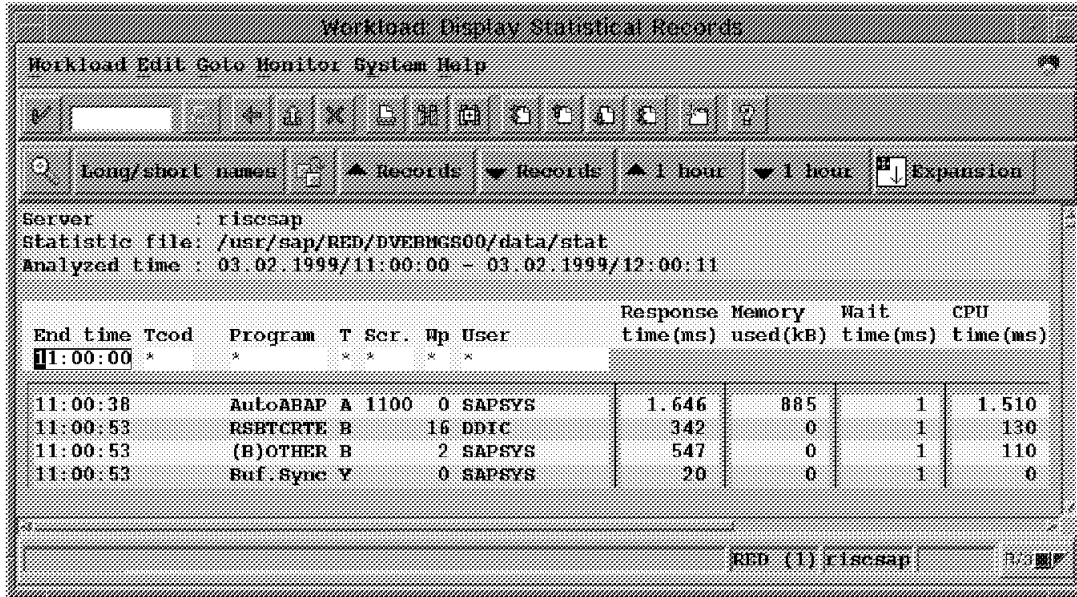


Figure 105. Workload: Display Statistical Records

As can be seen by the vertical scroll bar, there is much more data produced than is shown.

The data at this level is usually not obtained until specific information (user, transaction, time period, program, or other) regarding a problem is known. Then the related performance data can be selectively viewed.

3.2.9 Transaction ST05

Transaction ST05 allows traces to be set and the trace information to be retrieved. Entering the transaction from SAPGUI creates the screen shown in Figure 106.

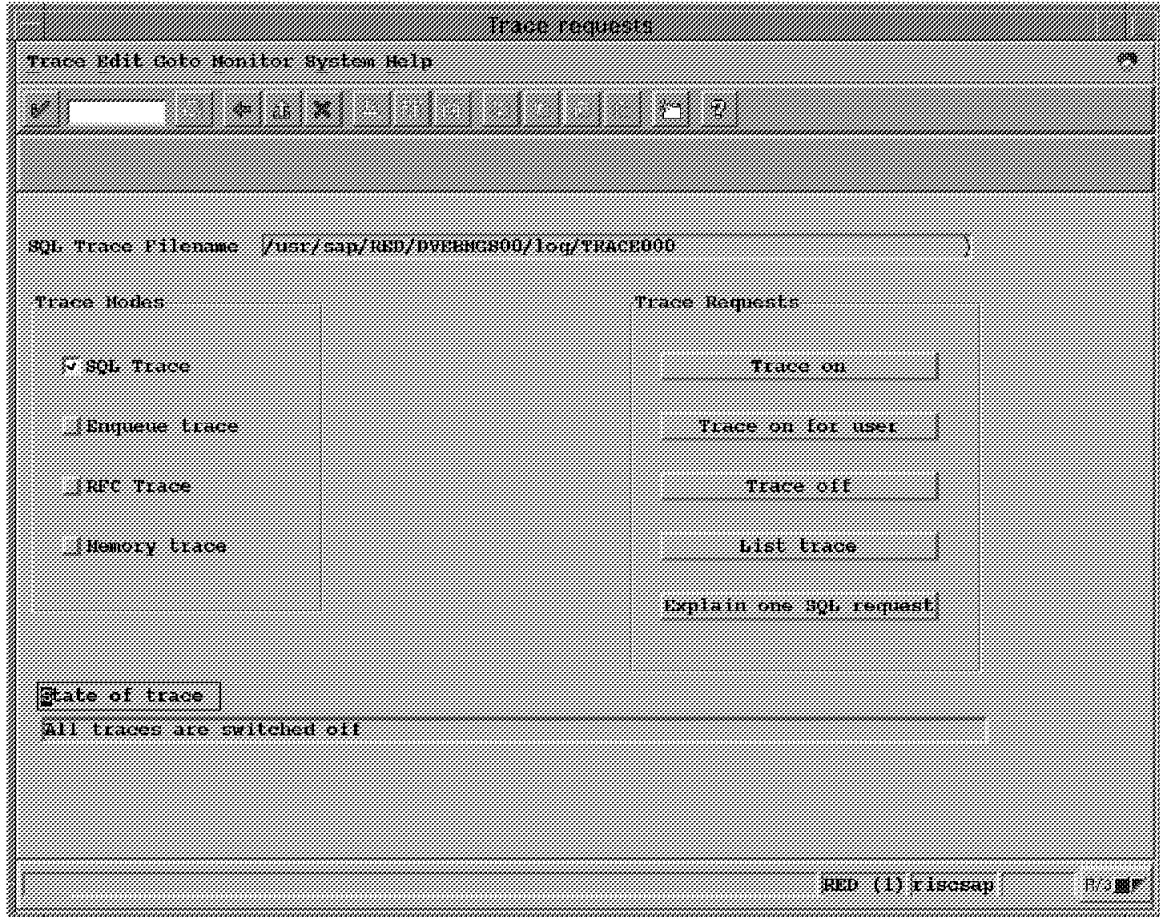


Figure 106. Trace Requests

A DBA can select **Explain one SQL request** and use this to determine the usefulness of an index in a query.

3.2.10 Transaction ST06

Monitoring transaction ST06 allows the examination of a local application server. This may not be of interest to a DBA, but it could be used to determine that a problem does not lie in database performance, rather the application server performance should be examined. Entering the transaction from a SAPGUI produces the screen seen in Figure 107.

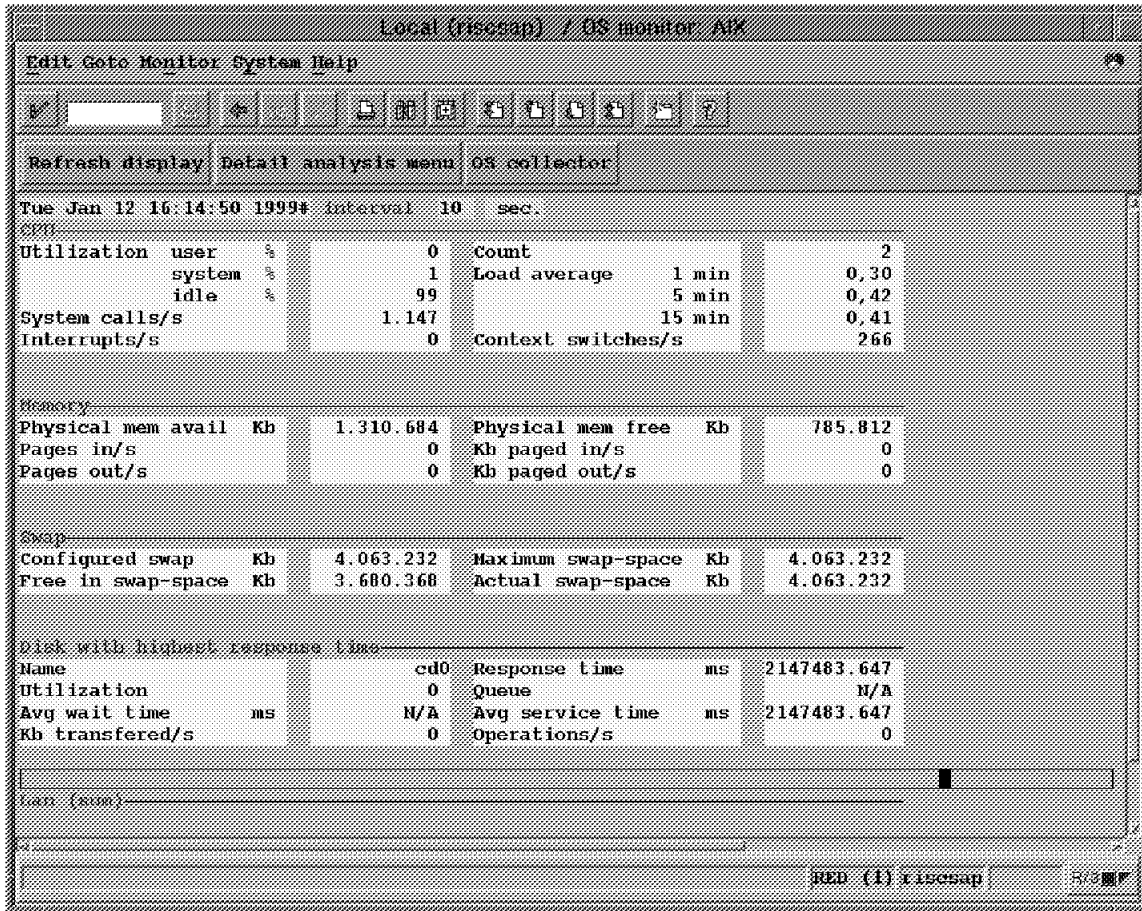


Figure 107. Local Server Monitor: General Information

Choosing **Detail analysis menu** on this screen produces the screen seen in Figure 108 on page 119.

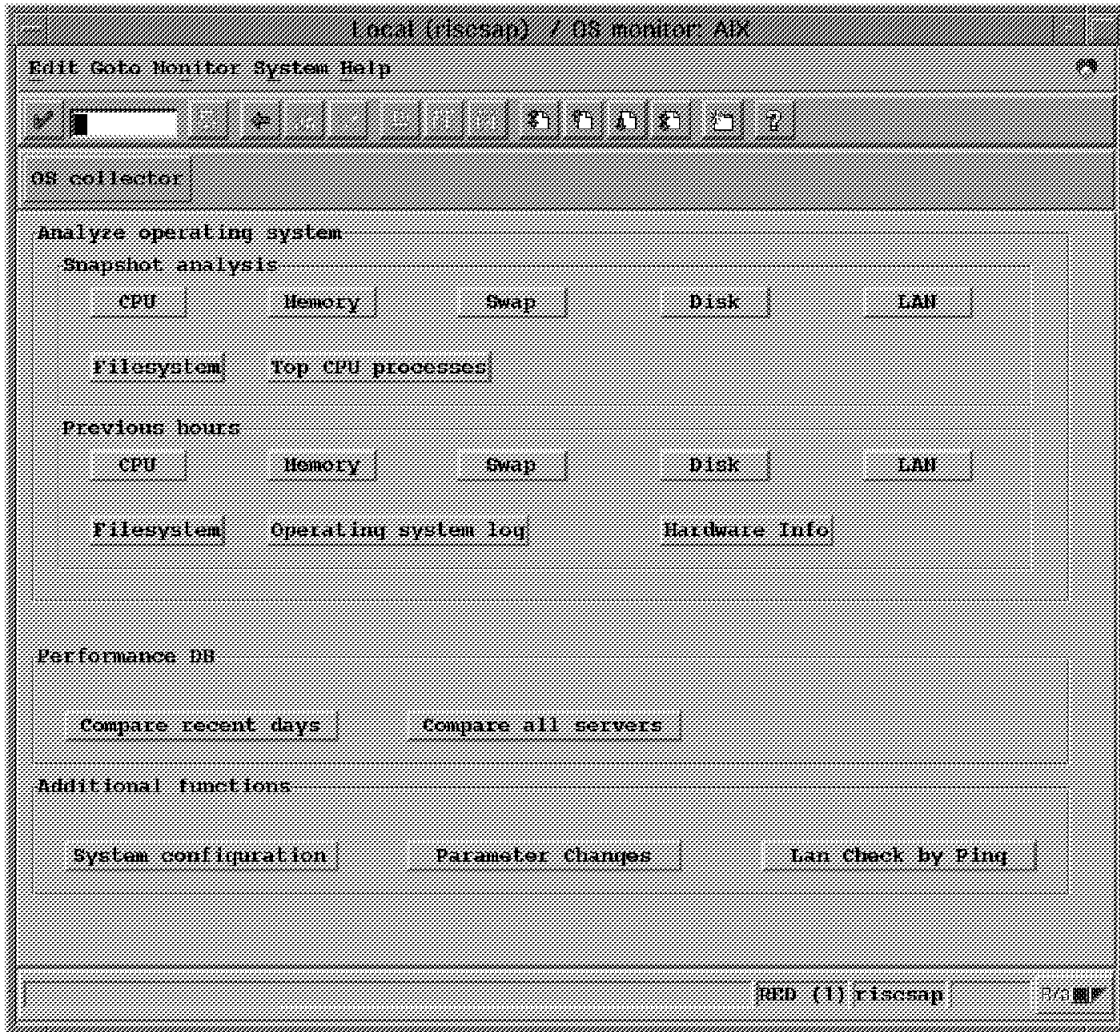


Figure 108. Local Server Monitor: Choose Detail Information

Making choices of individual items would lead to detailed examinations of tuning possibilities on an application server.

3.2.11 Transaction ST07

Transaction ST07 allows examination of performance information as it relates to users. Entering the transaction from SAPGUI produces the screen seen in Figure 109.



Figure 109. Application Monitor User Distribution

This could be a way of tracking what is being performed by a user who has placed a trouble call.

3.2.12 Transaction ST10

Transaction ST10 allows examination of table call statistics. Entering the transaction from a SAPGUI produces the screen seen in Figure 110.

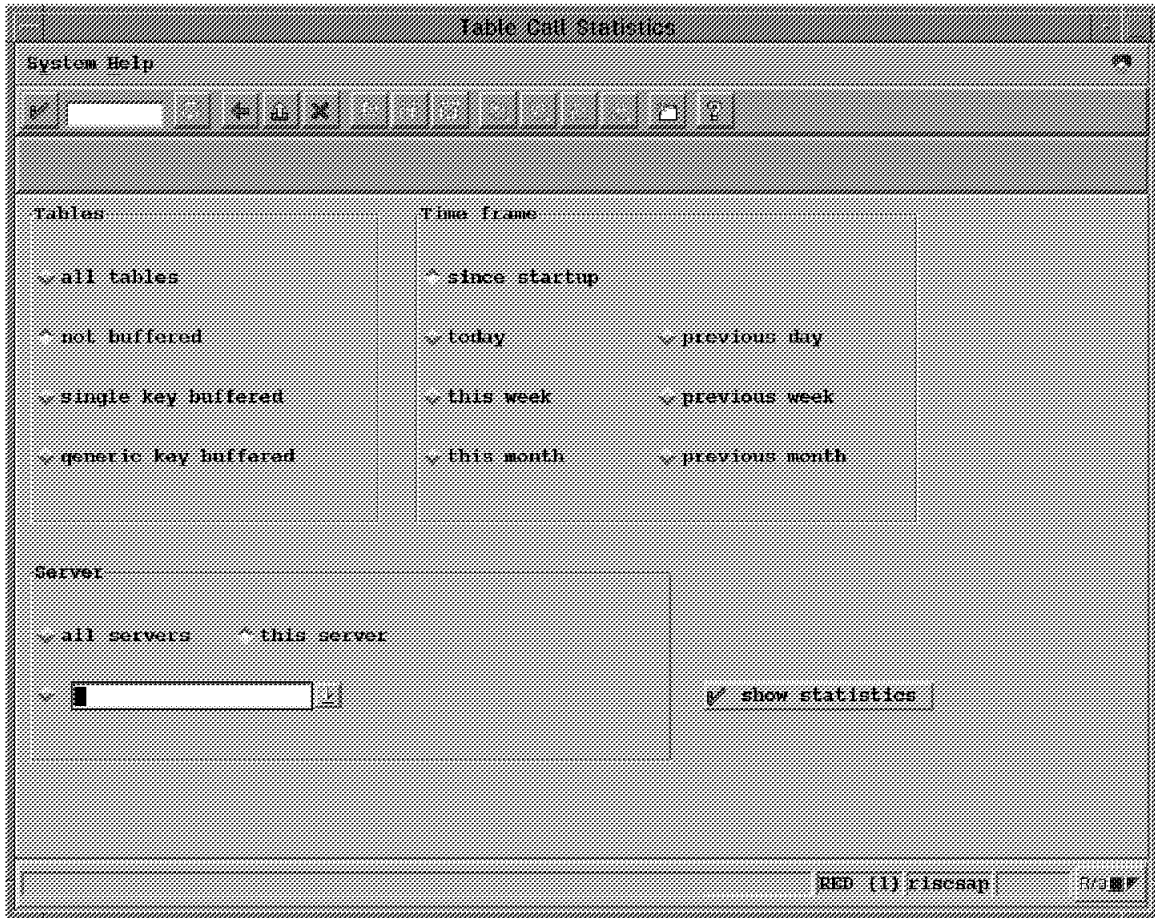


Figure 110. Table Call Statistics Choice

Choosing **generic key buffered** (clicking the choice, then clicking **show statistics**) results in the display of the screen shown in Figure 111 on page 122.

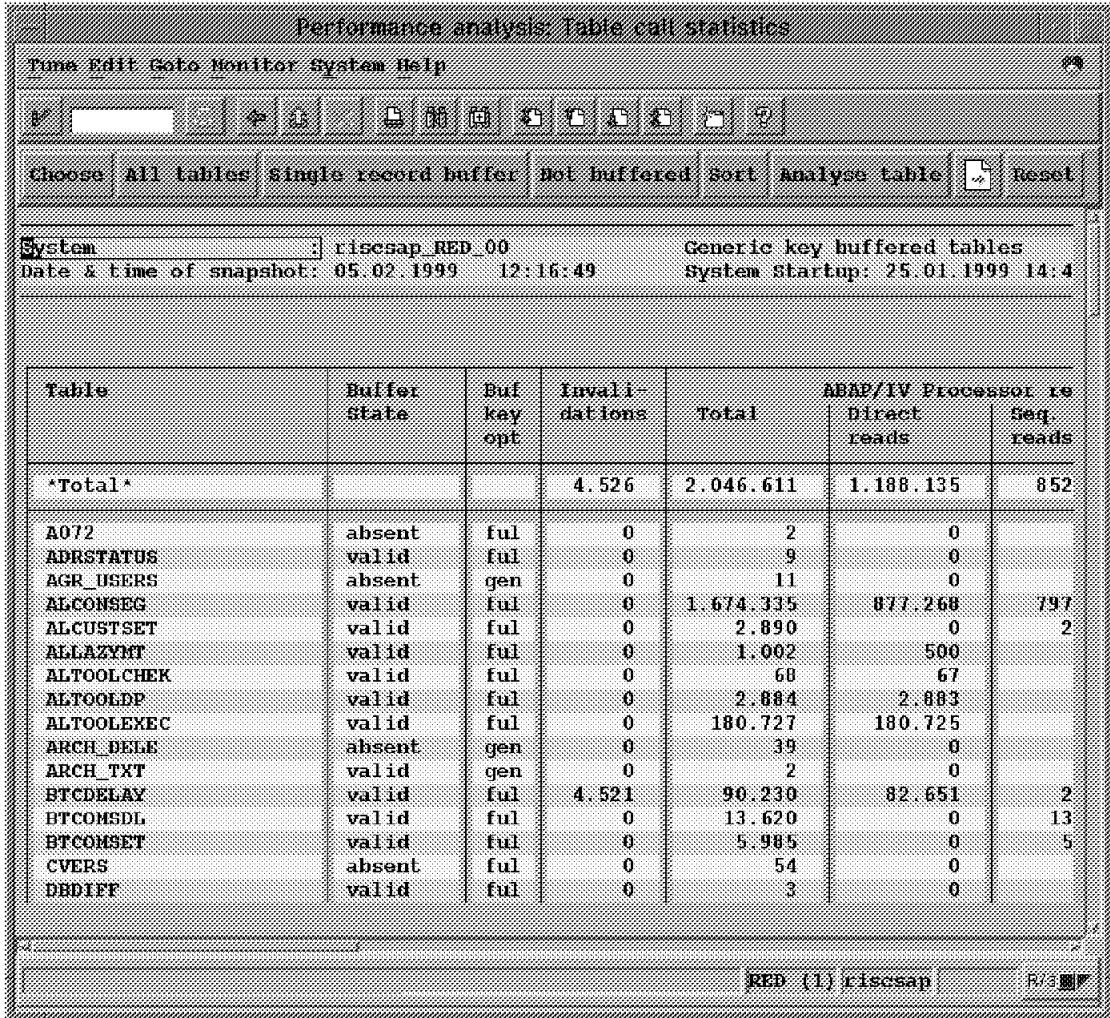


Figure 111. Table Call Statistics (Generic Key Buffered)

From this screen, choosing **All tables** results in the screen seen in Figure 112 on page 123.

Performance analysis: Table call statistics

Tune Edit Goto Monitor System Help

Choose All tables Single record buffer Hot buffered Sort Analyse table Since startup

System : riscsap_RED_00 Generic key buffered tables
 Time frame of analysis : 12.01.1999 13:00:43

Table	Buf key opt	Invalidations	Total	ADAP/IV Processor requests		Changes
				Direct reads	Seq reads	
Total		0	143.455	81.447	61.970	38
ADRSTATUS	ful	0	1	0	1	0
ALCONSEG	ful	0	120.744	62.766	57.978	0
ALCUSTSET	ful	0	216	0	216	0
ALLAZYMT	ful	0	0	0	0	0
ALTOOLCHEK	ful	0	0	0	0	0
ALTOOLDP	ful	0	216	216	0	0
ALTOOLEXEC	ful	0	13.770	13.770	0	0
HTCDELAY	ful	0	2.358	2.358	0	0
BTCONSDL	ful	0	1.080	0	1.080	0
HTCONSET	ful	0	432	0	432	0
CVERS	ful	0	2	0	2	0
DD35L	gen	0	2	1	1	0
DDFTX	gen	0	8	2	4	2
DDSHDEFSH	gen	0	2	1	1	0
DDSHVALUE	gen	0	2	0	2	0

RED (1) riscsap

Figure 112. Table Call Statistics (All Tables)

This data would lead a DBA to examine an individual table. To examine a table, choose a table at this point by clicking the table and then clicking **Choose**. The result is the screen shown in Figure 113 on page 124, statistics for calls against a single table.



Figure 113. Table Call Statistics (Single Table)

The specific table information could lead a DBA to perform parameter changes, index creation/deletion, or a number of other DB2 activities.

Chapter 4. Backup and Restore Scenarios

Database backup and restore procedures for your installation should be planned and thoroughly tested before production implementation. Indeed, the SAP R/3 installation procedure requires a full database backup when the initial database load is complete. To determine the type of backup that is required in your production environment, you must first decide what types of recovery scenarios you will support, as the type of recovery will influence the type of backup you choose to implement.

4.1 SAP R/3 and DB2 for OS/390 Architectural Comparison

There are many similarities between an SAP R/3 system on an AIX platform and an SAP R/3 system implemented on OS/390. However, there are significant differences that will affect how users manage backup and recovery operations.

4.1.1 Architectural Differences

There are two significant architectural differences between SAP R/3 implementations on a DB2 for AIX platform and a DB2 for OS/390 platform that pertain to backup and recovery:

1. From the perspective of the database administrator, an SAP R/3 DB2 for AIX database environment is equivalent in terms of application content to a DB2 for OS/390 subsystem. However, in the DB2 for AIX architecture, all SAP R/3 data is stored in one DB2 database, and the database itself is a unit of recovery. In the DB2 for OS/390 architecture, SAP R/3 tablespace data is stored in over 7200 tablespaces and a slightly smaller number of databases. The database is primarily a unit of DB2 objects that are started/stopped for availability. Recovery to currency is supported at the tablespace, index, or partition level; prior point-in-time recovery (PPR) is practical only for the entire SAP R/3 system.
2. The second major difference between these implementations is found by comparing the online and offline facilities available with the two platforms. Although the function from the perspective of the database administrator is equivalent, the implementation is different. Specifically, in an AIX implementation, an offline backup is done at the database level by stopping the SAP R/3 system; an online backup is done with the SAP R/3 system running. In the DB2 for OS/390 implementation, both types of backup are done with the DB2 subsystem running. The DB2 for OS/390 equivalent of the AIX offline backup is accomplished by use of the SHRLEVEL REFERENCE option of the COPY utility.

Important

The AIX offline backup is at the database level, and all SAP R/3 application activity is stopped for the duration of the copy. All SAP R/3 database data will be at a point of logical consistency that existed when the offline backup started. However, a SHRLEVEL REFERENCE copy for a tablespace in the DB2 for OS/390 environment will only prevent writes to the tablespace being copied, while writes to other tablespaces not otherwise stopped are allowed. Note that SAP R/3 has improved availability with Release 4.5A in this area; there are about 7000 tablespaces that contain a single table (SAP R/3 unbuffered tablespaces). Keep in mind that preventing writes in SAP R/3 for an entire buffered tablespace is nearly as bad as stopping the tablespace because chances are high that one or more of the 100 tables in the tablespace may need write access just at that time.

The DB2 for OS/390 utility closest in functional characteristics to the AIX offline backup is the DSN1COPY utility. Although the SAP R/3 AIX offline backup can copy an entire database while DSN1COPY can only copy individual files, the DSN1COPY utility can copy a DB2 for OS/390 tablespace data set when the target DB2 for OS/390 object is not available to DB2 for OS/390. Use of this utility places the entire backup management outside the control of DB2 for OS/390, with a significantly higher maintenance burden on the database administrator, as well as the potential for error that can lead to corrupted or unrecoverable data.

Important!

Refer to *BC SAP Database Administration Guide: DB2 for OS/390* (51003810) for additional information in this regard. Because of the dangers of corrupted, inconsistent, or unrecoverable data inherent with the use of DSN1COPY for backup purposes, the use of the DSN1COPY utility for operational, production system backup is *not* recommended.

4.1.2 SAP R/3 and DB2 for OS/390: Installation Differences

In an SAP R/3 on DB2 for AIX environment, the SAP R/3 R3INST installation process installs tools to perform many database administration tasks, including backup, recovery, space management, and reorganization. When SAP R/3 is installed in a DB2 for AIX environment, tools are available in SMIT via the DBADMIN option.

In the SAP R/3 on DB2 for OS/390 environment, however, the tools are provided differently (see Chapter 3, “Database Administration with SAP R/3 Transactions” on page 51) and are not the same as the DB2 for AIX tools.

Upon completion of an SAP R/3 system installation, one of the first steps is to complete a backup of the SAP R/3 system, including the DB2 for OS/390 catalog and directory databases. You have different options for backing up at the AIX level (for example, ADSM/BACKINT, SMIT. Refer to *BC SAP Database Administration Guide: DB2 for OS/390*, 51003810, for additional detail). You will also have to back up all the DB2 for OS/390 databases.

Attention

With an SAP R/3 DB2 for AIX implementation, the DBADMIN tools integrated into SMIT as part of the installation process provide facilities to perform backups as well as other database administration tasks. Similar facilities exist for SAP R/3 on DB2 for OS/390 although SMIT does not exist; see Chapter 3, “Database Administration with SAP R/3 Transactions” on page 51.

If local sites already have their own DB2 for OS/390 management and maintenance tools and procedures in place, these may be used, of course, but they must be tailored to support the DB2 for OS/390 objects that define the SAP R/3 system. The initial backup of the SAP R/3 environment is crucial, and must be completed before additional activity within SAP R/3 takes place. This backup, in the absence of completely developed procedures, may be manually prepared and run, with more elegant (and less manual) procedures to follow as experience is gained with the SAP R/3 system and as backup/recovery procedures are integrated within the structure of the local environment.

Note: Be aware that SAP R/3 can create tablespaces *as part of the operating environment*, and this must be taken into account with any backup strategy that is implemented.

4.2 Backup and Recovery for SAP R/3 Supporting Software and Files

As is the case with any software package, backup copies of system and application software must be available in the event that a recovery is required. Backup and recovery requirements for an SAP R/3 DB2 for OS/390 installation are somewhat different from traditional software packages in that the SAP R/3 application programs reside in the SAP R/3 database. Those program modules are backed up as a matter of course when the SAP R/3 database is backed up. What remains are files and executables that reside outside of the SAP R/3 database, and include:

- System software (OS/390, AIX, DB2 for OS/390)
- DB2 for OS/390 Catalog and Directory
- Central Instance/Application Servers
- Transport and Correction System

Important

To provide for effective recovery in the event of failure, any restoration must guarantee that every component in the SAP R/3 environment is logically consistent with the others in terms of the content and structure at a given point in time.

For more information on maintaining backups and planning for recovery, refer to the following publications:

- *BC SAP Database Administration Guide: DB2 for OS/390*, Material Number 51003810
- *DB2 for OS/390 V5 Administration Guide, Volumes I and II*, SC26-8957
- *R/3 Installation on UNIX: DB2 for OS/390*, Material Number: 51003808

4.3 DB2 for OS/390 Utilities

DB2 for OS/390 provides a number of utilities that will help you maintain the integrity, accuracy, and usability of your SAP R/3 system, and these utilities are more fully described in *DB2 for OS/390 V5 Utility Guide and Reference*.

QUIESCE	Establishes a point of consistency or quiesce point for one or more tablespace(s) and/or partition(s), and records it in the DB2 for OS/390 catalog. Use to establish a recovery point for point-in-time recovery. (It is <i>not</i> possible to use QUIESCE for this purpose with SAP R/3 4.5A due to the number of tablespaces limitation, see 4.5.2, "Point-in-Time Recovery" on page 133.) The quiesce point is the current log RBA, or if you are running in a data sharing environment the current Log Record Sequence Number (LRSN).
RECOVER TABLESPACE	Recovers data to currency or to a prior point in time.
RECOVER INDEX	Rebuilds indexes from the referenced table.
COPY	<p>Generates either a full or incremental copy of a tablespace or data set. A COPY done with the FULL YES option results in a complete copy; a COPY done with the FULL NO option results in a copy of only those pages that have changed since the last COPY was done.</p> <p>The COPY utility is run with either SHRLEVEL CHANGE or SHRLEVEL REFERENCE. SHRLEVEL CHANGE allows read and update access to the tablespace being copied, and bears functional equivalence to an SAP R/3 DB2 for AIX online image copy. SHRLEVEL REFERENCE prevents update access to the tablespace being copied, and bears functional equivalence to an SAP R/3 DB2 for AIX offline image copy.</p> <p>Note: One difference in the latter is that an SAP R/3 DB2 for AIX offline image copy is taken <i>after</i> the SAP R/3 system is shut down; in the SAP R/3 OS/390 implementation, DB2 for OS/390 must be running, although the SAP R/3 application servers may or may not be shut down.</p>
MERGECOPY	Merges incremental image copies produced by the COPY utility into a single incremental image copy, or merges a full image copy with incremental image copies to produce a new full image copy.
CHECK DATA	Checks tables for violations of DB2 for OS/390-maintained referential constraints. (Referential integrity in SAP R/3 is SAP R/3-maintained; DB2 for OS/390 referential integrity is not used. Therefore, your procedures will not require CHECK DATA.)
CHECK INDEX	Verifies whether indexes are consistent with the indexed data. Within your normal procedures you will not run CHECK INDEX.

4.3.1 Additional Notes on COPY

The COPY utility has other options that are available to give you greater flexibility in how you manage your environment. The CHANGELIMIT option of COPY provides you with the ability to determine the level of change to a tablespace that is required before any type of image copy is required. The REPORTONLY option provides you with the ability to execute the COPY utility to determine whether your CHANGELIMIT thresholds have been crossed without an image copy being done.

Additional planning information for database backup and recovery may be found in section 4 of *DB2 for OS/390 V5 Administration Guide, Volumes I and II*.

4.4 Backup Alternatives

Backup copies of DB2 for OS/390 tablespaces are generated to enable recovery in one of two ways:

Recover to Currency

Recovery to Currency is used to recover one or more tablespaces or indexes through the last committed unit of recovery before a failure occurred; for instance, if a DASD device is lost, only the DB2 objects resident on that device must be recovered.

This type of recovery is, by its nature, considerably less complicated and time-consuming than a point-in-time recovery. It usually encompasses a considerably smaller number of DB2 for OS/390 tablespaces and indexes, and it is generally accomplished by a straightforward invocation of the RECOVER utility. You need to recover only the damaged objects.

Point in Time

A point-in-time recovery is defined as a logically consistent restoration of a logically related set of objects to a specific moment of time. For example, if you are required to do a point-in-time recovery to 9:30 a.m., September 16, your result should reflect the exact state of *every* logically related database component as of that point in time.

Attention

In R/3, unless you *definitely* know otherwise, you should assume that there is only one logically related set of objects: *all* the R/3 databases and the associated DB2 subsystem catalog and directory.

Important

The use of ADSM is not an alternative at this point, as ADSM does not currently support the backup of DB2 for OS/390 tablespaces.

4.4.1 The COPY Utility

In the DB2 for OS/390 environment, the COPY utility operates at the tablespace, partition, or data set level. When you use COPY for backup, DB2 for OS/390 maintains a record of COPY activity in the DB2 for OS/390 catalog, and coordinates restoration when the RECOVER utility is used. There are several options available when using the COPY utility:

- COPY FULL YES** Performs a full image copy. This provides a complete copy of the entire tablespace, partition, or data set, and may be used in either a Recover to Currency or a point-in-time recovery. Depending on circumstances, additional items may be needed to perform the desired recovery. These items may include incremental copies and the log. A complete description is in *BC SAP Database Administration Guide: DB2 for OS/390, 51003810*.
- COPY FULL NO** Produces an incremental image copy. An incremental image copy contains copies of only those pages that have changed since the last image copy.
- A user-selected percentage of pages may optionally be specified, in which case the image copy will only be taken if the user-selected threshold is exceeded. Image copies are used for either a point-in-time recovery or recover to currency, subject to restrictions listed in *DB2 for OS/390 V5 Administration Guide, Volumes I and II*.
- Also, the MERGECOPY utility is used to combine the results of incremental image copies, or to combine the results of a full image copy with one or more incremental image copies.
- COPY CONCURRENT** The concurrent option invokes DFSMS Concurrent Copy. Specific hardware and software requirements for concurrent copy are documented in *DB2 for OS/390 V5 Administration Guide, Volumes I and II*.
- If you attempt this type of backup without the necessary hardware and software in place, you may receive a message similar to the following:
- ```
DSNU409I - DSNUBBUM NO HARDWARE SUPPORT FOR TABLESPACE
dbname.tsname
```

A major advantage of the COPY utility is that DB2 for OS/390 records backup activity in the DB2 for OS/390 catalog, and uses this information in the event that recovery is required.

### 4.4.1.1 COPY with Read/Write Access Using SHRLEVEL CHANGE

The COPY utility, when invoked with the SHRLEVEL CHANGE option, will permit read/write access to the tablespace being copied. This option of the COPY utility is functionally equivalent to an online image copy in a DB2 for AIX environment.

**Important**

When the SHRLEVEL CHANGE option of COPY is used, the COPY can be “fuzzy” with change activity that can include partial units of recovery. If this image copy is later required for a recovery operation, log activity will be applied by DB2 for OS/390 to bring the tablespace to consistency.

The SHRLEVEL CHANGE copy can be used for a valid point-in-time recovery since application of the DB2 for OS/390 log (which occurs with the recovery operation) restores the consistency.

#### 4.4.1.2 COPY - No Write Access: SHRLEVEL REFERENCE

When invoked with the SHRLEVEL REFERENCE option, COPY prohibits update access to the tablespace, but read access is allowed for users. This type of COPY operation is equivalent to an offline image copy in an DB2 for AIX environment, with the notable exception that users can continue read access during COPY execution. In a DB2 for AIX implementation, concurrent query access is not possible during an offline backup.

**Important**

When the SHRLEVEL REFERENCE option of COPY is used, the point of consistency for the tablespace is at the point in time that the COPY begins, since DB2 for OS/390 will not permit modification to the tablespace for the duration of the COPY. As with the DB2 for AIX implementation, a tablespace copied in this manner is logically consistent at the time that the copy began.

Point-in-time recovery in an SAP R/3 environment effectively requires recovery of all tablespaces in the subsystem to a point of consistency. SHRLEVEL REFERENCE copies are not appropriate for recovery of multiple tablespaces to a point in time. Although each copy is consistent (there are no partially committed units of recovery), the multiple SHRLEVEL REFERENCE copies may be inconsistent across copies. For example if a unit of recovery updates Table1 and Table2, and Table1 is copied *before* the update is committed while Table2 is copied *after* the update is committed - the copy of Table1 is inconsistent with the copy of Table2 when both copies are used for point-in-time recovery.

#### 4.4.2 DSN1COPY - No Concurrent Access

The DSN1COPY utility is used to copy tablespaces and indexes at the underlying data set level. DSN1COPY operates outside the control and tracking of DB2 for OS/390; this is an important reason why it should not be used in conjunction with SAP R/3. In particular, DSN1COPY can restore indexes on tables without scanning the indexed table *if, and only if*, the DSN1COPY-generated copies of the index data sets correspond *exactly* with the tablespaces that you want to restore.

**Attention**

DSN1COPY should *not* be used for normal backup and recovery, based upon the very real potential for damaged, corrupted, or unrecoverable data due to logical inconsistencies. Implications involving the potential use of DSN1COPY are described 4.5.2.3, “Why You Might Want to Do a Point-in-Time Recovery” on page 135 and 4.5.2.4, “Why You Might Not Want to Do a Point-in-Time Recovery” on page 135.

DSN1COPY is *not* recommended for SAP R/3 backup and recovery. Refer to *BC SAP Database Administration Guide: DB2 for OS/390* (51003810) for additional information.

Using DSN1COPY has several disadvantages, the most important of which is that copies of DB2 for OS/390 tablespace data sets are invisible to DB2 for OS/390 and SAP R/3. No record of DSN1COPY activity is carried in the DB2 for OS/390 catalog, and no record of DSN1COPY is available with SAP R/3 transaction DB04. The consequence of this is that if you choose to manage your point-in-time recovery using DSN1COPY, it is your responsibility to manage the process completely.

#### 4.4.3 OS/390 DFSMSdss (Data Set Dump/Restore)

Using OS/390 DFSMSdss (hereafter referred to as DSS) can also provide a viable method for point-in-time recovery by restoring an SAP R/3 environment at the device level. Every device involved in the SAP R/3 system must be copied and restored.

**Note:** This should be done when DB2 for OS/390 is down, or when all objects are stopped. Provision must also be made for system data sets, (such as the system catalog) that could be updated. There is a logical implication that *all* system activity (non-SAP as well as SAP R/3) is stopped.

---

### 4.5 Recovery Alternatives

There are two distinct types of recovery you may be required to perform:

1. Recover to currency
2. Point in time

#### 4.5.1 Recover to Currency

Recover to currency is the activity required to restore a DB2 tablespace or index to the last complete unit of recovery. For example, this type of recovery would be necessary in the event of a device failure; the DB2 for OS/390 tablespaces or indexes on the device would require recovery.

In contrast to a point-in-time recovery, the normal recover-to-currency process is a much more straightforward task, and typically involves a smaller number of objects. If, for example, you defined your DB2 for OS/390 tablespaces on different devices from your DB2 for OS/390 indexes, a failure involving the device upon which tablespaces reside would require only the tablespaces to be recovered - the indexes would remain consistent with the data because once the device failure rendered the underlying tablespace data inaccessible, the indexes would not be subject to change. Thus, when the data is recovered, the indexes would correspond to the data.

#### 4.5.1.1 Levels of Recovery

Although DB2 for AIX and DB2 for OS/390 both allow recovery, the operation for SAP R/3 is different.

**Database Recovery:** A DB2 for AIX system is backed up and recovered at either the database level or the tablespace level. In contrast, the SAP R/3 database in a DB2 for OS/390 environment is neither backed up nor recovered at the DB2 for OS/390 database level. Rather, image copies are taken at the tablespace, partition, or data set level. Recovery of the DB2 for OS/390 databases that make up an SAP R/3 database, therefore, is not done at the database level, which is also in contrast with the DB2 for AIX implementation.

**Tablespace Recovery:** Both a DB2 for AIX system and a DB2 for OS/390 system can be backed up and recovered at the tablespace level. DB2 for OS/390 provides an additional level of granularity by allowing backup and recovery to occur at the partition level. Refer to *DB2 for OS/390 V5 Utility Guide and Reference* for details.

### 4.5.2 Point-in-Time Recovery

A point-in-time recovery is a task considerably more complex and time-consuming than a recover to currency. Many more objects are involved. This creates a corresponding increase in the complexity of the operation, as well as in the time it may take to complete it.

#### 4.5.2.1 Planning for a Point-in-Time Recovery

If you plan to do a point-in-time recovery, you must consider the factors in the following sections.

#### 4.5.2.2 Establishing a Point of Consistency

Point-in-time recovery is done to a point of consistency or quiesce point, and a quiesce point can be established in one of three ways:

1. Using the ARCHIVE LOG command
2. Using the QUIESCE utility

This utility is *not* useable with SAP R/3 4.5A; see the discussion that follows.

3. Using the STOP DB2 command

All three options will provide a quiesce point, but there are significant differences between the options.

#### ARCHIVE LOG Command

This DB2 for OS/390 command performs the following functions:

1. Truncates the current active log data sets
2. Starts an asynchronous task to off-load the data sets
3. Archives previous active log data sets not yet archived
4. Returns control to the user (immediately)

The ARCHIVE LOG command has an option that allows modification of the amount of time the command will run before a timeout occurs (the default timeout value is specified in DSNZPARM). This affects user access. If the MODE(QUIESCE) option is used, DB2 for OS/390 will attempt to establish a system-wide point of consistency by

suspension of all user update activity prior to the off-load process (that is, when all active update users have reached a commit point). Newly-started user update activity is not allowed during the time the command is running. The TIME parameter allows you to override the default timeout value by extension (or reduction) of the length of time that DB2 for OS/390 has to complete the command, and the WAIT option is used to direct DB2 for OS/390 to wait for quiesce processing to complete before returning control to the invoking console.

The ARCHIVE LOG MODE(QUIESCE) command, upon successful completion, will post the system-wide quiesce point (current log RBA) to the bootstrap data set (BSDS).

#### **QUIESCE Utility**

This utility is used to establish a quiesce point for one or more tablespaces.

Because of the internal relationships maintained between tables in SAP R/3, a point-in-time recovery plan for an SAP R/3 system must have a single quiesce point for all tablespaces. However, the QUIESCE utility has a limit of 1165 tablespaces which can be specified in a single command. As noted earlier, the SAP R/3 database consists of approximately 7200 tablespaces. Therefore the QUIESCE utility cannot be used to establish a single quiesce point for point-in-time recovery.

#### **STOP DB2 Command**

This DB2 for OS/390 command stops the DB2 for OS/390 subsystem, and has two options:

1. MODE(QUIESCE)
2. MODE(FORCE)

The quiesce point with either option is stored in the bootstrap data set (BSDS).

The STOP DB2 MODE(QUIESCE) command will stop DB2 for OS/390 when active units of recovery complete. This will establish a quiesce point for the DB2 for OS/390 subsystem. STOP DB2 MODE(QUIESCE) is the default.

The STOP DB2 MODE(FORCE) command will also stop DB2 for OS/390 and establish a quiesce point for the subsystem, but it will cancel all DB2 for OS/390 threads and roll back any uncommitted activity.

To decide which method you will use to establish your quiesce point, you must first evaluate the characteristics and the corresponding options available with each quiesce point alternative in terms of your recovery objectives. In summary, each alternative establishes a quiesce point:

- ARCHIVE LOG MODE(QUIESCE) will establish a system-wide quiesce point and record it in the bootstrap data set where it can be accessed by the PRINT LOG MAP utility (DSNJU004). You also have control over the command timeout value, and can thus control the effect that this command has on user update processing.
- The QUIESCE utility is not a viable alternative due to the limit of 1165 tablespaces in a single command. It would be possible to stop the SAP R/3



system and produce a quiesce point by invoking the utility multiple times. We concluded that this would not be practical.

- STOP DB2 will establish a quiesce point in the bootstrap data set, and it will stop the subsystem.

Finally, since the process of taking a quiesce point may affect user access for the duration of the operation, you must decide the best time to take it. You must also decide which has the higher priority: uninterrupted user access, or the establishment of the point-in-time recovery quiesce point itself. For flexibility and to minimize the impact to SAP R/3 users, you should consider the use of the ARCHIVE LOG command. Additional information may be found in *BC SAP Database Administration Guide: DB2 for OS/390* (51003810).

#### 4.5.2.3 Why You Might Want to Do a Point-in-Time Recovery

Many potential scenarios exist for performing a point-in-time recovery; some of the more common are:

- At upgrade time, you want the ability to fall back to the original version in the event a major error occurred during the upgrade.
- For system or stress testing, you want the ability to reset your test environment to a specific point in time to enable regression testing.
- For training, you want to repeatedly reset your environment to a common point to permit test scripts to function properly without rewriting them.
- To recover from a program or operational error, you may have to restore the environment to a point in time before the error occurred.

There are undoubtedly other reasons to consider doing a point-in-time recovery, but be advised that in this environment it is not a trivial task, for reasons that are described in the following section.

#### 4.5.2.4 Why You Might Not Want to Do a Point-in-Time Recovery

There are several reasons why you might not want to consider a point-in-time recovery.

**Referential Integrity:** The SAP R/3 system maintains relationships between tables that are managed and controlled entirely by application logic; referential integrity is maintained by SAP R/3, not by the database management system. Because DB2 for OS/390 is not managing referential integrity between application tables, it is up to you, the user, to be certain that a point-in-time recovery will guarantee that all SAP R/3 tables are logically consistent with each other when a point-in-time recovery completes.

Because referential integrity is managed by the SAP R/3 application processes, and not by DB2 for OS/390 facilities, your backup and recovery strategy must reflect this fact, and insure that referential integrity is maintained by your backup and recovery procedures. At its most basic, your strategy may require that for any point that may become a target for a point-in-time recovery, you must be certain that you have a full backup across the SAP R/3, DB2 for OS/390, and AIX platforms.

**The Order of Magnitude of the Problem:** Performing a point-in-time recovery is no small task. With the current implementation, SAP R/3 has over 19,000 indexes defined, and maintains internal relationships among over 16,000 tables. Any point-in-time recovery must result in complete consistency between these

objects, as well as with any supporting operating system and database management system data upon which the SAP R/3 system is dependent.

In addition to recovery of the SAP R/3 tablespaces and indexes, planning for point-in-time recovery may extend well beyond just the restoration of the DB2 for OS/390 tablespaces and indexes. Other related system software and related SAP R/3 systems may have to be restored as well, depending upon the extent of the point-in-time recovery contemplated. Also note that any change in the DB2 for OS/390 catalog and directory resulting in a difference between what is stored in the backup of the SAP R/3 database being used for a point-in-time recovery, and what is actually defined in the catalog and directory at present, will require restoration of the catalog as well.

Consider two scenarios:

1. You want to reset your test environment daily to a consistent point to enable regression testing. No other changes have occurred.
2. You want to restore your production system to a point-in-time several days earlier, and have, since then, applied fixes to your operating and database management software, modified your central instance and application servers, run normal SAP R/3 production activity, and transported SAP R/3 objects from development through test and into production.

A simple point-in-time recovery which could be used, for example, in scenario 1, might be limited to only the SAP R/3 tablespaces and indexes. A recovery such as would be used in scenario 2 is considerably more complex, and must take into consideration the following:

**System Software (OS/390, AIX, DB2 for OS/390)**

If any modifications have been made to any of the operating systems, or any operating system upgrades have been completed, point-in-time recovery may require restoration of the original operating systems to the target point in time of the recovery.

**DB2 for OS/390 Catalog and Directory**

In addition to operating system changes, any modification to the DB2 for OS/390 catalog or directory may require being reset as well. This can be complicated by the fact that in addition to any tablespace or object changes that you have made, the SAP R/3 system can, under certain circumstances, generate additional objects that may not be immediately apparent to you. If the DB2 for OS/390 catalog and directory do not correspond to your SAP R/3 dictionary, the results may be unpredictable, and any attempt to subsequently roll forward may fail.

**Central Instance**

Any changes to the central instance environment may have to be reset.

**Application Servers**

Any change to an application server environment may have to be reset.

**/usr/sap/trans**

If you recover to a prior point in time, and you want your correction and transport system to correspond to your target recovery, these directories may have to be backed up at the same point in time that your SAP R/3

tablespaces are backed up, and recovered to match the SAP R/3 tablespace recovery as well.

This may, of course, present you with an even greater problem. For example, if you recover a production system to a prior point in time, and recover this directory and its files to that point as well, upstream systems (that is, your test and development systems) may no longer reflect the true state of your production environment. Both your test and development system may now contain updates marked as complete and transported that would not actually exist in the recovered system.

What this suggests is the following: If you plan to rely on point-in-time recovery to accomplish specific objectives, you *must* understand the full extent of the intended recovery, and prepare adequate procedures to make certain that any environmental object that is required for a point-in-time recovery has a corresponding backup available. You must be certain that all of the pieces that comprise the complete SAP R/3 environment are logically consistent when the point-in-time recovery completes.

#### **4.5.2.5 Operation and Availability**

For organizations with point-in-time recovery requirements, there are two time periods when user access will be affected:

1. When the point of consistency (quiesce point) is established
2. When the point-in-time recovery is taking place

To establish a quiesce point for point-in-time recovery, you have three options; refer to 4.5.2.1, “Planning for a Point-in-Time Recovery” on page 133 for more information.

There are four point-in-time recovery scenarios that are discussed in detail in the following section.

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## **4.6 SAP R/3 Point-in-Time Recovery**

The usual reason for a point-in-time recovery is an application programming error or a flawed operational procedure. Unfortunately, this exposure is always present regardless of your hardware/software configuration. Additionally, a point-in-time recovery has the potential to be the most disruptive outage you are likely to encounter.

The reason is that in an SAP R/3 environment, you may have to recover all of the tablespaces and indexes to a prior point in time. Why possibly *all* objects? SAP R/3 does dynamic SQL, so you may not be able to determine a subset of tables to be recovered. Therefore, to play it safe, you may decide to recover all objects to a prior point of consistency. Your usual point-in-time recovery techniques, which you likely regard as conventional at this time, may be insufficient in this environment.

The point-in-time recovery environment will be addressed as follows:

- Point-in-time recovery preventive measures
- Point-in-time recovery techniques

- Point-in-time recovery recommendations

#### 4.6.1 Point-In-Time Recovery Preventive Measures

A failure in application development (introducing a programming defect) or in operational procedures (perhaps by running a job twice), introduces the requirement for point-in-time recovery. The available preventive measures are increased attention to:

- Change management
- Problem management
- Testing

Each of these disciplines is procedure-oriented and management-driven. As attention to these disciplines is increased, the need for point-in-time recovery is usually decreased. Unfortunately, the need for point-in-time recovery is never entirely eliminated. Consequently, you will want to make every effort to avoid having to do a point-in-time recovery, but you should be prepared to do one if required.

#### 4.6.2 Point-In-Time Recovery Techniques

The concept behind point-in-time recovery is well understood. It usually involves setting a table or group of tables to a prior point in time when data was determined to be consistent. The challenge in the SAP R/3 environment is determining the set of tables that are logically related. It is possible that you will not be able to determine a subset of the SAP R/3 tables to be reset. You may be required to reset all SAP R/3 tables to a prior point of consistency. There are four generally used techniques to effect a point-in-time recovery.

- Point-in-time recovery using user-written application programs
- Point-In-time recovery using DB2 utilities

The DB2 Quiesce and Copy utilities are the primary tools.

- Point-in-time recovery using non-DB2 utilities

This is basically a dump/restore scenario.

- Point-in-time recovery using DB2 conditional restart

##### 4.6.2.1 Point-In-Time Recovery Using User-Written Application Programs

This is a strategic direction more than a scenario, and the approach is gaining favor among users striving for high availability. It acknowledges that data can be corrupted due to program error. If this happens, the support staff may attempt to correct the contaminated data with application programs. Failing the ability to correct the data with application programming, a scenario such as one of those following could be used as a last resort.

Use of this technique is seldom found in SAP R/3 installations due to SAP R/3 system data relationships: You *must know* the SAP R/3 affected data as well the application data, both by the original program (the one that was in error) and by the repairing program.

In implementing an approach like this, it is important to determine which transactions will make the data more corrupt or will propagate the errors. This

information then can either be communicated to end users, or the DBA can use the information to determine which dangerous transactions to disable.

#### 4.6.2.2 Point-in-Time Recovery Using DB2 Utilities

This method is discussed in *BC SAP Database Administration Guide: DB2 for OS/390*. SAP Material Number 51003810, in the chapter “Database Management”, topic “Backup and Recovery Options”, subtopic “Recovery to the State at the Time the R/3 Database was Quiesced”.

The scenario for a point-in-time recovery using DB2 utilities is:

- Determine the set of tables that are logically related.  
Typically this is a subset of the tables that make up the application database. However, it may be all SAP R/3 tablespaces and indexes.
- Determine the point of consistency.  
There are three techniques to accomplish this. See 4.5.2.2, “Establishing a Point of Consistency” on page 133 for a description of these techniques.
- Execute the COPY utility on all of the tablespaces that are candidates to be reset if a point-in-time recovery is required.
- Recover to this point of consistency.  
With the combination of COPY and the point of consistency established above, you can run RECOVER TORBA.
- Now RECOVER all indexes on all of the tables that have been reset to the point of consistency. The indexes must be synchronized with the data in the recovered tablespaces. The time required to recover indexes in an SAP R/3 environment is reduced by a DB2 for OS/390 Authorized Program Analysis Report (APAR). The text description of the APAR is found in Appendix E, “APAR PQ19077 Text” on page 235. The improvement comes from a new parameter (REUSE) that applies to the REBUILD function, which saves about 1 second for empty indexes. In our recovery processing, this resulted in about 30% elapsed time savings in index rebuilds. Customer experience with the parameter found even more savings, approximately 50% in elapsed time.

The benefits of this scenario are:

- There is minimal disruption to the user in preparing for the scenario.  
The user may see some slowness in response during the establishment of the point of consistency (depending on the technique you use), but this can likely be scheduled during off-hours to minimize the disruption.
- There is no disruption to the user when COPY is run with SHARE-LEVEL CHANGE.  
COPY — SHARE-LEVEL CHANGE allows updates concurrent with utility execution.
- The recovery of the tablespaces will likely be efficient.  
RECOVER TORBA will perform well, assuming little or no logging between the execution of the COPY utility and the execution of QUIESCE.

However, there is a significant disadvantage to this scenario: the requirement to recover potentially thousands of indexes may make this scenario impractical.

Additionally, as activity increases, the likelihood that the creation of the point of consistency will fail or become intolerably long also increases.

#### **4.6.2.3 Point-in-Time Recovery Using Non-DB2 Utilities**

This scenario will use a DB2 command and a dump/restore utility program.

This method is discussed in *BC SAP Database Administration Guide: DB2 for OS/390*. SAP Material Number 51003810, in the chapter “Database Management”, topic “Backup and Recovery Options”, subtopic “Recovery to the State at the Time an Offline Backup of the R/3 Database was Created”.

- Determine the set of tables that are logically related.  
Typically this is a subset of the tables that make up the application database. However, in the SAP R/3 environment, it may be all of the tables; it may include system data (such as the system catalog) as well.
- Use the DB2 Stop Database command to stop all of the tablespaces that are logically related.  
The Stop Database command will cause the DB2 buffers to be externalized and will cause the VSAM data sets that hold the DB2 data to be closed. While the tablespaces are stopped, the data will be unavailable to users.
- For system data, be certain that all applications that update are stopped or complete.
- Dump the tablespace, index data sets, and system data using your installation high-speed dump utility.  
You may consider using SnapShot, a program product that runs with the IBM RAMAC Virtual Array. The dumped data sets represent your point of consistency.
- When it is necessary to recover to this point of consistency, restore the data sets that were dumped in the previous step.  
Because the tablespaces are stopped, there will be no outstanding units of recovery, and the data will be consistent. The data being restored consists of the tablespaces, the associated indexes, and system data.

This scenario is more efficient than the previous one, but preparing for it is more disruptive to the user. The data is unavailable to the user while the tablespaces are stopped and while the data is being dumped. The duration of the period that data is unavailable can be lessened by using SnapShot.

#### **4.6.2.4 Point-in-Time Recovery Using DB2 Conditional Restart**

The following scenario will likely appeal to the more experienced DB2 user. The scenario requires a DB2 conditional restart, which is a part of DB2 not frequently exercised by many users. Its key advantage is an “almost free” establishment of a point of consistency.

More explanation of these procedures can be found in *BC SAP Database Administration Guide: DB2 for OS/390*, SAP Material Number 51003810, in the chapter “Database Management”, topic “Backup and Recovery Options”, subtopic “Recovery with Conditional Restart”.

At a high level, the scenario may be defined as follows:

1. Identify a set of candidate points of consistency.

2. Select that candidate point of consistency which best meets your requirements.
3. Make that best candidate point of consistency into a true point of consistency.

This is the point at which you will do the conditional restart. The conditional restart will make your candidate point of consistency the true point of consistency on the DB2 Log.

4. Recover all tablespaces to the true point of consistency.

The conditional restart will position you to recover all of your tablespaces. Because of the conditional restart, you will use a RECOVER to currency (not a RECOVER TORBA).

5. Now RECOVER all indexes on all of the tables that have been reset to the point of consistency.

The indexes must be synchronized with the data in the recovered tablespaces.

The first three steps listed are new and will receive the major part of our attention here. Once those steps are complete, the remainder of this scenario is conceptually similar to the later steps of the scenario 4.6.2.2, "Point-in-Time Recovery Using DB2 Utilities" on page 139 with the difference that you will recover to currency and not to an RBA.

**Identify a Set of Candidate Points of Consistency:** Consider a list that contains many items (or rows). Each list item has two entries in columns: the first column is a timestamp, and the second column is the DB2 Log RBA associated with that time. The list can be quite long (that is, showing many timestamps). This list of timestamps is our set of candidate points of consistency.

The list of candidate points of consistency might have an entry for each hour in the day or for each minute in the day. For each entry in the list, we have a timestamp and the corresponding DB2 Log RBA. This allows you to map a specific time to a DB2 Log RBA.

How do you build a list of timestamps and the associated Log RBAs? You start by defining a dummy database and tablespace. This will be a real DB2 database and tablespace, but there will be no activity against the dummy tablespace. SAP R/3 will not know about this tablespace.

Once the dummy tablespace is defined, you will initiate a user-developed procedure that will periodically QUIESCE that dummy tablespace. Since you will allow no activity against the dummy tablespace, the QUIESCE will be very fast. The QUIESCE will cause the Log RBA and the timestamp to be entered into SYSIBM.SYSCOPY. The entries within SYSIBM.SYSCOPY for the dummy tablespace make up our list of candidate points of consistency. If you do the QUIESCE each hour, there will be an entry for the dummy tablespace in SYSIBM.SYSCOPY each hour.

Note that the defined dummy table is *only* used as an aid in determining an RBA in the log that corresponds to a given time. It is possible to calculate the RBA without the dummy table but the calculation is complex; use of the table is simpler and less prone to error.

**Select the Candidate Point of Consistency That Best Meets Your Requirements:**

Suppose you determine that because of an application programming error, data in your SAP R/3 system is inconsistent. This part cannot be automated. You must determine when the inconsistencies began to enter your system. Suppose you determine that at 5:00PM on Thursday January 14, 1999, erroneous data began to enter your system. You make the determination that you want to take your system back before that date and time.

You have one more task. Query SYSIBM.SYSCOPY for the dummy tablespace entry before 5:00PM on Thursday January 14, 1999. Once you determine that entry from the list, note the DB2 Log RBA.

Where do you stand now? You have the Log RBA of the nearest time before the inconsistencies entered your system. You are now ready to make that Log RBA, which relates to a candidate point of consistency, a true point of consistency.

**Make the Best Candidate Point of Consistency into a True Point of Consistency:**

There is probably data inconsistency at the Log RBA you identified. You are running an active SAP R/3 system and it is likely that at the time you have identified, there was work in process (or in-flight units of recovery). However, you can make that Log RBA a true point of consistency.

By doing a DB2 conditional restart, you can make the Log RBA you identified into a point of consistency. You will use the CHANGE LOG INVENTORY DB2 utility to create a conditional restart control using the following statement:

```
CRESTART CREATE, FORWARD=YES, BACKOUT=YES, ENDRBA=XXXX
```

where XXXX is the true point of consistency you determined from your SYSIBM.SYSCOPY query. For more information on the CHANGE LOG INVENTORY DB2 utility, see *DB2 for MVS/ESA V4 Utility Guide and Reference*, SC26-3395.

The conditional restart will cause DB2 to truncate the log at your true point of consistency. Log entries beyond that point will be disregarded. Additionally, DB2 will remove from SYSLGRNGX and SYSCOPY any entries that occurred after the true point of consistency.

**Important**

In order for this to function, you must specify DEFER ALL as the restart parameter in DB2 installation panel DSNTIPS.

**Recover All Tablespaces to the True Point of Consistency:** After the conditional restart, this will be a recovery to currency and not a recovery to an RBA (recovery to an RBA is common in most point-in-time recovery scenarios).

**Recover All Indexes on the Tables That Have Been Reset to the Prior Point of Consistency:** The indexes must be made consistent with the data. The discussion of the REUSE parameter APAR with the associated time savings applies to this activity. See 4.6.2.2, "Point-in-Time Recovery Using DB2 Utilities" on page 139 and Appendix E, "APAR PQ19077 Text" on page 235.

**Execute Transaction SM13 on the SAP R/3 System:** After the SAP R/3 Central Instance is started, execute transaction SM13 to review aborted updates. Resolve all aborted updates before the SAP R/3 system is opened for productive use.



**Note:** Transaction SM13 should be executed as part of your daily activities.

### 4.6.3 Point-in-Time Recovery Recommendations

Your strategy should be to avoid a point-in-time recovery if possible, but also to provide a process that allows it to be performed when necessary. If a point-in-time recovery must be done, then choose the most efficient recovery scenario for your environment. More specifically, the following is recommended:

1. Point-in-time recovery using a DB2 conditional restart

The main benefit to this scenario is that there is effectively no impact on the user to create the list of candidate points of consistency.

The time required to actually recover the tablespaces and indexes will likely be somewhat longer than the time required to do the recovery described in 4.6.2.2, “Point-in-Time Recovery Using DB2 Utilities” on page 139, because this scenario will likely require more DB2 log processing during the recovery.

Since this scenario contains a conditional restart, anyone using it *must first practice it*. An improperly done conditional restart has the potential to severely damage your DB2 subsystem.

In summary, users should consider this scenario when:

- Having no disruption in defining the candidate points of consistency is of the greatest significance.
- The long outage to actually perform recovery is acceptable.
- You are willing to practice conditional restart to develop and maintain the skills necessary for its success.

2. Point-in-time recovery using DB2 utilities

This scenario is preferred over the “point-in-time recovery not using DB2 utilities” scenario when few tablespaces and indexes are to be recovered. However, the recovery of the number of tablespaces and indexes in an SAP R/3 system may imply an outage of 6 to 9 hours, making this scenario impractical.

3. Point-in-time recovery using non-DB2 utilities

The issue regarding this scenario is the number of tablespaces and indexes that must be recovered to an established point of consistency. As the number of tables and indexes to be recovered grows, dump-restore may become the practical alternative. Dumping packs and restoring data is faster than a recovery-based scenario *if the regularly scheduled dumping activities and database non-availability can be tolerated*. Note that recovery is required only when errors occur, while backup occurs on a scheduled basis even if no errors ever occur.

The major disadvantage to this scenario is that the dumping of the data is disruptive to the user and occurs on a regular basis (usually daily). The SAP R/3 system must be stopped in order to dump data that is consistent. Other applications must also be stopped if they are affected by SAP R/3 being unavailable.

An additional disadvantage (affecting all scenarios to some degree, but particularly noticeable in this one) is that work is lost when data is reset to a prior point of consistency. Considering the example given earlier, a once-per-week backup schedule would mean that the January 14, 1999 error

would require recovery to midnight January 10; all the transactions between those times would require re-entry even if the error was discovered on January 14.

It is recommended that you seriously consider implementing this scenario using SnapShot on the RAMAC Virtual Array. The advantages and considerations of using SnapShot on the RAMAC Virtual Array are:

- You must stop SAP R/3 in the DB2 environment to establish a point of consistency.
- You may SnapShot the data at the volume level quickly.

Tests show that a volume can be snapped in 3 to 5 seconds (slightly longer in SAP R/3 installations). However, you must consider that the time to stop/restart SAP R/3 should be expected to be 20 to 30 minutes; the impact on other applications may cause increases in the time.

- When the snapshot is complete, the data can be made available to the user.
- Once the snapshot is complete, the data can be copied to tape as a background task.

This DASD-to-tape process does not interfere with user access to SAP R/3 data.

- When a point-in-time recovery is required, the data can be quickly restored from the tape backup.

For more information on SnapShot on the RAMAC Virtual Array, see *Implementing SnapShot*, SG24-2241 and *Implementing DFSMSdss SnapShot and Virtual Concurrent Copy*, SG24-5268.

#### 4. Point-in-time recovery using user-written application programs

This is a preferred approach among users when possible. It has the following benefits:

- There is little or no disruption to the user.  
Data that has not been corrupted will be available to the user. (However, the user may see erroneous data prior to the recovery.)
- There is no loss of data entered between the time the data contamination was introduced into the system and the time the contaminated data was corrected.
- Fewer processor resources are likely to be required than using either of the other techniques.

Remember that this is an ideal and not a rigorous scenario that can be documented and tested. You must be prepared to reset your system by doing the point-in-time recovery when a “programming fix” is not possible or practical.

Application programming may *not* be able to repair SAP R/3 system data; if potential internal SAP R/3 defects exist, other point-in-time recovery techniques may be the only alternative.

It may not be practical to use this technique if the data relationships are unknown, such as with SAP structural data. If there is any question about the effect on such data of using user-written code, contact SAP support before starting such a procedure.

**Attention**

Above all, when considering point-in-time recovery, remember that *every* element of the *entire* SAP R/3 database must be recovered to the same point of logical consistency, as well as all supporting software.

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## 4.7 Utility Job Control Examples

Appendix A, “JCL Examples” on page 201, contains JCL examples for several DB2 utilities. These samples are provided as a guide in constructing your own job streams, and you may well have access to IBM products (for example, DBAUG, DBADMIN) or other vendor products that may be used to generate and help manage your utility definition and use. You will also need to modify these jobs to reflect your hardware environment, as well as to take into account the service levels your organization requires.

### **COPY TABLESPACE**

The COPY utility provides for tablespace backups that DB2 for OS/390 can use for recovery. In addition, DB2 for OS/390 stores COPY utility information in the DB2 for OS/390 catalog.

### **RECOVER TABLESPACE**

This execution of the RECOVER TABLESPACE utility is to recover selected tablespaces to a point of currency.

### **RECOVER TABLESPACE TOLOGPOINT**

This execution of the RECOVER TABLESPACE utility is to a common log point of recovery for all tablespaces backed up by the COPY utility in the previous section.

### **RECOVER INDEX**

This utility recovers all indexes for all tables in each of the tablespaces named in the control cards.

### **DSN1COPY**

This utility operates outside the control of DB2 for OS/390 to perform copies of tablespaces or indexspaces at the data set level.

**Important**

If you choose to incorporate DSN1COPY in your backup and recovery scenario, you *must* guarantee complete data integrity throughout the SAP R/3 system yourself. For this reason, DSN1COPY is not recommended.

## 4.7.1 COPY Utility, All SAP R/3 Tablespaces

This section contains sample JCL, shown in the following figures, which you can use to perform the initial backup of your SAP R/3 system after initial installation is complete. Modifications are necessary to tailor the JCL to your own installation and environment. This sample assumes you have 3490 tape devices. It was set up for the initial COPY, and it was run after the initial install was completed and several test scenarios were run. As tablespaces increase in size, your JCL will require modification to reflect tablespace growth.

The COPY is structured in 27 jobs, with the largest of the tablespaces (as identified using NACTIVE from the DB2 for OS/390 catalog after the initial RUNSTATS utility had been run) copied in the first job. Subsequent jobs typically copy a larger number of smaller tablespaces.

The 28th job then performs a backup of the DB2 system data from the DB2 catalog and directory. See Appendix A, "JCL Examples" on page 201, Figure 161 on page 201 for a listing of the JCL used.

### Attention

The QUIESCE utility was executed before the image copies were taken in order to verify that a point of consistency was possible, and again after the image copies were taken to establish a common recovery RBA to use in the subsequent point-in-time recovery samples described later in this section.

Typical run time for the entire set of image copy jobs at install time, depending upon hardware availability, was about 12 hours in this environment when not run in parallel. This time can be significantly reduced by running the jobs in parallel. How you structure your jobs is dependent on local standards, procedures, and the hardware that is available to you.

Table 6 lists the jobs that were run to perform a backup of a test system. The COPY utility was run after the initial installation was completed, and again after several test runs that added data to the tablespaces. The statistics for each of these jobs are listed in terms of the number of pages copied and restored, the elapsed time to complete each operation, and the number of indexes involved in recovery. All jobs were run serially - improved throughput may be realized if your jobs are run in parallel, and if the wait time for tape mounts can be kept to a minimum.

| Job    | # Tablespaces | Total Pages | Elapsed Time: Copy (Min) |
|--------|---------------|-------------|--------------------------|
| BAKT11 | 300           | 120,429     | 17.6                     |
| BAKT12 | 300           | 865         | 21.3                     |
| BAKT13 | 300           | 720         | 23.4                     |
| BAKT14 | 302           | 1,538       | 22.2                     |
| BAKT21 | 299           | 75,324      | 23.9                     |
| BAKT22 | 301           | 864         | 15.6                     |
| BAKT23 | 1             | 24,755      | 31.5                     |
| BAKT24 | 300           | 710         | 21.9                     |

| <i>Table 6 (Page 2 of 2). Backup Statistics</i> |                      |                    |                                     |
|-------------------------------------------------|----------------------|--------------------|-------------------------------------|
| <b>Job</b>                                      | <b># Tablespaces</b> | <b>Total Pages</b> | <b>Elapsed Time:<br/>Copy (Min)</b> |
| BAKT25                                          | 301                  | 903                | 21.2                                |
| BAKT31                                          | 300                  | 98,198             | 24.0                                |
| BAKT32                                          | 300                  | 749                | 28.1                                |
| BAKT33                                          | 302                  | 990                | 47.0                                |
| BAKT34                                          | 300                  | 652                | 17.7                                |
| BAKT35                                          | 300                  | 875                | 41.9                                |
| BAKT36                                          | 300                  | 88,180             | 19.6                                |
| BAKT4A                                          | 300                  | 33,223             | 15.3                                |
| BAKT4B                                          | 300                  | 2,238              | 15.2                                |
| BAKT4C                                          | 300                  | 1,631              | 21.3                                |
| BAKT4D                                          | 292                  | 653                | 42.3                                |
| BAKT4E                                          | 9                    | 51,549             | 22.5                                |
| BAKT6A                                          | 300                  | 83,603             | 42.1                                |
| BAKT6B                                          | 300                  | 764                | 41.8                                |
| BAKT6C                                          | 300                  | 690                | 41.3                                |
| BAKT6D                                          | 301                  | 735                | 19.7                                |
| BAKT7A                                          | 239                  | 611                | 12.1                                |
| BAKT7B                                          | 61                   | 1,363              | 3.6                                 |
| BAKT7C                                          | 301                  | 819                | 18.6                                |
| BAKTCAT                                         | 17                   | 43,084             | 9.4                                 |

The statistics in this table indicate that a full image copy of a newly installed system can, if multi-threaded, complete in less than 2 hours if you have the appropriate environment. Recovery of the tablespaces can be accomplished in a similar amount of elapsed time. Note, however, that index recovery can take longer to accomplish.

**Attention**

The COPY, RECOVER TABLESPACE, and RECOVER INDEX utilities can all engage sequential prefetch during operation. RECOVER INDEX, however, must also perform a sort for each index defined in each tablespace, and will operate serially for index recovery.

The sample image copy job listed in Figure 114 on page 148 copies the first 300 tablespaces.

This JCL was essentially duplicated into 26 more jobs to back up the 7209 tablespaces shipped in SAP R/3 4.5A. The jobs were the same as in Figure 114 on page 148 except for the changes of database and tablespace names in the DD and COPY statements.

The full set of database and tablespace names shipped in SAP R/3 4.5A is found in Appendix F, "Tablespaces Shipped in SAP R/3 4.5A" on page 237.

```

// JOB
//*
//* FULL IMAGE COPY OF TABLE SPACE
//*****
//IMAGE010 EXEC PGM=DSNUTILB,REGION=0K,PARM=(DB2R)
//STEPLIB DD DSN=DB2V510.SDSNLOAD,DISP=SHR
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//COPY0001 DD DSN=DB2V510U.SD40#4MK.DD03L.RUN1,
// DISP=(NEW,CATLG,DELETE),
// UNIT=3490,
// LABEL=(0001,SL),
// VOL=(,RETAIN,,99,SER=DEG000)
//COPY0002 DD DSN=DB2V510U.PO20#MUT.ATAB.RUN1,
// DISP=(NEW,CATLG,DELETE),
// UNIT=AFF=COPY0001,
// LABEL=(0002,SL),
// VOL=(,RETAIN,,99,REF=*.COPY0001)
//
//
//
//
//
// (296 MORE DD STATEMENTS FOR DATABASE.TABLESPACE COMBINATIONS)
//
//
//
//COPY0299 DD DSN=DB2V510U.A200#FTA.PTEXTLOG.RUN1,
// DISP=(NEW,CATLG,DELETE),
// UNIT=AFF=COPY0298,
// LABEL=(0299,SL),
// VOL=(,RETAIN,,99,REF=*.COPY0298)
//COPY0300 DD DSN=DB2V510U.A200#G25.TOA02.RUN1,
// DISP=(NEW,CATLG,DELETE),
// UNIT=AFF=COPY0299,
// LABEL=(0300,SL),
// VOL=(,RETAIN,,99,REF=*.COPY0299)
//SYSIN DD *
COPY TABLESPACE SD40#4MK.DD03L
COPYDDN COPY0001 CHANGELIMIT(0) SHRLEVEL CHANGE
COPY TABLESPACE PO20#MUT.ATAB
COPYDDN COPY0002 CHANGELIMIT(0) SHRLEVEL CHANGE
//
//
//
// (296 MORE COPY, COPYDDN STATEMENTS FOR DATABASE.TABLESPACE NAME)
//
//
//
// COPY TABLESPACE A200#FTA.PTEXTLOG
// COPYDDN COPY0299 CHANGELIMIT(0) SHRLEVEL CHANGE
// COPY TABLESPACE A200#G25.TOA02
// COPYDDN COPY0300 CHANGELIMIT(0) SHRLEVEL CHANGE
/*

```

Figure 114. COPY Utility: Image Copy after Initial Install, Image Copy Job BAKT11

### 4.7.1.1 Tablespace Sequence for COPY

There are three major considerations in determining how to order the tablespaces for the COPY operation:

1. Efficiency in the restore operation
2. Efficiency in the backup operation
3. Efficiency in the restore index operation

The first two considerations are very much the same; they imply that the jobs should be equally spread across available tape devices. Differences (such as more devices being available for restoring) should be resolved in favor of restore, since that is likely to occur at a time of crisis.

The third consideration implies that the longest-running index restore jobs should be started first; this means those tablespaces should be backed up and restored first. This will usually be the largest tablespaces, but experience and practice with restore operations may lead a DBA to a more sophisticated sequence.

## 4.7.2 DSN1COPY Utility

The DSN1COPY utility is invisible to DB2 for OS/390 to the extent that DSN1COPY operations are not recorded by DB2 for OS/390, and DSN1COPY operates on data sets that are not allocated by DB2 for OS/390. DSN1COPY is a stand-alone utility; it does not need the DB2 for OS/390 system to be up in order to run. Note that the use of DSN1COPY will endanger your ability to recover the data; the ability of support from IBM or SAP to assist you will also be at risk. There are certain precautions to take when invoking DSN1COPY, and these precautions, as well as more detailed information, are listed in *DB2 for OS/390 V5 Utility Guide and Reference*.

In addition to being able to copy different types of data sets (for example, an image copy dataset to a DB2 for OS/390 VSAM data set), the DSN1COPY utility is used to accomplish other tasks:

- Print hexadecimal dumps of DB2 for OS/390 data sets
- Check validity of data or index pages
- Translate Object IDs
- Reset the log RBA in each index or data page to 0

Figure 115 on page 150 is a sample of the JCL to copy the index related to the DOKCLU table.

```

// JOB
//DSN1COPY EXEC PGM=DSN1COPY,
// PARM=' CHECK,SEGMENT'
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSUT1 DD DSN=DB2V510U.DSNDBC.SX40#2R8.DOKCLU.I0001.A001,DISP=SHR,
// AMP=(' BUFND=181')
//SYSUT2 DD DSN=DB2R.SX40#2R8.DOKCLU.D01,
// DISP=(NEW,CATLG,CATLG),
// SPACE=(CYL,(100,50)),
// UNIT=3390,
// DCB=BUFNO=181
//

```

Figure 115. DSN1COPY: Sample JCL to Copy the DOKCLU Index Data Set

#### Attention

If you choose to use DSN1COPY, pay attention to the number of buffers you use for both the input and output data sets. The defaults will result in much higher throughput rates. In the job listed in Figure 115, tests indicated that specifying 181 buffers resulted in an elapsed time that was approximately 1/3 of the elapsed time recorded when using the defaults.

## 4.8 Sample RECOVER TABLESPACE JCL: Recover to Currency

Figure 116 lists JCL for a recovery to currency; it illustrates how to recover several tablespaces in a single execution of the RECOVER TABLESPACE utility. This is a straightforward example, but there are a couple of things to keep in mind:

- If you run the RECOVER TABLESPACE utility as coded, and your image copy data sets for these tablespaces all reside on the same tape volume, you will have to mount the tape for each image copy data set. You can avoid multiple tape mounts if you code the DD cards for the data set names of your image copy data sets (this information is in the DB2 for OS/390 catalog), and follow the example provided in the COPY chapter of *DB2 for OS/390 V5 Utility Guide and Reference* for the remaining DD card parameters.
- No recovery of indexes is required in this example. The assumption with recover to currency is that the indexes that correspond to tables in the recovered tablespaces were not damaged, and remain intact.

```

//JOB JOB
//UTIL EXEC DSNUPROC,SYSTEM=DB2R,UID=' RECOVERY.JOB01',UTPROC=''
//DSNUPROC.SYSIN DD *
RECOVER TABLESPACE A200#0U0.T52SES
 TABLESPACE A000#AFE.EWUSEL
 TABLESPACE P020#MUT.ATAB
 TABLESPACE A200#KZ9.MASSTAB
 TABLESPACE A000#9MK.BTABL#C
/*
//

```

Figure 116. Recover to Currency - Sample JCL



## 4.9 Sample RECOVER TABLESPACE JCL: Point-in-Time Recovery

This JCL for a point-in-time recovery is based upon the use of COPY TABLESPACE to generate the backups of the tablespaces. RECOVER TABLESPACE is used to recover the tablespace data, and RECOVER INDEX is used to recover the indexes to the data. A single QUIESCE point was taken before and after the image copies of the tablespaces were taken, and no concurrent access was allowed during the image copy.

As noted earlier, you might choose to use DSN1COPY under certain circumstances. For example, in test mode, you might use DSN1COPY to rebuild data prior to running test scenarios.

### Important

Do not plan to use DSN1COPY as a backup/restore facility for SAP R/3 production databases. The utility is a danger to your SAP R/3 database; the ability of support personnel to assist you in disaster situations is also at risk.

RECOVER TABLESPACE utility execution does *not* mirror the COPY TABLESPACE jobs listed earlier. RECOVER TABLESPACE TOLOGPOINT was not used because DB2 for OS/390 point-in-time recovery used conditional restart, as discussed in 4.6.2.4, "Point-in-Time Recovery Using DB2 Conditional Restart" on page 140.

The RECOVER TABLESPACE execution is structured in nine jobs, with the largest of the tablespaces (as identified using NACTIVE from the DB2 for OS/390 catalog after the initial RUNSTATS utility had been run) copied in the first job. The nine jobs are followed by three jobs which recover the DB2 catalog and directory tables.

The timing of the tablespace recovery jobs is provided in Table 7.

| Job      | # Tablespaces | Total Pages | Elapsed Time: Copy (Min) |
|----------|---------------|-------------|--------------------------|
| RECT0101 | 1,201         | 123,525     | 71.9                     |
| RECT0201 | 1,201         | 77,801      | 76.9                     |
| RECT0301 | 1,202         | 90,697      | 67.3                     |
| RECT0401 | 1,192         | 37,745      | 68.2                     |
| RECT0501 | 600           | 98,947      | 48.0                     |
| RECT0601 | 1,201         | 85,792      | 102.7                    |
| RECT0701 | 601           | 2,793       | 66.5                     |
| RECT2E01 | 1             | 24,755      | 18.1                     |
| RECT4E01 | 9             | 51,549      | 9.9                      |
| RECCAT01 | 2             | 8,843       | 5.0                      |
| RECCAT02 | 9             | 25,184      | 24.7                     |
| RECCAT03 | 6             | 9,057       | 9.5                      |

The first sample recover job, listed in Figure 117 on page 152, restores 1,201 tablespaces. As in the backup JCL (see Figure 114 on page 148), the first job



#### 4.9.1 Sample JCL: RECOVER INDEX ALL

RECOVER INDEX ALL was run twice; once with REUSE specified and once with NOREUSE specified. This was done in order to measure the savings gained by the parameter. For a description of the REUSE parameter, see Appendix E, “APAR PQ19077 Text” on page 235.

A summary of the timing of the index recovery job streams in the two modes is provided in Table 8, for detailed timings of individual jobs see Appendix D, “Detailed Index Recovery Statistics” on page 233.

| <b>Job Stream</b> | <b>Tablespaces</b> | <b>Indexes</b> | <b>Elapsed Min<br/>NOREUSE</b> | <b>Elapsed Min<br/>REUSE</b> |
|-------------------|--------------------|----------------|--------------------------------|------------------------------|
| Stream 1          | 1202               | 3078           | 181.0                          | 149.4                        |
| Stream 2          | 1202               | 3139           | 149.0                          | 118.2                        |
| Stream 3          | 1202               | 3361           | 199.2                          | 141.9                        |
| Stream 4          | 1201               | 3291           | 221.2                          | 151.2                        |
| Stream 5          | 1201               | 2879           | 228.0                          | 174.5                        |
| Stream 6          | 1201               | 3027           | 235.3                          | 124.7                        |
| Total             | 7209               | 18775          | 1213.7                         | 859.9                        |

This JCL for point-in-time index recovery is based upon a prior COPY TABLESPACE to a common point of consistency and a subsequent RECOVER TABLESPACE to the point of consistency established by the earlier QUIESCE. RECOVER INDEX is then executed to restore all indexes for all tables.

The first sample recover index job, listed in Figure 118 on page 154, restores the indexes for all tables in 237 tablespaces. Included in this JCL is the REUSE parameter (on the REBUILD statement). Obviously this parameter was not specified in the JCL when the NOREUSE executions were done.

```

// JOB
//*
//* REBUILD INDEX(ALL) FOR TABLESPACE
//* SAPRES3.RECIJOB.CNTL(RECJOB1A)
//ATAB EXEC PGM=DSNUTILB,REGION=OK,PARM=(DB2R)
//STEPLIB DD DSN=DB2V510.SDSNLOAD,DISP=SHR
//*****
//* RECOVER INDEX ALL FOR TABLE SPACE *
//*****
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SYSIN DD *
REBUILD INDEX(ALL) TABLESPACE PO20#MUT.ATAB
SORTDEVT SYSDA SORTNUM 6 REUSE
//*
.
.
.
Job Step duplicated 235 times with changes to the EXEC statement
(tablespace name is step name) and REBUILD statement where
database and tablespace names are specified.
.
.
.
//TA20PSF EXEC PGM=DSNUTILB,REGION=OK,PARM=(DB2R)
//STEPLIB DD DSN=DB2V510.SDSNLOAD,DISP=SHR
//*****
//* RECOVER INDEX ALL FOR TABLE SPACE *
//*****
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SYSIN DD *
REBUILD INDEX(ALL) TABLESPACE A200#JUS.TA20PSF
SORTDEVT SYSDA SORTNUM 6 REUSE
//*

```

Figure 118. Point in Time Recovery: RECOVER INDEX ALL, Index Job 1

The subsequent recover index jobs used similar JCL to Figure 118, with changes to the EXEC statement (simply for convenience, tablespace name was used as the step name), and to the REBUILD statement where tablespace name is specified. For a listing of all database and tablespace names shipped with SAP R/3 4.5A, see Appendix F, “Tablespaces Shipped in SAP R/3 4.5A” on page 237.

#### 4.9.1.1 Tablespace Sequence for RECOVER INDEX ALL

Efficiency in this operation will be the most critical factor in the time taken to recover the SAP R/3 databases. Administrators should, *in times of non-crisis*, invest time in optimizing this activity, because such optimization will be of enormous benefit if a crisis does occur.

Here are some ideas to make the indexes available at the earliest possible time:

- Automatically start the REBUILD INDEX jobs, when the recovery of the necessary tablespace is recognized as complete.
- Be certain that tablespace recovery gets the tablespaces with the longest-running index recoveries *first*, so that those index recoveries can be started earlier.

- Use the REUSE parameter to reduce the time for index delete and define.
- Minimize disk contention by not starting an index recovery if one using the same DASD output device is already running. (Note that the REUSE parameter guarantees that the index will be recovered to the same device to which it was previously assigned).



---

## Chapter 5. Reorganization of Tablespaces

This chapter describes considerations for doing a tablespace reorganization, the impact of reorganization on users, and the benefits of the DB2 Version 5 online reorganization.

---

### 5.1 Considerations for Doing Tablespace Reorganizations

The following is a list of reasons that could necessitate a tablespace reorganization:

1. SQL queries that benefit from sequential processing like generic key searches of the tablespace begin to experience degraded performance.

This situation may show up during a generic key search or during batch sequential processing of the tablespace.

2. Free space is exhausted, causing the sequence of the data to degrade.

This tends to be the root cause of the degraded performance of the sequential processes.

3. The underlying VSAM file that contains the DB2 tablespace reaches the extent limit.

There are other ways to resolve this problem that might use less resources. See 6.3, "How to Handle Growing Tablespaces or Index Spaces" on page 179 for more discussion of this topic.

4. The DASD volume where the VSAM file resides that contains the DB2 tablespace runs out of space.

There are other ways to resolve this problem that might use less resources. See 6.3, "How to Handle Growing Tablespaces or Index Spaces" on page 179 for more discussion of this topic.

Although there are many considerations for doing a tablespace reorganization, one major consideration is how the tablespace is accessed and processed. If you are doing direct processing, such as a fully qualified SQL Select of a single row using a unique key, then there should be little need to do a tablespace reorganization. The DB2 processing to retrieve a single uniquely-qualified row requires locating the unique key in the index, then reading the DB2 page that contains the qualifying row. The physical order of the data is unimportant when doing uniquely-qualified single-row direct processing. However, if you are doing sequential processing, then the physical order of the data may influence performance. In that case, a tablespace reorganization will most likely improve performance.

The REORG utility can be beneficial when there is an explicitly defined clustering index on the table. The implementation of SAP R/3 now explicitly specifies a clustering index on the SAP R/3 DB2 tables (this was not true in the past).

Users of SAP R/3 will not frequently find it necessary to override SAP R/3 table options implemented when SAP R/3 is installed. Clustering indexes defined by SAP are usually the best ones for performance, however there are cases where applications perform better with a different clustering index. A DBA should review performance, especially sequential batch and generic key performance, to determine if changing the clustering index could provide improvements.

If there is a need to do a tablespace reorganization, there are two possible methods that can be supported by DB2: offline or online. An offline reorganization is the name applied to the REORG utility as it executed prior to DB2 Version 5. Online REORG is a feature introduced in DB2 Version 5. The following sections present the differences between these methods.

---

## 5.2 Offline Reorganization

In this section we discuss at a high level how DB2 REORG worked prior to DB2 Version 5 and what the impact of running REORG in that environment would be on an SAP R/3 user.

### 5.2.1 How Does It Work

The execution of the DB2 REORG utility in the offline mode is as follows:

- DB2 unloads the data from the tablespace.  
During the unload phase of the REORG utility, the data is available to the user in read-only mode.
- DB2 may invoke SORT to re-establish the data in clustering sequence.  
During this phase the data from the tablespace being reorganized is not available to the user.
- DB2 reloads the data to the tablespace and re-establishes free space.  
Again, the data from the tablespace being reorganized is not available to the user.
- Indexes are brought into synchronization with the tablespace data.  
This provides for the fact that the reorganization has moved the data. However, the data from the tablespace remains unavailable to the user during this phase.

### 5.2.2 What Is the Impact on Users

Except for the unload phase, the data is unavailable to the SAP R/3 user during the execution of the REORG utility in an off-line mode.

---

## 5.3 Online Reorganization

In this section we discuss at a high level how the DB2 Version 5 online REORG works and what the impact is on SAP R/3 users.

### 5.3.1 How Does It Work

A capability of DB2 Version 5 online REORG is to allow the user almost unrestricted availability to data in a tablespace during REORG. It works as follows:

- At the beginning of the online REORG utility, DB2 notes the current point on the recovery log.  
For DB2 to allow changes during the execution of the REORG utility, it must know where the data changes are to be found on the recovery log.
- DB2 makes a “shadow copy” of the tablespace.



It is the shadow copy that is reorganized. Data modifications are posted to the original copy of the data and those changes will of course be logged by DB2 to the recovery log.

- The REORG of the shadow copy completes.
- In an iterative fashion, the DB2 REORG utility reproduces changes from the original copy of the data to the shadow copy.

The objective is to bring the shadow copy in synchronization with the original copy of the tablespace. DB2 determines the changes that must be applied to the shadow copy of the tablespace from the recovery log.

This process is iterative, because during the updating of the shadow copy of the data from the DB2 log, more changes could occur to the original copy of the data, which, of course, need to be applied.

- During the last iteration of updating the shadow copy, DB2 allows reading of the data but disallows updating.

DB2 disallows updating for two reasons:

- Enable REORG to end

If DB2 did not prohibit writers for the last iteration of shadow copy maintenance, it is theoretically possible that the utility would never end (during each iteration, another change could occur to the original copy).

- Enable REORG to end in a user-controlled time period

DB2 measures the time required for each iterative application of logged changes to the shadow copy of the data. The measured timings form a trend that DB2 analyzes to project when it is likely to finish the online REORG. If this projected finish time is out of line with the user's requirements, DB2 presents the option either to continue or to terminate the REORG.

- After the shadow copy of the data is synchronized with the original copy of the data, REORG replaces the original copy with the shadow copy by changing the data set names.

As you might expect, during this final REORG phase when data set names are changed, there is neither read nor write activity allowed against the data.

### 5.3.2 What Is the Impact on Users

The data is available to the user during the execution of the DB2 Version 5 online REORG in read/write mode except for the last iteration of applying logged changes to the shadow table. The data is not available for read or write during the phase when shadow and original data set names are changed.

---

## 5.4 Methods of Testing

SAP R/3 makes no unique demands on DB2 Version 5 online REORG. Users would test online REORG using whatever installation standards they typically apply to testing a new release of DB2.

---

## 5.5 Guidelines

The general recommendations relative to SAP R/3 DB2 tablespaces are:

- Plan to REORG SAP R/3 tables.

As stated previously, a reorganized tablespace benefits set-level browse-type sequential processing. Experience indicates that a significant part of the SAP R/3 SQL is unique single-row processing. This is frequently referred to as random processing. Because REORG does not particularly benefit random processing, SAP R/3 tablespaces may not greatly benefit, however REORG can significantly benefit generic key searches, and SAP R/3 uses this function quite heavily. When a generic key search is done, a DB2 function called sequential pre-fetch is used, which involves priming DB2 buffers to hold rows of the table whose key is near the key of a target row. Also because of free space recovery and for locality of reference, REORG can benefit performance.

The invocation of REORG should be evaluated. The use of SAP R/3 transactions ST10 and ST04 can indicate tables that would benefit from running RUNSTATS; a subset of those tables should benefit from REORG. Do not REORG small inactive tables, nor large static tables. Read-only tables may benefit from an initial REORG, but not subsequently.

- Define free space on SAP R/3 DB2 tables.

Free space benefits an application that does set-level sequential processing or generic key searches, the latter is important in an SAP R/3 installation.

- REORG indexes as required.

Insert processing will cause index pages to fill and eventually split. Do online REORG of indexes to re-establish index free space. This will benefit insert processing.

### 5.5.1 Scenarios for High Availability

From the point of view of tablespace reorganization, high availability can be achieved. Availability is negatively affected by both planned and unplanned outages. The discussion of REORG in this section addresses the planned outage. Should you determine that a REORG of a tablespace is required, the online REORG feature of DB2 Version 5 effectively removes disruption to availability resulting from that REORG.

#### 5.5.1.1 Online REORG and SAP R/3

As previously stated, during an online reorganization, there is a brief time during which neither read nor write activity is allowed. Measurements during our testing of the online REORG with share-level change showed that access was prohibited for about three minutes. This occurred specifically when we reorganized an SAP R/3 tablespace that contained 100 tables. We believe this time to be higher than users outside of the SAP R/3 environment will typically encounter for the following reasons:

- A buffered SAP R/3 tablespace contains approximately 100 tables.  
REORG is at the tablespace or partition level.
- There are typically one to three indexes defined on each table.  
Each index is stored in a data set.

- Online REORG of a SAP R/3 buffered tablespace typically requires DB2 to change the names of between 100 and 300 shadow data sets.

We believe the requirement to change many data set names is the main cause of the three-minute delay during which access was prohibited. However, SAP R/3 has introduced many tablespaces with a single table (SAP R/3 refers to these as an unbuffered tablespaces). This means that the condition we encountered would rarely be met by an SAP R/3 user. Buffered tablespaces contain relatively inactive tables, it would be rare that reorganization of one of these be necessary. For the unbuffered tablespaces, the read/write restriction during data set name changes should be insignificant.



---

## Chapter 6. Planning for Growth

This chapter describes how to determine which tables should be placed in individual tablespaces, and how to actually put them there. The chapter is performance-oriented, but focused on DBA activities.

---

### 6.1 How to Find Growing Tablespaces, Index Spaces or Tables

To find growing tablespaces, index spaces and tables we use the LISTCAT command (see *DFSMS/MVS V1R4 Access Method Services for the Integrated Catalog Facility*, SC26-4906), as well as the RUNSTATS and STOSPACE utility of DB2 for OS/390. We look at the DB2 tools DB2ADM and DB2AUG, which simplify the monitoring of growth quite a bit. In addition to considering OS/390, we also show two possibilities of using knowledge of the SAP R/3 product to find tables that are likely to grow.

#### 6.1.1 LISTCAT

The LISTCAT command lists catalog entries for the VSAM data sets in which DB2 for OS/390 stores its data.

The VSAM data set name is composed of:

catname.DSNDBx.dbname.psname.I0001.Annn

where the parts of the name are:

|                |                                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>catname</b> | This is the high level qualifier of your DB2 for OS/390 data sets.                                                                                                        |
| <b>x</b>       | This is C for the cluster part of the data set, D for the data part of the data set.                                                                                      |
| <b>dbname</b>  | This is the name of the DB2 database.                                                                                                                                     |
| <b>psname</b>  | This the tablespace or index space name.                                                                                                                                  |
| <b>nnn</b>     | For partitioned tablespaces, this is the partition (001-064 respectively 001-254 for LARGE tablespace); for simple or segmented tablespaces, this is the data set number. |

Invoke LISTCAT either with a TSO command or by using Job Control Language (JCL). We recommend using a TSO command for queries on single data sets only. In JCL you can route the LISTCAT output to a file with the OUTFILE parameter and modify this data set according to your needs (for instance, you may wish to reduce the output to only important fields). Since a DBA will be running this job frequently, it is a good candidate for access as an SAP R/3 job. See 3.2.5, "Transaction DB2J" on page 105 for information on how to define jobs to be used within SAP R/3.

To list the catalog entries for a specific data set, use the ENTRIES parameter with the cluster part of the data set name (DSNDBC) as shown in Figure 119.

```
LISTCAT ENTRIES(' DSN510.DSNDBC.ATAB.ATAB.I0001.A001') DATA ALLOCATION
```

Figure 119. Example LISTCAT Command in TSO

To list the catalog entries for all data sets with a specific high-level qualifier, use the LEVEL parameter with the data part of the data set name (DSNDBD) as shown in Figure 120 on page 164.

```
//PETRAL2 JOB (999,POK),' LISTCAT', NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//LISTSAMP EXEC PGM=IDCAMS,REGION=1024K
//*
//*****
//* LISTCAT ON WHOLE SUBSYSTEM *
//*****
//OUTFILE DD DSN=PETRA.JCLOUT,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
LISTCAT -
LEVEL('DSN510.DSNDBD') -
DATA -
ALLOCATION -
OUTFILE(OUTFILE)
/*
```

Figure 120. Example JCL for LISTCAT Command

If you want to see the catalog entries for all tablespaces in your SAP R/3 database, specify LEVEL ('catname.DSNDBD') in your LISTCAT command.

Use parameters DATA and ALLOCATION to list all fields indicating growth.

Sample output of LISTCAT LEVEL('DSN510.DSNDBD.ATAB.ATAB') DATA ALLOCATION is shown in Figure 121 on page 165. Notice that this is the example we used in submitting an SAP R/3 job; see Figure 95 on page 106

```

IDCAMS SYSTEM SERVICES TIME:: 19:17:44 05/06/97 PAGE 1
DATA ----- DSN510.DSNDBD.ATAB.ATAB.I0001.A001
IN-CAT --- CATALOG.DB2ICF1.VLABDB2
HISTORY
DATASET-OWNER-----SYSADM CREATION-----1997.115
RELEASE-----2 EXPIRATION-----0000.000
ACCOUNT-INFO----- (NULL)
ALLOCATION
SPACE-TYPE-----CYLINDER HI-A-RBA-----128286720
SPACE-PRI-----174 HI-U-RBA-----113541120
SPACE-SEC-----18
VOLUME
VOLSER-----SAP005 PHYREC-SIZE-----4096 HI-A-RBA-----128286720 EXTENT-NUMBER-----1
DEVTYPE-----X'3010200F' PHYRECS/TRK-----12 HI-U-RBA-----113541120 EXTENT-TYPE-----X'40'
VOLFLAG-----PRIME TRACKS/CA-----15
EXTENTS:
LOW-CCHH-----X'01430000' LOW-RBA-----0 TRACKS-----2610
HIGH-CCHH-----X'01F0000E' HIGH-RBA-----128286719
IDCAMS SYSTEM SERVICES TIME: 19:17:44 05/06/97 PAGE 2
 THE NUMBER OF ENTRIES PROCESSED WAS:
 AIX -----0
 ALIAS -----0
 CLUSTER -----0
 DATA -----1
 GDG -----0
 INDEX -----0
 NONVSAM -----0
 PAGESPACE -----0
 PATH -----0
 SPACE -----0
 USERCATALOG -----0
 TAPELIBRARY -----0
 TAPEVOLUME -----0
 TOTAL -----1
 THE NUMBER OF PROTECTED ENTRIES SUPPRESSED WAS 0
IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0

```

Figure 121. Output of LISTCAT Command for One Tablespace

The most important item to look at in the LISTCAT output regarding growth is the field EXTENT-NUMBER, which shows the actual number of extents of allocated space for the data set. If the data set is already split over several volumes, you will get an ALLOCATION section for each volume.

SAP R/3 transaction DB02 will show those tablespaces that have more extents in use than user-specified levels for severity one or two warnings. See 3.2.1, “Transaction DB02” on page 89 and Figure 75 on page 89. Another way to see extent information is through the screen shown in Figure 83 on page 96.

For optimal performance, the recommendation is to have only one extent (in total), since that means all data is physically located in one place. Therefore, for frequently-accessed tablespaces or indexes, you may consider increasing the size of the first extent (primary allocation) of that tablespace or index space as explained in 6.3.1, “Increase Size of Tablespace or Index Space” on page 179. The actual size of the primary allocation is shown as SPACE-PRI in units of SPACE-TYPE.

In an SAP R/3 production environment, it is probably not possible to keep all data only in primary extents because of permanently growing data. Therefore, for performance reasons we recommend that you keep the number of extents low.

The allocated space for the data set in kilobytes (which is necessary, for instance, to compare to actual used space provided by RUNSTATS) is the sum of

the allocated space on all listed volumes. See 6.1.2, "RUNSTATS Utility" on page 166 for further information.

The space allocation in KB on one volume is:

$$\text{PHYREC-SIZE} * \text{PHYRECS/TRK} * \text{TRACKS} / 1024$$

where:

- PHYREC-SIZE** This the page size in bytes (4096 (4 KB) or 32768 (32KB)).
- PHYRECS/TRK** This the number of pages per track (dependent on DASD model).
- TRACKS** This is the number of allocated tracks on the volume.

## 6.1.2 RUNSTATS Utility

The DB2 for OS/390 RUNSTATS utility gathers summary information about the characteristics of the data in tablespaces, indexes, and partitions. The summary information is stored in the DB2 for OS/390 catalog. RUNSTATS records information on used space.

RUNSTATS runs on the basis of tablespaces. Be aware that whenever the number of tablespaces changes, the RUNSTATS jobs must be adapted. Tools like DB2AUG (see 6.1.5, "DB2AUG Growth Monitoring" on page 173) can minimize these efforts.

RUNSTATS gives you the ability to choose between SHRLEVEL REFERENCE and SHRLEVEL CHANGE. SHRLEVEL REFERENCE allows only read-only access by other programs to the tablespace, while SHRLEVEL CHANGE allows changes to the tablespace. We compared the runtime for RUNSTATS on all tablespaces of the default installation R/3 subsystem with SHRLEVEL CHANGE versus SHRLEVEL REFERENCE (see Table 9). No additional parameters were specified. Work load was generated running the SAP R/3 Sales & Distribution (SD) Standard Application Benchmark with 10 users.

| SHRLEVEL  | Workload    | Run Time     |
|-----------|-------------|--------------|
| CHANGE    | None        | 1586 seconds |
| REFERENCE | None        | 1519 seconds |
| CHANGE    | 10 SD users | 1618 seconds |
| REFERENCE | 10 SD users | 1568 seconds |

Because SHRLEVEL CHANGE is only slightly slower and has the advantage of allowing read-write access from other programs, we recommend using SHRLEVEL CHANGE and running during low workload hours.

To get the information for growth planning, it is sufficient to run RUNSTATS without any additional option as shown in Figure 122 on page 167.



```

//PETRAR1 JOB (999,POK),'RUNSTATS 1 TS',NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//RUNSAMP EXEC PGM=DSNUTILB,REGION=1024K,
// PARM='DB2R,RUNSTAT1'
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//*
//*****
//* RUNSTATS ON ONE TABLESPACE ONLY *
//* WITHOUT ANY ADDITIONAL PARAMETERS *
//*****
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
 RUNSTATS TABLESPACE ES30F00.SES30F00
 SHRLEVEL CHANGE
//*

```

Figure 122. Example JCL for RUNSTATS Utility

For access path optimization, however, you might want to add TABLE(ALL) INDEX(ALL) KEYCARD as in the installation jobs. Be aware that these options increase run time significantly - with no parallelizing, the job took about 2 hours and 45 minutes. For shorter times split the RUNSTATS job into several jobs (20 - 25 tablespaces each) and run these jobs in parallel. You may also specify the SAMPLE parameter to reduce run time. For more information on this parameter see *DB2 for OS/390 V5 Utility Guide and Reference*, SC26-8967.

You should consider running RUNSTATS daily without options for growth monitoring and once or twice a week with the access path optimization parameters (see also the topic “Maintaining Catalog Statistics” in the chapter “Database Management” of *BC SAP Database Administration Guide: DB2 for OS/390*, Material Number 51003810). How often you execute RUNSTATS is dependent on the growth of your SAP R/3 installation; less growth implies executing RUNSTATS less often.

The following DB2 for OS/390 catalog columns updated by RUNSTATS can help to find growth in tablespaces and tables:

- SYSIBM.SYSTABLESPACE columns:
  - NACTIVE - number of active pages
  - PGSIZE - size of a page in kilobytes
  - STATSTIME - timestamp when last RUNSTATS taken
- SYSIBM.SYSTABSTATS columns:
  - NACTIVE - number of pages with rows in a partition
  - CARD - number of rows
  - STATSTIME - timestamp when last RUNSTATS taken
- SYSIBM.SYSTABLES columns:
  - NPAGES - number of pages with rows

Two SAP R/3 considerations have to be taken into account when looking at this number:

1. The number is set to 100 for all tables in the default SAP R/3 installation. If the number of pages with rows is less than six, this avoids tablespace scans on tables that start nearly empty at installation time and grow.

**Important**

Releases of SAP R/3 occurred after the writing of this section. The default of 100 is now a more sophisticated calculation. Review SAP OSS note 113008.

Because executing RUNSTATS will update this column you should run the job in Figure 124 on page 170 to reset NPAGES.

2. NPAGES gives the number of pages that actually contain rows. For scratch tables (see 6.2.3, "Scratch Tables" on page 179) this might not indicate how much space is needed when the table is filled.
- CARDF - number of rows
  - STATSTIME - timestamp when last RUNSTATS taken

One way to see the total space (in KB) for all tables is the use of SAP R/3 transaction code DB02, reaching the screen shown in Figure 77 on page 91.

Another way to see this data is to run the job shown in Figure 123 on page 169 which uses SQL to print out the space used (in KB) for all tablespaces in SAP R/3. Run it before and after the RUNSTATS job and compare the two job outputs to get a quick overview of which tablespaces have grown.

```

//PETRARO JOB (999,POK),'RUNSTATS ',NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//RUNSAMPO EXEC PGM=IKJEFT01,DYNAMNBR=20
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD DSN='PETRA.RUNBEFOR',DISP=SHR
//SYSTSIN DD *
 DSN SYSTEM(DB2R)
 RUN PROGRAM (DSNTEP2) LIB('DSN510.RUNLIB.LOAD') -
 PLAN(DSNTEP51) PARM('/ALIGN(LHS)')
 END
/*
//SYSIN DD *
-/******
-/* SHOW RUNSTATS SPACE INFO FOR TABLESPACES *
-/******
SELECT NAME, PGSIZE*NACTIVE
 FROM SYSIBM.SYSTABLESPACE WHERE CREATOR='SAPR3' ORDER BY NAME
 WITH UR;
-/******
-/* SHOW RUNSTAT SPACE INFO FOR PARTITIONED TABLESPACES *
-/******
SELECT A.TSNAME, PARTITION, B.PGSIZE*A.NACTIVE, CARD
 FROM SYSIBM.SYSTABSTATS A, SYSIBM.SYSTABLESPACE B WHERE
 CREATOR='SAPR3' AND TSNAME=B.NAME ORDER BY A.TSNAME, PARTITION
 WITH UR;
-/******
-/* SHOW RUNSTAT NUMBER OF PAGES WITH ROWS FOR TABLES *
-/* ONLY VALID RIGHT AFTER RUNSTATS WITHOUT UPDATE OF NPAGES *
-/******
SELECT NAME, NPAGES, CARDF
 FROM SYSIBM.SYSTABLES WHERE CREATOR='SAPR3'
 ORDER BY NAME WITH UR;
/*

```

Figure 123. JCL to Query Catalog Columns Updated by RUNSTATS

In SAP R/3 tablespace scans should be avoided for performance reasons also on momentarily nearly empty tables because they can grow over time. For this reason, we ran the job shown in Figure 124 on page 170 following the run of RUNSTATS (see also the RUNSTATS jobs that come with the default SAP R/3 installation and the topic “Maintaining Catalog Statistics” in the chapter “Database Management” of *BC SAP Database Administration Guide: DB2 for OS/390*, Material Number 51003810).

Note that the jobs shown in Figure 123 and Figure 124 on page 170 are good candidates for jobs a DBA would define to be scheduled from SAP R/3; see 3.2.5, “Transaction DB2J” on page 105.

#### Important

Releases of SAP R/3 occurred after the writing of this section. Review SAP OSS note 113008 for JCL that might substitute for that in Figure 124 on page 170.

```

//PETRAR$ JOB (999,POK), 'RUNSTATS', CLASS=A,MSGCLASS=T,
// NOTIFY=PETRA,TIME=1440,REGION=5000K,
// MSGLEVEL=(1,1)
//*
//UTIL2 EXEC PGM=IKJEFT01
//STEPLIB DD DISP=SHR,DSN=DSN510.SDSNLOAD
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSIN DD *

UPDATE SYSIBM.SYSTABLES
 SET CARDF=50, NPAGES=10
 WHERE CREATOR='SAPR3' AND TYPE='T' AND NPAGES <= 10;

UPDATE SYSIBM.SYSTABLESPACE
 SET NACTIVE=10
 WHERE CREATOR='SAPR3' AND NACTIVE <= 10;

UPDATE SYSIBM.SYSTABSTATS
 SET CARD=50, NPAGES=10
 WHERE OWNER='SAPR3' AND TSNAME IN
 (SELECT NAME FROM SYSIBM.SYSTABLESPACE
 WHERE CREATOR='SAPR3' AND NACTIVE <= 10);

UPDATE SYSIBM.SYSINDEXES
 SET CLUSTERRATIO=0,
 FIRSTKEYCARDF=-1, FULLKEYCARDF=-1, NLEAF=-1, NLEVELS=-1
 WHERE TBcreator='SAPR3' AND TBNAMEIN
 (SELECT NAME FROM SYSIBM.SYSTABLES
 WHERE CREATOR='SAPR3' AND TYPE='T' AND NPAGES<-10);

UPDATE SYSIBM.SYSCOLUMNS
 SET COLCARDF=-1, HIGH2KEY=' ', LOW2KEY=' '
 WHERE TBcreator='SAPR3' AND TBNAMEIN
 (SELECT NAME FROM SYSIBM.SYSTABLES
 WHERE CREATOR='SAPR3' AND TYPE='T' AND NPAGES<-10);

DELETE FROM SYSIBM.SYSCOLDIST SET NPAGES = 100
 WHERE TOWNER='SAPR3' AND TBNAME IN
 (SELECT NAME FROM SYSIBM.SYSTABLES
 WHERE CREATOR='SAPR3' AND TYPE='T' AND NPAGES<-10);

/*
//SYSTSIN DD *
DSN SYSTEM(DB2R)
 RUN PROGRAM(DSNTIAD) PLAN(DSNTIA51) -
 LIB('DSN510.RUNLIB.LOAD')
END
/*

```

Figure 124. JCL to Update NPAGES after RUNSTATS

Figure 125 on page 171 is an example of the SYSIBM.SYSTABLES output of RUNSTATS.

```
DSNU614I -DB2R DSNUSUTB - SYSTABLES CATALOG STATISTICS FOR SAPR3.MSEG
 CARD = 9051
 CARDF = 9.051E+03
 NPAGES = 2263
 PCTPAGES = 99
 PCTROWCOMP = 0
```

Figure 125. Sample RUNSTATS Output for a Table in a Tablespace

### 6.1.3 STOSPACE Utility

This utility was used with earlier releases of SAP R/3; we left the discussion in this edition of the redbook for completeness. However, current users of SAP R/3 generally do not use STOSPACE.

The DB2 for OS/390 STOSPACE utility updates DB2 for OS/390 catalog columns that indicate how much space is allocated for storage groups, as well as related tablespaces and indexes.

Databases, tablespaces and index spaces must not be in a stopped state if information about them is to be captured. The STOSPACE utility can be executed with SAP R/3 up and running.

First get the actual space information with a job submitting queries to the DB2 for OS/390 catalog as shown in Figure 126 on page 172. The output data set will list the allocated storage per storage group, per tablespace and per index space.

```

//PETRASO JOB (999,P0K),' STOSPACE ', NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//STOSPAC1 EXEC PGM=IKJEFT01,DYNAMNBR=20
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD DSN=' PETRA.STOBEFOR', DISP=SHR
//SYSTSIN DD *
 DSN SYSTEM(DB2R)
 RUN PROGRAM (DSNTEP2) LIB(' DSN510.RUNLIB.LOAD') -
 PLAN(DSNTEP51) PARM('/ ALIGN(LHS)')
 END
/*
//SYSIN DD *
-/* SHOW ALLOCATED SPACE IN KB FOR ALL STOGROUPS *
-/* SHOW ALLOCATED SPACE IN KB FOR ALL TABLESPACES *
SELECT NAME, SPACE
 FROM SYSIBM.SYSSTOGROUP WHERE CREATOR=' SAPR3'
 ORDER BY NAME WITH UR;
-/* SHOW ALLOCATED SPACE IN KB FOR ALL INDEXSPACES *
SELECT B.TSNAME, PARTITION, B.SPACE
 FROM SYSIBM.SYSSTOGROUP A,
 SYSIBM.SYSTABLEPART B, SYSIBM.SYSTABLESPACE C WHERE
 STORNAME=A.NAME AND C.NAME=B.TSNAME AND
 C.CREATOR=' SAPR3' ORDER BY B.TSNAME, PARTITION
 WITH UR;
-/* SHOW ALLOCATED SPACE IN KB FOR ALL INDEXSPACES *
SELECT B.IXNAME, C.INDEXSPACE, B.SPACE
 FROM SYSIBM.SYSSTOGROUP A, SYSIBM.SYSINDEXPART B,
 SYSIBM.SYSINDEXES C WHERE STORNAME=A.NAME AND
 C.NAME=B.IXNAME AND C.CREATOR=' SAPR3'
 ORDER BY B.IXNAME WITH UR;
/*

```

Figure 126. JCL to Query Catalog Columns Updated by STOSPACE

Next, run the STOSPACE utility to update the catalog columns to the current status. Specify the following command to cover all storage groups in the subsystem as shown in Figure 127 on page 173:

```
STOSPACE STOGROUP *
```

```

//PETRAS1 JOB (999,P0K),' STOSPACE', NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//STOSAMP EXEC PGM=DSNUTILB,REGION=1024K,
// PARM='DB2R,RUNSTAT1'
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//*
//*****
//* STOSPACE ON ALL STOGROUPS *
//*****
//SYSPRINT DD DSN='PETRA.JCLOUT',DISP=SHR
//SYSIN DD *
 STOSPACE STOGROUP *
/*

```

Figure 127. JCL to Run STOSPACE Utility

Finally, run the SQL job again (shown in Figure 126 on page 172) with a different data set listed in the SYSPRINT DD statement and compare the two output data sets to find growing tablespaces and index spaces.

#### 6.1.4 DB2ADM Growth Monitoring

The DB2ADM product provides a user-friendly interface to information collected by RUNSTATS and STOSPACE. It also shows DB2 catalog information.

Start DB2ADM by calling *TSO %ADB* or *TSO %ADBL*. ADB and ADBL are CLISTS provided by the DB2ADM product.

Selection **3 - DB2 performance queries** of the main menu gives you access to all growth-related data (see Figure 7 on page 23).

If you execute RUNSTATS on all tablespaces regularly, use option **1** to list all tablespaces that have no RUNSTATS information, that is, any tablespace created since the last RUNSTATS.

For growth monitoring, consider options **12**, **12X**, and **13** which all require that STOSPACE has been previously run. Option **12** (for tablespaces) and **12X** (for index spaces) show all those items that use more than one extent. Option **13** lists allocated and used space for all tablespaces.

#### 6.1.5 DB2AUG Growth Monitoring

The DB2AUG product (IBM Product number 5695-077) automates the generation of utility JCL to be used with DB2 for OS/390. It supports dynamic DB2 for OS/390 object definition, which is very helpful in the SAP R/3 environment because DB2 for OS/390 objects can be generated by the SAP R/3 applications.

DB2 for OS/390 utility JCL can be generated dynamically. It would be logical to generate it near the scheduling of RUNSTATS and STOSPACE jobs. The JCL can apply to different object levels; for instance a database or an entire subsystem.

Important utilities for growth monitoring, such as STOSPACE and RUNSTATS, can be triggered. The updated catalog columns are utilized by DB2AUG for data set and volume statistics. These statistics can be loaded into DB2 for OS/390 tables by DB2AUG for historical and exception reporting.

Furthermore, DB2AUG can determine when to run REORG and even include the statements needed to change the size of a DB2 for OS/390 object.

Refer to 2.4.2.2, "DB2 Automated Utility Generator (DB2AUG)" on page 24 for more information and to see sample panels of DB2AUG.

### 6.1.6 Table Statistics Workload

The table statistics workload is collected beginning with the last start of the current application server. Get the statistics by calling transaction ST10 in SAP R/3. Enter tab1 in the transaction field. Go to the Database call activity section on the right side of the table. Select an entry in the Changes column and click **Sort** under the **Edit** submenu (see Figure 128).

The screenshot shows the 'Performance analysis: Table call statistics' window in SAP. The window title is 'Performance analysis: Table call statistics'. Below the title bar, there is a menu bar with 'Time Edit Data Monitor System Help'. A toolbar contains several icons. Below the toolbar, there are buttons for 'Choose', 'Generic buffer', 'Single record buffer', 'Not buffered', 'Sort', 'Analyse table', 'Reset', and 'Refresh'. The main area displays system information: 'System: r1ncsap.RED.00', 'Data & time of snapshot: 09.02.1999 12:45:18', 'All tables', and 'System startup: 25.01.1999 14:45:31'. The main data is presented in a table with the following columns: Table, Buffer State, Buf key opt, Invali-dations, Total, ABAP/IV Processor requests (Direct reads, Seq. reads), changes, and ca.

| Table      | Buffer State | Buf key opt | Invali-dations | Total     | ABAP/IV Processor requests | changes    | ca     |
|------------|--------------|-------------|----------------|-----------|----------------------------|------------|--------|
|            |              |             |                |           | Direct reads               | Seq. reads |        |
| *Total*    |              |             | 4 527          | 6.946.710 | 5.758.349                  | 1.141.123  | 47.238 |
| BTCCTL     |              |             | 0              | 27.974    | 13.989                     | 0          | 13.985 |
| MONI       |              |             | 0              | 26.575    | 0                          | 14.490     | 12.085 |
| TBTCP      |              |             | 0              | 11.192    | 0                          | 5.686      | 5.506  |
| BTCDELAY   | valid        | ful         | 4 521          | 99.230    | 82.651                     | 2.442      | 5.137  |
| SNAP       |              |             | 0              | 5.087     | 0                          | 18         | 5.069  |
| TBTCO      |              |             | 0              | 19.012    | 16.755                     | 221        | 1.096  |
| TST01      |              |             | 0              | 1.286     | 366                        | 0          | 920    |
| TRTCS      |              |             | 0              | 19.845    | 5.317                      | 13.619     | 908    |
| TSPOPTIONS | valid        | ful         | 0              | 885       | 442                        | 1          | 442    |

At the bottom right of the window, it says 'RED (1) r1ncsap'.

Figure 128. Table Statistics Workload (Transaction ST10)

To get a differentiation between INSERT, DELETE and UPDATE activity, select the table and click **Choose**, which will show the screen seen in Figure 129 on page 175.



Performance analysis: table call statistics

Time Edit Goto Monitor System Help

Print

System: riscsap RED.00      All tables  
 Date & time of snapshot: 09.02.1999 12:45:18      System Startup: 25.01.1999 14:45:31

Type: TRSNP  
 Application class: SBTG  
 Client dependent: no  
 Last modified: 18.11.1997  
 by: SAP

| Operation Type | ADAP/IV Processor |       | Prepares | Opsns | Database Calls |      | Time [ms] |
|----------------|-------------------|-------|----------|-------|----------------|------|-----------|
|                | Requests          | Fails |          |       | Fetch/Exec     | Rows |           |
| Select single  | 16.755            | 5.325 | 0        | 1.307 | 1.305          |      | 0         |
| Select         | 221               | 0     | 10       | 0     | 0              | 0    | 0         |
| Update         | 732               | 1     | 7        |       | 723            | 723  | 0         |
| Delete         | 180               | 0     | 2        |       | 180            | 180  | 0         |
| Insert         | 184               | 0     | 4        |       | 183            | 183  | 0         |
| Buffer load    |                   |       | 0        | 0     | 0              | 0    | 0         |

RED (1) riscsap

Figure 129. Table Call Statistics (Transaction ST10)

To find growing tables, look for tables with high insert and low delete activity. Monitor these tables more closely; for instance, include only SELECT statements of these tables in the job to query the RUNSTATS information (see Figure 123 on page 169).

### 6.1.7 SQL Trace in SAP R/3

With the SQL trace function of SAP R/3 you can identify tables that are likely to grow in your installation.

During hours with normal workload, call transaction ST05 and click **Trace on** to start the SQL trace. Specify \* as USER to trace SQL of every user. Stop the trace after five minutes to an hour, depending on the workload (higher workloads imply shorter intervals) by clicking the **Stop trace** button. List the SQL trace by clicking the **List trace** button and specify \* for **USER** again. Select **Trace SQL → Summary**.

You can get the output sorted by SQL operation only if you use the following sequence:

- Select an entry in the Table column and then click **Sort**.
- Select an entry in the **SQL-Op** column and then click **Sort** again.

**Note:** Do not get confused: SEL will be listed before INS, UPD and CW (commit work).

To get the tables with INS and DEL accesses sorted by name:

- Select the first table with INS access and click **Select beginning**.
- Select the last table with INS access and click **Select end**.

- Select the first table with DEL access and click **Select beginning**.
- Select the last table with DEL access and click **Select end**.
- Select **Edit** → **Set TCode**, enter a name for your selection (for instance INSDEL), then press **Continue**.
- Click **Compress** and confirm the question in the next panel by clicking **Yes**.

Now look for tables listed with INSERT statements but no DELETE statements; these are the tables growing in your installation.

## 6.1.8 Performance Traces

Tracing growth of tablespaces or tables with DB2PM requires the running of performance traces; these can generate a significant overhead depending on the performance classes started. Therefore, monitoring growth with performance traces is not recommended.

---

## 6.2 Hot Spot Tables in SAP R/3

Hot spot tables in SAP R/3 regarding growth are tables that are either known to be high insert tables, expected to grow according to their SAP R/3 size category and SAP R/3 data class, or scratch tables.

### 6.2.1 High Insert Tables in SAP R/3

Table 10 lists tables that are likely to grow over time in your SAP R/3 installation. The table is based on SAP statistics and customer data. The table is not considered to be complete. The tablespace shown in the table is the one where the table is located during SAP R/3 standard installation.

| <i>Table 10 (Page 1 of 2). High Insert Tables in SAP R/3</i> |            |    |    |    |    |         |    |           |
|--------------------------------------------------------------|------------|----|----|----|----|---------|----|-----------|
| Table                                                        | Tablespace | SD | MM | FI | WM | CO (PP) | PS | SAPOffice |
| ACCTCR                                                       | SBTAB00    | *  | *  |    |    | *       |    |           |
| ACCTHD                                                       | SBTAB00    | *  | *  |    |    | *       |    |           |
| ACCTIT                                                       | SBTAB00    | *  | *  |    |    | *       |    |           |
| AFRU                                                         | SBTAB00    |    |    |    |    | *       |    |           |
| AFVC                                                         | SBTAB00    |    |    |    |    | *       |    |           |
| AFVU                                                         | SBTAB00    |    |    |    |    | *       |    |           |
| AFVV                                                         | SBTAB00    |    |    |    |    | *       |    |           |
| BKPF                                                         | SBTAB01    | *  | *  | *  |    | *       |    |           |
| BSIM                                                         | SBTAB01    | *  | *  |    |    | *       |    |           |
| BSIS                                                         | SBTAB01    | *  | *  | *  |    | *       |    |           |
| COEP                                                         | SBTAB02    |    |    |    |    | *       |    |           |
| COEPL                                                        | SBTAB02    |    |    |    |    | *       |    |           |
| COKA                                                         | SBTAB02    |    |    |    |    | *       |    |           |
| COKP                                                         | SBTAB02    |    |    |    |    | *       |    |           |
| COKS                                                         | SBTAB02    |    |    |    |    | *       |    |           |
| COSP                                                         | SBTAB02    |    |    |    |    | *       | *  |           |

| Table 10 (Page 2 of 2). High Insert Tables in SAP R/3 |            |    |    |    |    |         |    |           |
|-------------------------------------------------------|------------|----|----|----|----|---------|----|-----------|
| Table                                                 | Tablespace | SD | MM | FI | WM | CO (PP) | PS | SAPOffice |
| COSPD                                                 | SBTAB02    |    |    |    |    | *       |    |           |
| COSS                                                  | SBTAB02    |    |    |    |    | *       | *  |           |
| EBAN                                                  | SBTAB03    |    | *  |    |    |         |    |           |
| EIPA                                                  | SBTAB03    |    | *  |    |    |         |    |           |
| EKBE                                                  | SBTAB04    |    | *  |    |    |         |    |           |
| EKPO                                                  | SBTAB04    |    | *  |    |    |         |    |           |
| MSEG                                                  | SBTAB07    | *  | *  |    |    | *       |    |           |
| NAST                                                  | SBTAB07    | *  | *  |    |    |         |    |           |
| RESB                                                  | SBTAB08    |    |    |    |    | *       |    |           |
| RFBLG                                                 | SCLU00     | *  | *  | *  |    | *       |    |           |
| SOC3                                                  | SBTAB10    |    |    |    |    |         |    | *         |
| SOFM                                                  | SBTAB10    |    |    |    |    |         |    | *         |
| SOOD                                                  | SBTAB10    |    |    |    |    |         |    | *         |
| VBAP                                                  | SBTAB17    | *  |    |    |    |         |    |           |
| VBBS                                                  | SBTAB17    | *  |    |    |    |         |    |           |
| VBEP                                                  | SBTAB17    | *  |    |    |    |         |    |           |
| VBFA                                                  | SBTAB17    | *  |    |    |    |         |    |           |

## 6.2.2 Size Category and Data Class in SAP R/3

Within SAP R/3 the term *size category* is used to classify tables according to their expected size in normal operation. Size category describes the estimated number of records a table can contain.

There are five size categories, 0 to 4, defined by SAP R/3. Size category 0 is expected to grow less than size category 4.

The size category can be displayed with transaction SE13. Enter a table name and click **Display**. The resulting panel (as seen in Figure 130 on page 178) will also show you the estimated number of records to expect for this table.

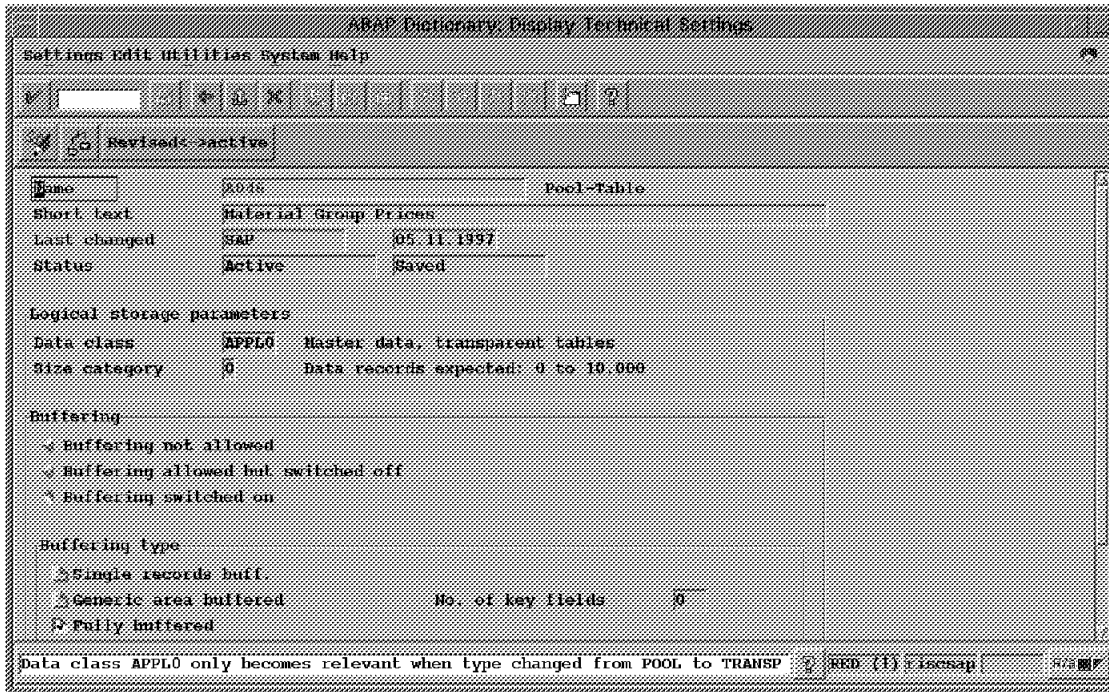


Figure 130. ABAP Dictionary: Display Technical Settings

Within SAP R/3 the term *data class* is used to describe whether the data in the table is accessed or changed frequently and also in which database a table is stored in (see *BC SAP Database Administration Guide: DB2 for OS/390*, Material Number 51003810).

The data classes defined by SAP R/3 for customer data are shown in Table 11.

| Data Class | Description                                                                                                    |
|------------|----------------------------------------------------------------------------------------------------------------|
| APPL0      | Master data - data that is accessed frequently but rarely updated                                              |
| APPL1      | Transaction data - data that is changed frequently                                                             |
| APPL2      | Organization and customizing - data that is entered when the system is configured and rarely changed afterward |
| USER       | For customer use - we recommend to use for rarely changed data                                                 |
| USER1      | For customer use - we recommend to use for frequently changed data                                             |
| USER2      | For customer use                                                                                               |
| USER3      | For customer use                                                                                               |

Therefore, tables with size category 4 and data class APPL1 (or USER1) are likely to grow.

### 6.2.3 Scratch Tables

A *scratch table* is a table that can get large but will shrink again, as for instance a table containing spool jobs. Table 12 shows known scratch tables in SAP R/3. The tablespace shown is the tablespace where the table is located during SAP R/3 standard installation.

| Table  | Tablespace | Table Description                                      |
|--------|------------|--------------------------------------------------------|
| APQD   | BBTAB00    | Batch Queue DATA DEFINITION                            |
| APQI   | SBTAB00    | Batch Queue INFO DEFINITION                            |
| EDIDC  | SBTAB03    | Control record for Electronic Data Interchange (EDI)   |
| EDI30C | SCLU00     | Intermediate Document Cluster for EDI                  |
| TST01  | SBTAB16    | TemSe (Spool) List of all Objects and Parts            |
| TST03  | BBTAB16    | TemSe (Spool) Data                                     |
| VBHDR  | SPROT00    | Update Header                                          |
| VBDATA | BPROT00    | Update Data                                            |
| VBMOD  | SPROT00    | Update Function Modules                                |
| VBLOG  | SCLU00     | Cluster for Updating (if you run clustered VBLOG only) |

---

## 6.3 How to Handle Growing Tablespaces or Index Spaces

No action is needed, except for performance reasons, if tablespaces or index spaces have more than one extent. The maximum number of extents for a single VSAM dataset at the moment is 255. To avoid reaching the 255 extents limitation, see 6.3.2, "Reaching 255 VSAM Extents" on page 184. If a tablespace or index space requires a new extent and no space for extents is found on all volumes of the storage group specified for the table or index space, refer to 6.3.3, "All Volumes in Storage Group Full" on page 185. If 255 extents or all volumes of the storage group are full all inserts or updates to this tablespace that require additional space will fail.

For performance reasons, you might want to enlarge the primary allocation of a tablespace or an index space to be certain that only one extent is used.

### 6.3.1 Increase Size of Tablespace or Index Space

Note that the example in this section was used with an earlier release of SAP R/3. The example was kept in this edition because users may need to perform the function, however the actual table, tablespace or allocations may now be different.

To increase the size of a tablespace or index space, the following steps have to be executed.

Because in SAP R/3 on DB2 for OS/390 all datasets are DB2-managed or SMS-managed, you alter the size of the tablespace or index space with the ALTER TABLESPACE command.

We issued the LISTCAT command to find the actual sizes of BTAB07.SBTAB07. The Primary allocation is 25\*15\*12\*4KB=18000 KB, the secondary allocation is 136\*15\*12\*4KB=97920 KB, and the tablespace has two extents (one primary and one secondary). The allocated space for the tablespace is 115920 KB.

To get the best performance, change allocations so that all allocated space fits into the primary allocation: choose 132000 KB. It was decided to keep secondary allocation unchanged (because of the kind of workload we use, the tablespace will still grow in the future).

Change the primary and secondary allocations by issuing the ALTER TABLESPACE command either through using SQL Processing Using File Input (SPUFI) or through using an SQL job, as shown in Figure 131.

```
//PETRAAT1 JOB (999,POK),' SPUFI ALTER TS',NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//JOB LIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//STOP EXEC PGM=IKJEFT01,DYNAMNBR=20
//SYSPRINT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSIN DD DUMMY
//SYSTSIN DD *
DSN SYSTEM(DB2R)
RUN PROGRAM (DSNTEP2) LIB('DSN510.RUNLIB.LOAD') -
PLAN(DSNTEP51) PARM('/ALIGN(LHS)')
-STOP DATABASE(BTAB07) SPACENAM(SBTAB07)
END
/*
//SPUFI0 EXEC PGM=IKJEFT01,DYNAMNBR=20,COND=(4,LT)
//SYSPRINT DD DSN='PETRA.JCLOUT',DISP=SHR
//SYSPRINT DD SYSOUT=*
//SYSTSIN DD *
DSN SYSTEM(DB2R)
RUN PROGRAM (DSNTEP2) LIB('DSN510.RUNLIB.LOAD') -
PLAN(DSNTEP51) PARM('/ALIGN(LHS)')
END
/*
//SYSIN DD *
ALTER TABLESPACE BTAB07.SBTAB07 PRIQTY 132000 SECQTY 97920;
/*
```

Figure 131. Example JCL for ALTER TABLESPACE to Change Primary and Secondary Allocations

Then run the DB2 for OS/390 REORG utility on the altered tablespace so that the new sizes come into effect. To reduce impact on the running system also consider running online REORG (see 5.3, "Online Reorganization" on page 158).

To run online REORG, a mapping table, index, and its tablespace have to be provided. We did this by issuing SPUFI as shown in Figure 132 on page 181 and Figure 133 on page 181.

```
CREATE TABLESPACE MAPPING SEGSIZE 32 USING STOGROUP SYSDEFLT PRIQTY 10000
SECQTY 30000;
```

Figure 132. SPUFI to Create Tablespace for REORG Mapping Table

The SPUFI shown in Figure 132 creates tablespace MAPPING in default database DSNDB04.

```
CREATE TABLE MAP
(TYPE CHAR(1) NOT NULL,
SOURCE_RID CHAR(5) NOT NULL,
TARGET_XRID CHAR(9) NOT NULL WITH DEFAULT,
LRSN CHAR(6) NOT NULL)
IN DSNDB04.MAPPING;
CREATE TYPE 2 UNIQUE INDEX MAP1 ON MAP
(SOURCE_RID ASC, TYPE, TARGET_XRID, LRSN);
```

Figure 133. SPUFI to Create REORG Mapping Table

The SPUFI shown in Figure 133 creates the mapping table in the corresponding tablespace.

The JCL in Figure 134 was used to perform the online REORG.

```
//PETRAR01 JOB (999,POK),'REORG TEST 1 TS',NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//REOSAMP EXEC PGM=DSNUTILB,REGION=1024K,
// PARM='DB2R,REORG1'
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//*
//*****
//* ONLINE REORG ON ONE TABLESPACE ONLY *
//*****
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SYSCOPY DD DSN='PETRA.KEEPIC',SPACE=(CYL,(20,20),,,ROUND),DISP=(NEW,KEEP)
//SYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(20,20),,,ROUND)
//SORTOUT DD UNIT=SYSDA,SPACE=(CYL,(20,20),,,ROUND)
//SYSREC DD UNIT=SYSDA,SPACE=(CYL,(20,20),,,ROUND)
//SYSIN DD *
REORG TABLESPACE BTAB07.SBTAB07
SHRLEVEL CHANGE
MAPPINGTABLE MAP MAXRO 120 LONGLOG DRAIN DELAY 300
SORTDEVT SYSDA
//*
```

Figure 134. Example JCL to Run Online REORG

We recommend that you specify the SYSCOPY data set as a permanent data set rather than as a temporary one. This gives the advantage of getting an image copy of the reorganized tablespace.

Execution of RUNSTATS on the altered tablespace is recommended.

Altering the size of a tablespace of the SAP R/3 system has a user impact: for a time, the tablespace is not accessible because it has to be stopped during the ALTER TABLESPACE command. To reduce this impact to a minimum, prepare all steps ahead and restart the tablespace immediately after running the ALTER TABLESPACE command. Execution time for the ALTER TABLESPACE job is about 10 seconds.

A second impact occurs if you run workload during the online REORG. During the last iteration of updating the shadow copy (see 5.3, "Online Reorganization" on page 158) there is no read/write access to the data possible by any SAP R/3 user. This can result in SQL error -911 timeout errors or SQL error -904. The timeout errors are visible in the OS/390 system log (see Figure 135).

```
DSNT376I -DB2R PLAN=FOMEPLAN WITH 458
CORRELATION-ID=ICLI
CONNECTION-ID=DB2CALL
LUW-ID=DB2R.DB2RLU.AEB113D5308A
IS TIMED OUT. ONE HOLDER OF THE RESOURCE IS PLAN=DSNUTIL WITH
CORRELATION-ID=PETRAR01
CONNECTION-ID=UTILITY
LUW-ID=DB2R.DB2RLU.AEB12B23247B
ON MEMBER DB2R

DSNT501I -DB2R DSNILMCL RESOURCE UNAVAILABLE 459
CORRELATION-ID=ICLI
CONNECTION-ID=DB2CALL
LUW-ID=*
REASON 00C900BA
TYPE 00002005
NAME BTAB07 .NASTRRRR
DSNT376I -DB2R PLAN=FOMEPLAN WITH 460
CORRELATION-ID=ICLI
CONNECTION-ID=DB2CALL
LUW-ID=DB2R.DB2RLU.AEB113D43F48
IS TIMED OUT. ONE HOLDER OF THE RESOURCE IS PLAN=DSNUTIL WITH
CORRELATION-ID=PETRAR01
CONNECTION-ID=UTILITY
LUW-ID=DB2R.DB2RLU.AEB12B23247B
ON MEMBER DB2R
```

Figure 135. OS/390 System Log Timeout Error during Online REORG

The timeout errors are also visible in the ICLI server message file (see Figure 136 on page 183).



```

DSNT408I SQLCODE = -911, ERROR: THE CURRENT UNIT OF WORK HAS BEEN ROLLED BACK
 DUE TO DEADLOCK OR TIMEOUT. REASON 00C900BA, TYPE OF RESOURCE
 00002005, AND RESOURCE NAME BTAB07 .NASTRRRR
DSNT418I SQLSTATE = 40001 SQLSTATE RETURN CODE
DSNT415I SQLERRP = DSNXRUID SQL PROCEDURE DETECTING ERROR
DSNT416I SQLERRD = -110 13172746 0 13820889 -1041948663 12714050 SQL
 DIAGNOSTIC INFORMATION
DSNT416I SQLERRD = X'FFFFFF92' X'00C9000A' X'00000000' X'00D2E3D9'
 X'C1E52009' X'00C20042' SQL DIAGNOSTIC INFORMATION

71235 Time: 864228846.511290 = (Wed) 1997 May 21 15:34:06.511290

ICLI1418 (W) ERROR: SQLCODE is -911, dumping received buffer (length 1140).

```

Figure 136. ICLI Server Message File Timeout Error during Online REORG

The SAP R/3 users will see timeout errors as ABAP/4 shortdump (see Figure 137).

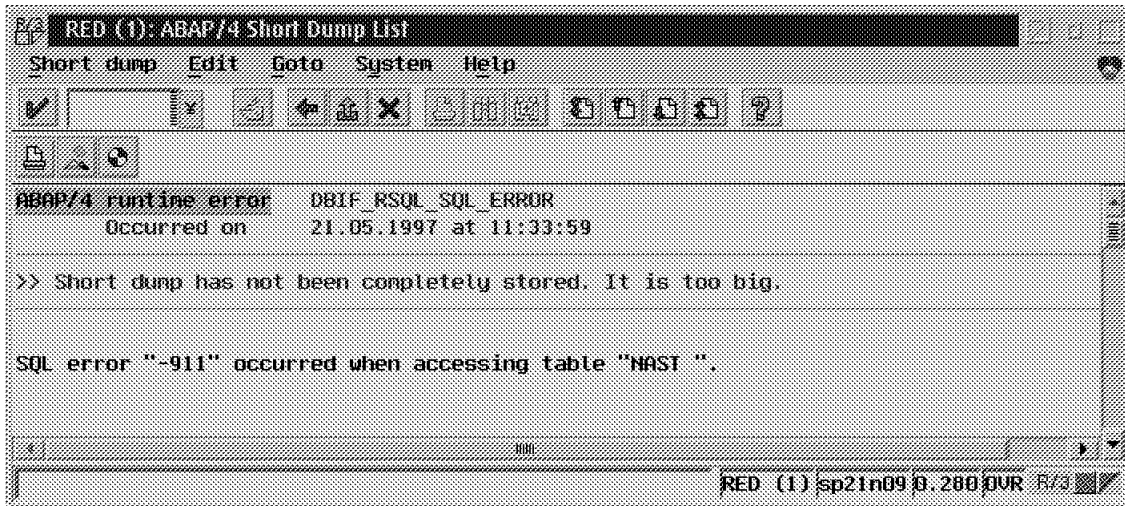


Figure 137. ABAP/4 Shortdump for Timeout during Online REORG (Extract)

The SAP R/3 administrator will see a message in the SAP R/3 system log. If SAP R/3 errors result from the timeout problem, those errors are also in the SAP R/3 system log; an example is the termination of the update in Figure 138 on page 184. The -904 error shows up in the same way as for the stop/start tablespace, because a stop/start tablespace is done by online REORG.

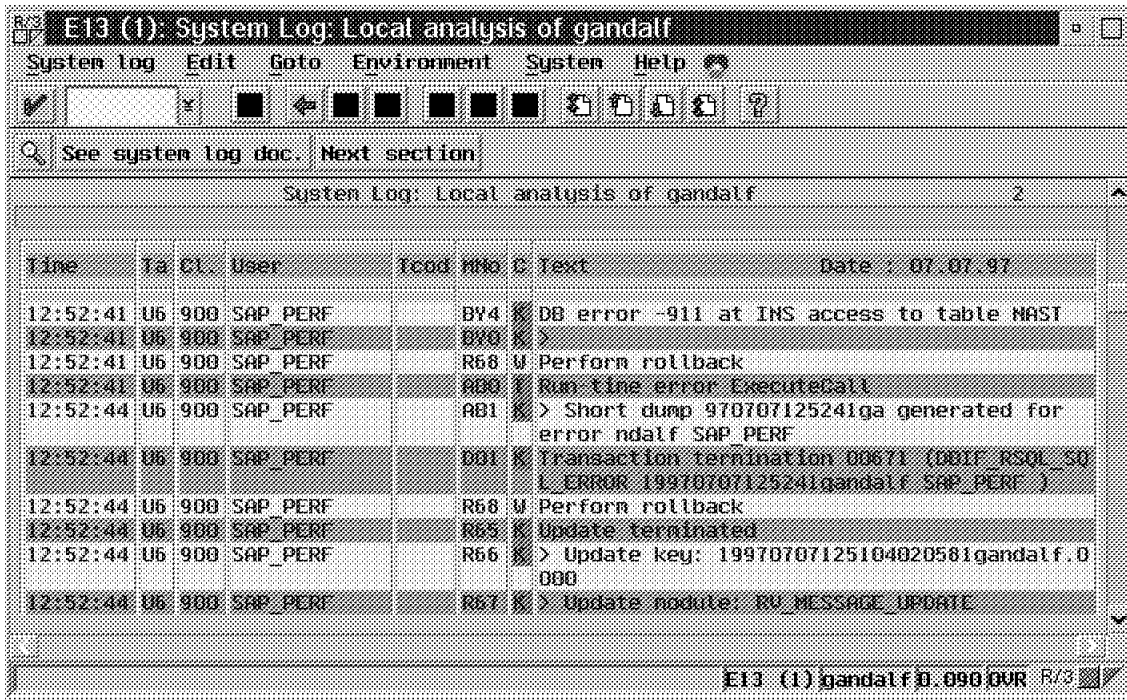


Figure 138. Messages in SAP R/3 System Log for Timeout during Online REORG

### 6.3.2 Reaching 255 VSAM Extents

DB2 for OS/390 non-partitioned tablespaces, index spaces and partitions of partitioned tablespaces are represented as VSAM data sets in OS/390. The maximum number of extents a VSAM data set can allocate is 255 extents. If there is no space on a volume to allocate the next extent, or if the maximum file size of 2 GB is reached, a new VSAM dataset will be allocated.

If you reach the 255 VSAM extents limit, increase the size of the primary and secondary allocations of the tablespace or index space as described in 6.3.1, "Increase Size of Tablespace or Index Space" on page 179. Errors similar to those shown in Figure 139 on page 185 will show up on the OS/390 system log if you reach the maximum number of VSAM extents.

```

.
IEC070I 204-211,DB2RDBM1,DB2RDBM1,SYS06604,2040,LABDB2,
IEC070I DSN510.DSNDBC.DSNDB04.ATSTEMP.I0001.A001,
IEC070I DSN510.DSNDBD.DSNDB04.ATSTEMP.I0001.A001,
IEC070I CATALOG.DB2ICF1.VLABDB2
IEC070I 204-211,DB2RDBM1,DB2RDBM1,SYS06604,2040,LABDB2,
IEC070I DSN510.DSNDBC.DSNDB04.ATSTEMP.I0001.A001,
IEC070I DSN510.DSNDBD.DSNDB04.ATSTEMP.I0001.A001,
IEC070I CATALOG.DB2ICF1.VLABDB2
DSNP011I -DB2R DSNPXTNO - MEDIA MANAGER SERVICES 930
ERROR FOR
 DSN510.DSNDBC.DSNDB04.ATSTEMP.I0001.A001
 MMRC=8 DSMRC=00D70014
 CONNECTION-ID=DB2CALL, CORRELATION-ID=ICLI,
 LUW-ID=*
IEC070I 204-211,DB2RDBM1,DB2RDBM1,SYS06604,2040,LABDB2,
IEC070I DSN510.DSNDBC.DSNDB04.ATSTEMP.I0001.A001,
IEC070I DSN510.DSNDBD.DSNDB04.ATSTEMP.I0001.A001,
IEC070I CATALOG.DB2ICF1.VLABDB2
IEC070I 204-211,DB2RDBM1,DB2RDBM1,SYS06604,2040,LABDB2,
IEC070I DSN510.DSNDBC.DSNDB04.ATSTEMP.I0001.A001,
IEC070I DSN510.DSNDBD.DSNDB04.ATSTEMP.I0001.A001,
IEC070I CATALOG.DB2ICF1.VLABDB2
DSNP011I -DB2R DSNPXTNO - MEDIA MANAGER SERVICES 939
ERROR FOR
 DSN510.DSNDBC.DSNDB04.ATSTEMP.I0001.A001
 MMRC=8 DSMRC=00D70014
 CONNECTION-ID=DB2CALL, CORRELATION-ID=ICLI,
 LUW-ID=*
DSNP007I -DB2R DSNPXTNO - EXTEND FAILED FOR 940
 DSN510.DSNDBD.DSNDB04.ATSTEMP.I0001.A001.
 RC=00D70014
 CONNECTION-ID=DB2CALL, CORRELATION-ID=ICLI,
 LUW-ID=*

```

Figure 139. Errors on OS/390 System Log If Maximum Number of VSAM Extents Reached

Avoid reaching the 255 VSAM extents limitation by defining the size of a tablespace or index space (primary extent + 254 \* secondary extents) larger than the free space left by all other data sets on the volume where the data set resides. The definition should be for greater than 2 GB for non-partitioned spaces or for greater than 4 GB for non-partitioned indexes on a partitioned tablespace. Such a definition will cause VSAM to allocate a new dataset on another volume in the storage group before reaching the 255 extent limit.

Consider implementing the policy for VSAM definitions primarily for large tablespaces; for small tablespaces it can be a waste of space.

### 6.3.3 All Volumes in Storage Group Full

If VSAM cannot extend a DB2 for OS/390 dataset to another volume because all volumes of the storage group defined for the tablespace or index space are full, another volume has to be added (see also the topic “Monitoring Tables and Indexes” in the chapter “Monitoring and CCMS Topics” of *BC SAP Database Administration Guide: DB2 for OS/390*, Material Number 51003810). An error message like the one shown in Figure 140 on page 186 will be displayed in the OS/390 system log. No errors will be seen in the ICLI server message file.

```
IEC070I 104-204,DB2RDBM1,DB2RDBM1,SYS00276,2041,SAP001,
IEC070I DSN510.DSNDBC.BTAB07.NAST1F8W.I0001.A001,
IEC070I DSN510.DSNDBD.BTAB07.NAST1F8W.I0001.A001,
IEC070I CATALOG.DB2ICF1.VLABDB2
```

Figure 140. Sample Errors in OS/390 System Log When All Volumes of Storage Group Are Full

To resolve this problem, add volumes with the ALTER STOGROUP command either through SPUFI or an SQL job, as shown in Figure 141.

```
//PETRAAS1 JOB (999,POK),'SPUFI ALTER SG',NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//SPUFI0 EXEC PGM=IKJEFT01,DYNAMNBR=20
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSPRINT DD DSN='PETRA.JCLOUT',DISP=SHR
//SYSVRT DD SYSOUT=*
//SYSTSIN DD *
 DSN SYSTEM(DB2R)
 RUN PROGRAM (DSNTEP2) LIB('DSN510.RUNLIB.LOAD') -
 PLAN(DSNTEP51) PARM(' /ALIGN(LHS)')
 END
/*
//SYSIN DD *
ALTER STOGROUP DBTAB07 ADD VOLUMES(LABSMP);
/*
```

Figure 141. Example JCL for ALTER STOGROUP to Add a Volume

## 6.4 How to Handle a Specific Table Growing in Tablespace

### Note for SAP R/3 4.5a

This section is unchanged from the redbook that referred to SAP R/3 3.1h. The *logic* of the steps performed is the same for newer releases, however the *specifics* of the steps may now be different. Included in those specifics is JCL, DB2 statements, and commands. To perform this function, you *must* refer to current SAP documentation. The primary reference you should consult is *BC SAP Database Administration Guide: DB2 for OS/390* SAP Material Number 51003810.

The example table used in this section, MSEG, is now buffered. This means that it has been isolated to a separate tablespace. SAP R/3 now has many more tables with this characteristic than was true in earlier releases, *therefore the function of isolating tables to a tablespace should seldom be necessary*. A DBA should still be familiar with the function, since it is possible that a decision to combine tables into a tablespace will be made, and a subsequent isolation may need to be performed.

If monitoring of tables shows specific tables growing more than others, you should move these tables into separate tablespaces for performance and maintenance considerations as explained in 6.4.1, "Isolate Table to Separate

Tablespace” on page 187 (refer also to “R/3 Technical Settings” in the chapter titled “Database Layout” in *BC SAP Database Administration Guide: DB2 for OS/390* Material Number 51003810). If a meaningful partitioning key exists on the table, consider partitioning that table as well, as shown in 6.4.2, “Isolate Table to Separate, Partitioned Tablespace” on page 189.

### 6.4.1 Isolate Table to Separate Tablespace

#### Important

Whenever DB2 objects are created with SPUFI or SQL which will be used in SAP R/3, make sure to set the SQLID with SET CURRENT SQLID='SAPR3'. Otherwise, the objects will not be accessible from SAP R/3.

Because MSEG is one of the tables growing more than others in most SAP R/3 installations (see 6.2.1, “High Insert Tables in SAP R/3” on page 176), we used MSEG as an example.

To move a table from its original tablespace to a separate tablespace, the following steps have to be executed:

1. Define the new storage group according to the naming conventions stated in *BC SAP Database Administration Guide: DB2 for OS/390*, SAP order number 51003810 for the tablespace, that means create DMSEG as shown in Figure 142. A template storage group does not need to be created.

```
SET CURRENT SQLID='SAPR3';
CREATE STOGROUP DMSEG VOLUMES(SAP001,SAP002,SAP003,SAP005) VCAT DSN510;
```

Figure 142. Example SPUFI to Create Storage Group

2. Create a database for the tablespace with the same name as the table. Because MSEG is a highly inserted table in our environment, we want to put it into a separate bufferpool (BP5 is selected) for highly inserted tables (see Figure 143). Define the tablespace storage group as the default storage group.

```
SET CURRENT SQLID='SAPR3';
CREATE DATABASE MSEG BUFFERPOOL BP5 STOGROUP DMSEG;
```

Figure 143. Example SPUFI to Create Database

3. Define the new tablespace. To determine the sizes for the new tablespace, we executed a RUNSTATS job on MSEG's old tablespace BTAB07.SBTAB07 to find the actual sizes. The output of this job is shown in Figure 144 on page 188.

```

DSNU614I -DB2R DSNUSUTB - SYSTABLES CATALOG STATISTICS FOR SAPR3.MSEG
 CARD = 9051
 CARDF = 9.051E+03
 NPAGES = 2263
 PCTPAGES = 99
 PCTROWCOMP = 0

```

Figure 144. Example RUNSTATS Output for a Table in a Tablespace

With page size 4 KB, the amount of used space is  $2263 * 4 \text{ KB} = 9052 \text{ KB}$  for 9051 rows. Create the new tablespace with a primary allocation of 10800 KB and a secondary allocation of 3600 KB. The SPUFI to create the tablespace is shown in Figure 145.

```

SET CURRENT SQLID='SAPR3';
CREATE TABLESPACE MSEG IN MSEG
 USING STOGROUP DMSEG
 PRIQTY 10800 SECQTY 3600
 SEGSIZE 32
 BUFFERPOOL BP5
 LOCKSIZE ROW
 CLOSE NO;

```

Figure 145. Example SPUFI to Create Tablespace

Segment size 32 is the value set for all tablespaces in an SAP R/3 default installation. This value should be adequate for the separate tablespace also, since it improves insert performance. LOCKSIZE ROW is required for the SAP R/3 application.

4. Move the table to the new tablespace by using SAP R/3s transaction SE14 or by using DB2 for OS/390 utilities. For large tables we recommend that you use DB2 for OS/390 utilities to reduce execution time. We used SAP R/3 transaction SE14 to move the table to the new tablespace (for an example of moving the table using DB2 for OS/390, refer to 6.4.2, "Isolate Table to Separate, Partitioned Tablespace" on page 189).

Specify the table name on the first panel of SE14, select the **Tables** radio button (because MSEG is a transparent table, for cluster tables select **Pools/cluster**) and press **Edit**. In the resulting panel select **Storage parameters**. Then select one of the options under **Change Tablespace**; a new tablespace name will be generated in Tablespace name.

**Important**

If you are using version 3.0F of SAP R/3, *do not* use the pulldown choice **DB parameters** → **Apply Immediately** or Shift **F04**. These choices call a function not supported by DB2 for OS/390 which drops the tablespace!

The problem will be redressed in the next release. (This choice is not available in SAP R/3 release 4.5A).

5. To get statistics for this new table, run RUNSTATS on the new created tablespace (for a JCL example of RUNSTATS see Figure 122 on page 167). Run RUNSTATS with parameters TABLE(ALL) INDEX(ALL) KEYCARD to also update the information relevant to optimizing access paths.

- You might also want to move the indexes related to the separated table to a new buffer pool for monitoring purposes. Find all indexes defined for the table with SPUFI (as described in Figure 146 on page 189) or use a job containing SQL.

```
SELECT * FROM SYSIBM.SYSINDEXES WHERE TBNAME='MSEG';
```

Figure 146. Example SPUFI to Find All Indexes on a Table

Output of this statement was indexes MSEG\_\_\_\_\_0 and MSEG\_\_\_\_\_M. To change the bufferpool assignment use ALTER INDEX from SPUFI as shown in Figure 147 or write a job that uses SQL.

```
SET CURRENT SQLID='SAPR3';
ALTER INDEX MSEG_____0 BUFFERPOOL BP6;
```

Figure 147. Example SPUFI to Change Bufferpool Assignment of an Index

## 6.4.2 Isolate Table to Separate, Partitioned Tablespace

### Important

Whenever DB2 objects are created with SPUFI or SQL which will be used in SAP R/3, make sure to set the SQLID with SET CURRENT SQLID='SAPR3'. Otherwise, the objects will not be accessible from SAP R/3.

If a table is under consideration for being moved to a separate tablespace, you should examine the columns and indexes of the table to determine if there is a key that is meaningful to use as a partitioning key for the table. Partitioning would depend on the business structure configured in SAP R/3 (company codes, factories, storage locations and so on), and the columns defined in the table. One would need to investigate the key columns in the table, the business configuration, and the amount of data in the table to determine if the table is a candidate for partitioning. To see how a partitioning index is defined, refer to section 6.20 in *DB2 for OS/390 V5 SQL Reference*, SC26-8966.

**Note:** Be aware that the SAP R/3 data dictionary now supports the notion of partitioned tablespaces. Therefore it is possible to move the table from the old tablespace to the partitioned tablespace using DB2 for OS/390, or by using a SAP R/3 transaction.

As an example, we will take table BKPF and partition this table on a combination of the columns MANDT (client) and BUKRS (company code). The only client used in our example is client 900. We will assume that mainly four different company codes are used: 0001, 0002, 0003, 0004.

### Important

It might or might not be appropriate in your business environment to partition table BKPF, and it might or might not be a good idea to choose the partitioning key we chose. The choice of a key is highly dependent on your business logic. This section simply shows you technically how to do the partitioning.

To move a table from its original tablespace to a separate partitioned tablespace, the following steps have to be executed:

1. Define new storage groups for each partition of the tablespace and each partition of the index space. For the BKPF table, you might use as many partitions as you have company codes and then add one (as a collector for all keys not qualifying for the other partitions). You might consider grouping several company codes in one partition. Our example is for five partitions; see the examples in Figure 148 and Figure 149. If you have many volumes you might want to assign different volumes to the different storage groups to get better performance.

```
SET CURRENT SQLID='SAPR3';
CREATE STOGROUP DBKPF01 VOLUMES(SAP001,SAP002,SAP003,SAP005) VCAT DSN510;
 .
 .
CREATE STOGROUP DBKPF05 VOLUMES(SAP005,SAP003,SAP002,SAP001) VCAT DSN510;
```

Figure 148. Example SPUFI to Create Storage Groups for Partitioned, Separate Tablespace

```
SET CURRENT SQLID='SAPR3';
CREATE STOGROUP IBKPF01 VOLUMES(SAP001,SAP002,SAP003,SAP005) VCAT DSN510;
 .
 .
CREATE STOGROUP IBKPF05 VOLUMES(SAP005,SAP003,SAP002,SAP001) VCAT DSN510;
```

Figure 149. Example SPUFI to Create Storage Groups for the Index Spaces of a Partitioned Tablespace

2. Create a database for the tablespace and index space; an example of doing this with SPUFI is shown in Figure 150.

```
SET CURRENT SQLID='SAPR3';
CREATE DATABASE BKPF BUFFERPOOL BP5 STOGROUP IBKPF05;
```

Figure 150. Example SPUFI to Create Database for Partitioned, Separated Tablespace

3. To calculate sizes for the new tablespace, execute RUNSTATS and calculate from the number of used pages listed in the output, or use transaction SE13 to look for the expected number of rows and calculate using the maximum length of a row. Define the tablespace with the calculated size, as shown in Figure 152 on page 191. We ran a RUNSTATS job on BKPF's old tablespace BTAB01.SBTAB01 to find the actual sizes. The output of this job is shown in Figure 151.



```

DSNU614I -DB2R DSNUSUTB - SYSTABLES CATALOG STATISTICS FOR SAPR3.BKPF
 CARD = 9230
 CARDF = 9.23E+03
 NPAGES = 923
 PCTPAGES = 99
 PCTROWCOMP = 0

```

Figure 151. Example RUNSTATS Output for a Table in a Tablespace

With page size 4 KB the amount of used space is  $923 * 4 \text{ KB} = 3692 \text{ KB}$  for 9230 rows. Create the new tablespace with primary allocation 5000 KB and secondary allocation 1000 KB. If the partitions are nearly equally used, we can split the space evenly for the partitions; for example, here we use 1000 KB for the primary allocation per partition and 200 KB for the secondary allocation per partition.

```

SET CURRENT SQLID='SAPR3';
CREATE TABLESPACE BKPF IN BKPF
 LOCKSIZE ROW
 LOCKMAX SYSTEM
 BUFFERPOOL BP5
 NUMPARTS 5
 (PART 1 USING STOGROUP DBKPF01 PRIQTY 1000 SECQTY 200,
 PART 2 USING STOGROUP DBKPF02 PRIQTY 1000 SECQTY 200,
 PART 3 USING STOGROUP DBKPF03 PRIQTY 1000 SECQTY 200,
 PART 4 USING STOGROUP DBKPF04 PRIQTY 1000 SECQTY 200,
 PART 5 USING STOGROUP DBKPF05 PRIQTY 1000 SECQTY 200);

```

Figure 152. SPUIFI to Create Tablespace for Partitioned, Separated BKPF Table

4. The data dictionary function of SAP R/3 now supports partitioning indexes; therefore, the move with transaction SE14 as described in 6.4, "How to Handle a Specific Table Growing in Tablespace" on page 186 is now possible.
5. If the tables you want to partition are not empty, we recommend that you do the following:
  - a. Stop the SAP R/3 system in order to unload the data from the old table.
  - b. Drop the old table,
  - c. Define the table.
  - d. Reload into the new table.
  - e. Restart the SAP R/3 system.

For empty tables you only have to stop the SAP R/3 system as long as it takes to drop the old table and define the new table.

In either case, prepare all steps ahead to reduce outage.

6. To unload the data from the tables you can use, for instance, the sample DSNTIAUL program as shown in Figure 153 on page 192 and described in *DB2 for OS/390 V5 Installation Guide*, GC26-8970, or you can use the DB2ADM product.

```

//PETRAUN1 JOB (999,POK),'UNLOAD JOB',NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//*
//* RUN UNLOAD PROGRAM
//*
//UNLOAD EXEC PGM=IKJEFT01,DYNAMNBR=100
//STEPLIB DD DSN=DSN510.RUNLIB.LOAD,DISP=SHR
// DD DSN=DSN510.SDSNEXIT,DISP=SHR
// DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSTSIN DD *
 DSN SYSTEM(DB2R)
 RUN PROGRAM(DSNTIAUL) PLAN(DSNTIB51)
 END
//SYSRECOO DD DSN=PETRA.BKPFUNL2.SYSRECOO,
// DCB=(BLKSIZE=8192),
// SPACE=(8192,(300,30),RLSE),
// UNIT=SYSDA,DISP=(,CATLG,DELETE)
//SYSPUNCH DD DSN=PETRA.BKPFUNL2.SYSPUNCH,
// SPACE=(1024,(250,250),RLSE),
// UNIT=SYSDA,DISP=(MOD,CATLG,DELETE)
//SYSIN DD *
 "SAPR3"."BKPF"
/*
//

```

Figure 153. Example JCL to Unload Table BKPF with Program DSNTIAUL

#### Important

Before dropping the non-partitioned table you have to look up the definition of the table, as well as all its indexes and views, in the DB2 for OS/390 catalog. Write these definitions down to use them for the creation of the partitioned table as well as its indexes and views.

The catalog queries in Figure 154 on page 193 help to get the required information:

```
Information to create the table again:
SELECT NAME, COLTYPE, LENGTH, NULLS, DEFAULT, DEFAULTVALUE, COLNO FROM SYSIBM.SYSCOLUMNS
WHERE TBCREATOR='SAPR3' AND TBNAME='BKPF' ORDER BY COLNO;
```

For information on the primary key see the UNIQUERULE column in the next statement.

```
Information to create the indexes on the table again:
SELECT IXNAME, COLSEQ, COLNAME, ORDERING, UNIQUERULE FROM SYSIBM.SYSINDEXES AS I
INNER JOIN SYSIBM.SYSKEYS AS K ON IXCREATOR=CREATOR AND IXNAME=NAME
WHERE CREATOR='SAPR3' AND TBCREATOR='SAPR3' AND TBNAME='BKPF'
GROUP BY IXNAME, COLSEQ, COLNAME, ORDERING, UNIQUERULE;
SELECT IXNAME, STORNAME, PQTY, SQTY FROM SYSIBM.SYSINDEXES AS I
INNER JOIN SYSIBM.SYSINDEXPART AS IP ON IXCREATOR=CREATOR AND IXNAME=NAME
WHERE CREATOR='SAPR3' AND TBCREATOR='SAPR3' AND TBNAME='BKPF'
ORDER BY IXNAME;
```

Information to create the views on the table again:

```
SELECT TEXT, CHECK FROM SYSIBM.SYSVIEWS AS V
INNER JOIN SYSIBM.SYSVIEWDEP AS VD ON NAME=DNAME
WHERE CREATOR='SAPR3' AND BCREATOR='SAPR3' AND BNAME='BKPF'
GROUP BY NAME, SEQNO, TEXT, CHECK;
```

To check whether there are views on these views.

The number of rows returned should be zero, otherwise repeat the statement above for each DNAME returned.

```
SELECT DNAME, BNAME FROM SYSIBM.SYSVIEWDEP
WHERE BCREATOR='SAPR3' AND BTYPE='V' AND
BNAME IN (SELECT DNAME FROM SYSIBM.SYSVIEWDEP
WHERE BCREATOR='SAPR3' AND BNAME='BKPF' AND BTYPE='T');
```

Figure 154. SQL Statements to Query Catalog for BKPF Table and Index Definitions

7. After successfully unloading the data you can now drop the table. Figure 155 shows the relevant SPUFI commands.

```
DROP TABLE SAPR3.BKPF;
```

Figure 155. SPUFI to Drop Non-Partitioned BKPF Table

8. Create the partitioned table and the partitioning type 2 indexes. Figure 156 on page 194 and Figure 157 on page 195 show the SPUFI commands for the creation of partitioned table BKPF plus its partitioning index.

```

SET CURRENT SQLID='SAPR3';
CREATE TABLE BKPF
(MANDT CHAR(3) NOT NULL WITH DEFAULT '000',
BUKRS CHAR(4) NOT NULL WITH DEFAULT ' ',
BELNR CHAR(10) NOT NULL WITH DEFAULT ' ',
GJAHR CHAR(4) NOT NULL WITH DEFAULT '0000',
BLART CHAR(2) NOT NULL WITH DEFAULT ' ',
BLDAT CHAR(8) NOT NULL WITH DEFAULT '00000000',
BUDAT CHAR(8) NOT NULL WITH DEFAULT '00000000',
MONAT CHAR(2) NOT NULL WITH DEFAULT '00',
CPUDT CHAR(8) NOT NULL WITH DEFAULT '00000000',
CPUTM CHAR(6) NOT NULL WITH DEFAULT '000000',
AEDAT CHAR(8) NOT NULL WITH DEFAULT '00000000',
UPDDT CHAR(8) NOT NULL WITH DEFAULT '00000000',
WWERT CHAR(8) NOT NULL WITH DEFAULT '00000000',
USNAM CHAR(12) NOT NULL WITH DEFAULT ' ',
TCODE CHAR(4) NOT NULL WITH DEFAULT ' ',
BVORG CHAR(16) NOT NULL WITH DEFAULT ' ',
XBLNR CHAR(16) NOT NULL WITH DEFAULT ' ',
DBBLG CHAR(10) NOT NULL WITH DEFAULT ' ',
STBLG CHAR(10) NOT NULL WITH DEFAULT ' ',
STJAH CHAR(4) NOT NULL WITH DEFAULT '0000',
BKTXT CHAR(25) NOT NULL WITH DEFAULT ' ',
WAERS CHAR(5) NOT NULL WITH DEFAULT ' ',
KURSF DECIMAL(9) NOT NULL WITH DEFAULT 0,
KZWR5 CHAR(5) NOT NULL WITH DEFAULT ' ',
KZKRS DECIMAL(9) NOT NULL WITH DEFAULT 0,
BSTAT CHAR(1) NOT NULL WITH DEFAULT ' ',
XNETB CHAR(1) NOT NULL WITH DEFAULT ' ',
FRATH DECIMAL(13) NOT NULL WITH DEFAULT 0,
XRUEB CHAR(1) NOT NULL WITH DEFAULT ' ',
GLVOR CHAR(4) NOT NULL WITH DEFAULT ' ',
GRPID CHAR(12) NOT NULL WITH DEFAULT ' ',
DOKID CHAR(40) NOT NULL WITH DEFAULT ' ',
ARCID CHAR(10) NOT NULL WITH DEFAULT ' ',
IBLAR CHAR(2) NOT NULL WITH DEFAULT ' ',
AWTYP CHAR(5) NOT NULL WITH DEFAULT ' ',
AWKEY CHAR(20) NOT NULL WITH DEFAULT ' ',
FIKRS CHAR(4) NOT NULL WITH DEFAULT ' ',
HWAER CHAR(5) NOT NULL WITH DEFAULT ' ',
HWAE2 CHAR(5) NOT NULL WITH DEFAULT ' ',
HWAE3 CHAR(5) NOT NULL WITH DEFAULT ' ',
KURS2 DECIMAL(9) NOT NULL WITH DEFAULT 0,
KURS3 DECIMAL(9) NOT NULL WITH DEFAULT 0,
BASW2 CHAR(1) NOT NULL WITH DEFAULT ' ',
BASW3 CHAR(1) NOT NULL WITH DEFAULT ' ',
UMRD2 CHAR(1) NOT NULL WITH DEFAULT ' ',
UMRD3 CHAR(1) NOT NULL WITH DEFAULT ' ',
XSTOV CHAR(1) NOT NULL WITH DEFAULT ' ',
STODT CHAR(8) NOT NULL WITH DEFAULT '00000000',
XMWST CHAR(1) NOT NULL WITH DEFAULT ' ',
CURT2 CHAR(2) NOT NULL WITH DEFAULT ' ',
CURT3 CHAR(2) NOT NULL WITH DEFAULT ' ',
KUTY2 CHAR(4) NOT NULL WITH DEFAULT ' ',
KUTY3 CHAR(4) NOT NULL WITH DEFAULT ' ',
XSNET CHAR(1) NOT NULL WITH DEFAULT ' ',
AUSBK CHAR(4) NOT NULL WITH DEFAULT ' ',
XUSVR CHAR(1) NOT NULL WITH DEFAULT ' ',
DUEFL CHAR(1) NOT NULL WITH DEFAULT ' ',
AWSYS CHAR(10) NOT NULL WITH DEFAULT ' ',
TXKRS DECIMAL(9) NOT NULL WITH DEFAULT 0,
LOTKZ CHAR(10) NOT NULL WITH DEFAULT ' ',
XWVOF CHAR(1) NOT NULL WITH DEFAULT ' ',
PRIMARY KEY(MANDT, BUKRS, BELNR, GJAHR)
IN BKPF.BKPF;

```

Figure 156. SPUFI to Create Partitioned BKPF Table

```

SET CURRENT SQLID='SAPR3';
CREATE TYPE 2 UNIQUE INDEX BKPF_____0 ON BKPF
(MANDT ASC,
BUKRS ASC,
BELNR ASC,
GJAHR ASC)
BUFFERPOOL BP6
CLUSTER
(PART 1 VALUES('900','0001')
 USING STOGROUP IBKPF01 PRIQTY 16 SECQTY 2560,
PART 2 VALUES('900','0002')
 USING STOGROUP IBKPF02 PRIQTY 16 SECQTY 2560,
PART 3 VALUES('900','0003')
 USING STOGROUP IBKPF03 PRIQTY 16 SECQTY 2560,
PART 4 VALUES('900','0004')
 USING STOGROUP IBKPF04 PRIQTY 16 SECQTY 2560,
PART 5 VALUES('900','9999')
 USING STOGROUP IBKPF05 PRIQTY 16 SECQTY 2560);

```

Figure 157. SPUFI to Create Partitioning Index for the BKPF Table

9. Create all other indexes that existed on table BKPF with the parameters that existed before as shown in Figure 158 on page 196.

```

SET CURRENT SQLID='SAPR3';

CREATE TYPE 2 INDEX BKPF_____1 ON BKPF
(MANDT ASC,
 BUKRS ASC,
 BSTAT ASC,
 XBLNR ASC)
 BSTAT ASC)
 BUFFERPOOL BP6
 USING STOGROUP IBKPF05 PRIQTY 12 SECQTY 160;

CREATE TYPE 2 INDEX BKPF_____2 ON BKPF
(MANDT ASC,
 BUKRS ASC,
 BSTAT ASC,
 BUDAT ASC)
 BUFFERPOOL BP6
 USING STOGROUP IBKPF05 PRIQTY 12 SECQTY 160;

CREATE TYPE 2 INDEX BKPF_____3 ON BKPF
(MANDT ASC,
 BUKRS ASC,
 BSTAT ASC,
 BLART ASC)
 BUFFERPOOL BP6
 USING STOGROUP IBKPF05 PRIQTY 12 SECQTY 160;

CREATE TYPE 2 INDEX BKPF_____4 ON BKPF
(MANDT ASC,
 AWTYP ASC,
 AWKEY ASC,
 AWSYS ASC)
 BUFFERPOOL BP6
 USING STOGROUP IBKPF05 PRIQTY 16 SECQTY 2560;

CREATE TYPE 2 INDEX BKPF_____5 ON BKPF
(MANDT ASC,
 BUKRS ASC,
 CPUDT ASC,
 BSTAT ASC)
 BUFFERPOOL BP6
 USING STOGROUP IBKPF05 PRIQTY 16 SECQTY 2560;

CREATE TYPE 2 INDEX BKPF_____6 ON BKPF
(MANDT ASC,
 BUKRS ASC,
 BLDAT ASC,
 BSTAT ASC)
 BUFFERPOOL BP6
 USING STOGROUP IBKPF05 PRIQTY 16 SECQTY 2560;

```

Figure 158. SPUFI to Create Indexes on Table BKPF after Partitioning

10. Re-create all views that were defined on table BKPF. Figure 159 on page 197 shows the necessary SPUFI statements.

```

SET CURRENT SQLID='SAPR3';

CREATE VIEW ENT2083 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART , T0001.BLDAT,
T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM , T0001.AEDAT,
T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE , T0001.BVORG,
T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.XRUEB, T0001.GLVOR, T0001.GRPID FROM
BKPF T0001;

CREATE VIEW ENT2089 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART , T0001.BLDAT,
T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM , T0001.AEDAT,
T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE , T0001.BVORG,
T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.XRUEB, T0001.GLVOR, T0001.GRPID FROM
BKPF T0001;

CREATE VIEW ENT2090 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART , T0001.BLDAT,
T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM , T0001.AEDAT,
T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE , T0001.BVORG,
T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.XRUEB, T0001.GLVOR, T0001.GRPID FROM
BKPF T0001;

CREATE VIEW ENT2094 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
FRATH, XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART ,
T0001.BLDAT, T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM ,
T0001.AEDAT, T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE ,
T0001.BVORG, T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.FRATH, T0001.XRUEB, T0001.GLVOR ,
T0001.GRPID FROM BKPF T0001;

```

Figure 159 (Part 1 of 3). SPUFI to Create the Views on Table BKPF after Partitioning

```

CREATE VIEW ENT2098 (MANDT, BUKRS, BELNR, GJAHR) AS SELECT
T0001.MANDT, T0001.BUKRS, T0001.BELNR, T0001.GJAHR FROM BKPF T0001;
CREATE VIEW ENT2113 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
FRATH, XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART ,
T0001.BLDAT, T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM ,
T0001.AEDAT, T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE ,
T0001.BVORG, T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.FRATH, T0001.XRUEB, T0001.GLVOR ,
T0001.GRPID FROM BKPF T0001;

CREATE VIEW ENT2117 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART , T0001.BLDAT,
T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM , T0001.AEDAT,
T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE , T0001.BVORG,
T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.XRUEB, T0001.GLVOR, T0001.GRPID FROM
BKPF T0001;

CREATE VIEW ENT2187 (MANDT, BUKRS, GJAHR, BLART, BLDAT, BUDAT, WWERT,
WAERS, KURSF, KZWRS, XBLNR, KZKRS, XNETB, BELNR, XRUEB, GLVOR, MONAT,
TCODE, BVORG, STBLG, STJAH, BKTXT, CPUPT, CPUTM, AEDAT, UPDDT, USNAM)
AS SELECT T0001.MANDT, T0001.BUKRS, T0001.GJAHR,
T0001.BLART, T0001.BLDAT , T0001.BUDAT, T0001.WWERT, T0001.WAERS,
T0001.KURSF, T0001.KZWRS , T0001.XBLNR, T0001.KZKRS, T0001.XNETB,
T0001.BELNR, T0001.XRUEB , T0001.GLVOR, T0001.MONAT, T0001.TCODE,
T0001.BVORG, T0001.STBLG , T0001.STJAH, T0001.BKTXT,
T0001.CPUPT, T0001.CPUTM, T0001.AEDAT , T0001.UPDDT, T0001.USNAM
FROM BKPF T0001;

CREATE VIEW ENT2212 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
DBBLG, STBLG, STJAH, BKTXT, WAERS, KURSF, KZWRS, KZKRS, BSTAT, XNETB,
XRUEB, GLVOR, GRPID) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART , T0001.BLDAT,
T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM , T0001.AEDAT,
T0001.UPDDT, T0001.WWERT, T0001.USNAM, T0001.TCODE , T0001.BVORG,
T0001.XBLNR, T0001.DBBLG, T0001.STBLG, T0001.STJAH ,
T0001.BKTXT, T0001.WAERS, T0001.KURSF, T0001.KZWRS, T0001.KZKRS ,
T0001.BSTAT, T0001.XNETB, T0001.XRUEB, T0001.GLVOR, T0001.GRPID FROM
BKPF T0001;

```

Figure 159 (Part 2 of 3). SPUFI to Create the Views on Table BKPF after Partitioning



```

CREATE VIEW ENT2219 (MANDT, BUKRS, BELNR, GJAHR) AS SELECT
T0001.MANDT, T0001.BUKRS, T0001.BELNR, T0001.GJAHR FROM BKPF T0001;
CREATE VIEW ENT2236 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, WWERT, USNAM, TCODE, XBLNR, BKTXT, WAERS, KURSF,
BSTAT, XNETB, XRUEB, HWAER, XSNET) AS SELECT T0001.MANDT, T0001.BUKRS,
T0001.BELNR, T0001.GJAHR, T0001.BLART ,
T0001.BLDAT, T0001.BUDAT, T0001.MONAT, T0001.CPUPT, T0001.CPUTM ,
T0001.WWERT, T0001.USNAM, T0001.TCODE, T0001.XBLNR, T0001.BKTXT ,
T0001.WAERS, T0001.KURSF, T0001.BSTAT, T0001.XNETB, T0001.XRUEB ,
T0001.HWAER, T0001.XSNET FROM BKPF T0001;

CREATE VIEW ENT2285 (MANDT, BUKRS, BUDAT, BLDAT, MONAT, BVORG, XBLNR,
WAERS, GLVOR, BELNR, GJAHR, CPUPT, CPUTM, USNAM, BLART, WWERT, TCODE,
KURSF, BSTAT, XNETB, FRATH, XRUEB) AS SELECT T0001.MANDT, T0001.BUKRS,
T0001.BUDAT, T0001.BLDAT, T0001.MONAT ,
T0001.BVORG, T0001.XBLNR, T0001.WAERS, T0001.GLVOR, T0001.BELNR ,
T0001.GJAHR, T0001.CPUPT, T0001.CPUTM, T0001.USNAM, T0001.BLART ,
T0001.WWERT, T0001.TCODE, T0001.KURSF, T0001.BSTAT, T0001.XNETB ,
T0001.FRATH, T0001.XRUEB FROM BKPF T0001;

CREATE VIEW ENT2290 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, BKTXT, WAERS, GLVOR, XBLNR, CPUPT, CPUTM, USNAM, WWERT, TCODE,
BVORG, KURSF, BSTAT, XNETB, FRATH, XRUEB) AS SELECT T0001.MANDT,
T0001.BUKRS, T0001.BELNR, T0001.GJAHR, T0001.BLART ,
T0001.BLDAT, T0001.BUDAT, T0001.MONAT, T0001.BKTXT, T0001.WAERS ,
T0001.GLVOR, T0001.XBLNR, T0001.CPUPT, T0001.CPUTM, T0001.USNAM ,
T0001.WWERT, T0001.TCODE, T0001.BVORG, T0001.KURSF, T0001.BSTAT ,
T0001.XNETB, T0001.FRATH, T0001.XRUEB FROM BKPF T0001;

CREATE VIEW U_12180 (MANDT, BUKRS, BELNR, GJAHR, BLART, BLDAT, BUDAT,
MONAT, CPUPT, CPUTM, AEDAT, UPDDT, WWERT, USNAM, TCODE, BVORG, XBLNR,
STBLG, STJAH, BKTXT, WAERS, KURSF, KZWR, KZKR, XNETB, XRUEB, GLVOR)
AS SELECT T0001.MANDT, T0001.BUKRS, T0001.BELNR,
T0001.GJAHR, T0001.BLART , T0001.BLDAT, T0001.BUDAT, T0001.MONAT,
T0001.CPUPT, T0001.CPUTM , T0001.AEDAT, T0001.UPDDT, T0001.WWERT,
T0001.USNAM, T0001.TCODE , T0001.BVORG, T0001.XBLNR, T0001.STBLG,
T0001.STJAH, T0001.BKTXT , T0001.WAERS, T0001.KURSF,
T0001.KZWR, T0001.KZKR, T0001.XNETB , T0001.XRUEB, T0001.GLVOR
FROM BKPF T0001;

```

Figure 159 (Part 3 of 3). SPUFI to Create the Views on Table BKPF after Partitioning

11. To reload the data into the partitioned tables you can use, for instance, the DB2 for OS/390 LOAD utility together with the data sets generated by the unload with program DSNTIAUL as shown in Figure 160 on page 200, or you can use the DB2ADM product. We changed the LOG option of the LOAD statement in the control data set PETRA.BKPFUNL2.SYSPUNCH to YES to avoid receiving a copy pending status on the tablespace after loading.

```

//PETRARL1 JOB (999,POK),' ', NOTIFY=&SYSUID,
// CLASS=A,MSGCLASS=T,TIME=1439,
// REGION=5000K,MSGLEVEL=(1,1)
//*
//* RUN LOAD UTILITY TO LOAD TABLES
//*
//LOAD EXEC DSNUPROC, PARM=' DB2R,DSNTEX'
//STEPLIB DD DSN=DSN510.RUNLIB.LOAD,DISP=SHR
// DD DSN=DSN510.SDSNEXIT,DISP=SHR
// DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSPRINT DD SYSOUT=*
//SORTLIB DD DSN=SYS1.SORTLIB,DISP=SHR
//SORTWK01 DD UNIT=SYSDA,SPACE=(CYL,(1,1),,,ROUND)
//SORTWK02 DD UNIT=SYSDA,SPACE=(CYL,(1,1),,,ROUND)
//SORTWK03 DD UNIT=SYSDA,SPACE=(CYL,(1,1),,,ROUND)
//SORTWK04 DD UNIT=SYSDA,SPACE=(CYL,(1,1),,,ROUND)
//SYSRECOO DD DSN=PETRA.BKPFUNL2.SYSRECOO,
// DISP=(OLD,KEEP)
//SYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(1,1),,,ROUND)
//SORTOUT DD UNIT=SYSDA,SPACE=(CYL,(1,1),,,ROUND)
//SYSIN DD DSN=PETRA.BKPFUNL2.SYSPUNCH,
// DISP=(OLD,KEEP)
//*

```

Figure 160. Example JCL to Reload Table BKPF with DB2 for OS/390 LOAD Utility

12. To get statistics for the new tables, run RUNSTATS on the newly created tablespace (for a JCL example for RUNSTATS see Figure 122 on page 167). Run RUNSTATS with parameters TABLE(ALL) INDEX(ALL) KEYCARD to update the information relevant to optimizing access paths.

**Attention**

Be certain you have read the note at the beginning of 6.4, "How to Handle a Specific Table Growing in Tablespace" on page 186 before attempting to implement any of the JCL or commands shown.

---

## Appendix A. JCL Examples

Note that JOB card used in the sample JCL provided in this section is only the barest of templates. In order for your jobs to run successfully, your site standards for JCL will have to be followed for JOB card creation, as well as for other JCL in these examples.

---

### A.1 Backup and Recovery JCL

This section contains JCL used in backup and recovery operations, discussed in Chapter 4, "Backup and Restore Scenarios" on page 125.

#### A.1.1 COPY TABLESPACE Catalog and Directory

Figure 161 contains the JCL to back up the system tables found in the DB2 catalog and directory.

```
// JOB
//*****
//* JOB NAME = IMAGCAT *
//* *
//* DESCRIPTIVE NAME = IMAGE COPY DSNDBO1 & DSNDBO6 *
//* *
//* LICENSED MATERIALS - PROPERTY OF IBM *
//* 5655-DB2 *
//* (C) COPYRIGHT 1982, 1997 IBM CORP. ALL RIGHTS RESERVED. *
//* *
//* STATUS = VERSION 5 *
//* *
//* FUNCTION = CREATE IMAGE COPIES OF ALL THE SYSTEM CATALOG TABLES *
//* *
//* NOTES = *
//* *
//* THIS JOB CREATES IMAGE COPIES OF THE DB2 DIRECTORY AND CATALOG. *
//* *
//* THE IMAGE COPY FOR EACH TABLE SPACE IS DONE IN A SEPARATE STEP *
//* SO THAT THE JOB WILL EXECUTE SUCCESSFULLY WHEN AN IMAGE COPY *
//* OUTPUT DATA SET SPANS MORE THAN ONE VOLUME. EACH STEP'S DATA *
//* SET IS PASSED TO THE NEXT STEP SO THAT A TAPE WILL NOT HAVE TO *
//* BE DEMOUNTED AND REMOUNTED AFTER EVERY STEP. HOWEVER, WE ALSO *
//* RECOMMEND THAT THE IMAGE COPY TAPES BE MOUNTED AS PRIVATE *
//* VOLUMES TO PREVENT THIS PROBLEM. *
//* *
//* IF A FAILURE OCCURS IN ONE STEP, FIX THE PROBLEM AND RERUN THE *
//* JOB, BEGINNING WITH THE STEP THAT FAILED. *
//* *
//* THE SYSCOPY STEP MUST BE THE LAST STEP IN THE JOB *
//* *
//*****
//JOBLIB DD DISP=SHR,
// DSN=DB2V510.SDSNLOAD
```

Figure 161 (Part 1 of 7). Create Image Copies of DB2 System Catalog Tables

```

/* ***** *
/* SYSUTILX IMAGE COPY STEP *
/* ***** *
//DSNTICX EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K
//SYSCOPYX DD DSN=DB2V510U.DSNDB01.SYSUTILX.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=3490,LABEL=(01,SL),
// VOL=(,RETAIN,,99,SER=DEG010)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB01.SYSUTILX COPYDDN SYSCOPYX
/* ***** *
/* DBD01 IMAGE COPY STEP *
/* ***** *
//DSNTIC1 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPYX DD DSN=DB2V510U.DSNDB01.SYSUTILX.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY1 DD DSN=DB2V510U.DSNDB01.DBD01.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPYX,
// VOL=(,RETAIN,,99,REF=*.DSNTICX.SYSCOPYX),LABEL=(02,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB01.DBD01 COPYDDN SYSCOPY1
/* ***** *
/* SCT02 IMAGE COPY STEP *
/* ***** *
//DSNTIC2 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPY1 DD DSN=DB2V510U.DSNDB01.DBD01.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY2 DD DSN=DB2V510U.DSNDB01.SCT02.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY1,
// VOL=(,RETAIN,,99,REF=*.DSNTIC1.SYSCOPY1),LABEL=(03,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB01.SCT02 COPYDDN SYSCOPY2

```

Figure 161 (Part 2 of 7). Create Image Copies of DB2 System Catalog Tables

```

//* ***** *
//* SPT01 IMAGE COPY STEP *
//* ***** *
//DSNTIC3 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY',REGION=1024K,
// COND=(4,LT)
//SYSCOPY2 DD DSN=DB2V510U.DSNDB01.SCT02.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY3 DD DSN=DB2V510U.DSNDB01.SPT01.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY2,
// VOL=(,RETAIN,,99,REF=*.DSNTIC2.SYSCOPY2),LABEL=(04,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
COPY TABLESPACE DSNDB01.SPT01 COPYDDN SYSCOPY3
//* ***** *
//* SYSDBASE IMAGE COPY STEP *
//* ***** *
//DSNTIC4 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY',REGION=1024K,
// COND=(4,LT)
//SYSCOPY3 DD DSN=DB2V510U.DSNDB01.SPT01.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY4 DD DSN=DB2V510U.DSNDB06.SYSDBASE.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY3,
// VOL=(,RETAIN,,99,REF=*.DSNTIC3.SYSCOPY3),LABEL=(05,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
COPY TABLESPACE DSNDB06.SYSDBASE COPYDDN SYSCOPY4
//* ***** *
//* SYSDBAUT IMAGE COPY STEP *
//* ***** *
//DSNTIC5 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY',REGION=1024K,
// COND=(4,LT)
//SYSCOPY4 DD DSN=DB2V510U.DSNDB06.SYSDBASE.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY5 DD DSN=DB2V510U.DSNDB06.SYSDBAUT.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY4,
// VOL=(,RETAIN,,99,REF=*.DSNTIC4.SYSCOPY4),LABEL=(06,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
COPY TABLESPACE DSNDB06.SYSDBAUT COPYDDN SYSCOPY5

```

Figure 161 (Part 3 of 7). Create Image Copies of DB2 System Catalog Tables

```

/* ***** *
/* SYSPGAUT IMAGE COPY STEP *
/* ***** *
//DSNTIC6 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPY5 DD DSN=DB2V510U.DSNDB06.SYSDBAUT.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY6 DD DSN=DB2V510U.DSNDB06.SYSGPAUT.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY5,
// VOL=(,RETAIN,,99,REF=*.DSNTIC5.SYSCOPY5),LABEL=(07,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSGPAUT COPYDDN SYSCOPY6
/* ***** *
/* SYSGROUP IMAGE COPY STEP *
/* ***** *
//DSNTIC7 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPY6 DD DSN=DB2V510U.DSNDB06.SYSGPAUT.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY7 DD DSN=DB2V510U.DSNDB06.SYSGROUP.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY6,
// VOL=(,RETAIN,,99,REF=*.DSNTIC6.SYSCOPY6),LABEL=(08,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSGROUP COPYDDN SYSCOPY7
/* ***** *
/* SYSPLAN IMAGE COPY STEP *
/* ***** *
//DSNTIC8 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPY7 DD DSN=DB2V510U.DSNDB06.SYSGROUP.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY8 DD DSN=DB2V510U.DSNDB06.SYSPLAN.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY7,
// VOL=(,RETAIN,,99,REF=*.DSNTIC7.SYSCOPY7),LABEL=(09,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSPLAN COPYDDN SYSCOPY8

```

Figure 161 (Part 4 of 7). Create Image Copies of DB2 System Catalog Tables

```

//* ***** *
//* SYSPKAGE IMAGE COPY STEP *
//* ***** *
//DSNTIC9 EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPY8 DD DSN=DB2V510U.DSNDB06.SYSPLAN.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPY9 DD DSN=DB2V510U.DSNDB06.SYSPKAGE.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY8,
// VOL=(,RETAIN,,99,REF=*.DSNTIC8.SYSCOPY8),LABEL=(10,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSPKAGE COPYDDN SYSCOPY9
//* ***** *
//* SYSUSER IMAGE COPY STEP *
//* ***** *
//DSNTICA EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPY9 DD DSN=DB2V510U.DSNDB06.SYSPKAGE.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYA DD DSN=DB2V510U.DSNDB06.SYSUSER.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPY9,
// VOL=(,RETAIN,,99,REF=*.DSNTIC9.SYSCOPY9),LABEL=(11,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSUSER COPYDDN SYSCOPYA
//* ***** *
//* SYSSTR IMAGE COPY STEP *
//* ***** *
//DSNTICB EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPYA DD DSN=DB2V510U.DSNDB06.SYSUSER.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYB DD DSN=DB2V510U.DSNDB06.SYSSTR.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPYA,
// VOL=(,RETAIN,,99,REF=*.DSNTICA.SYSCOPYA),LABEL=(12,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSSTR COPYDDN SYSCOPYB

```

Figure 161 (Part 5 of 7). Create Image Copies of DB2 System Catalog Tables

```

/* ***** *
/* SYSVIEWS IMAGE COPY STEP *
/* ***** *
//DSNTICC EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY',REGION=1024K,
// COND=(4,LT)
//SYSCOPYB DD DSN=DB2V510U.DSNDB06.SYSSTR.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYC DD DSN=DB2V510U.DSNDB06.SYSVIEWS.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPYB,
// VOL=(,RETAIN,,99,REF=*.DSNTICB.SYSCOPYB),LABEL=(13,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSVIEWS COPYDDN SYSCOPYC
/* ***** *
/* SYSSTATS IMAGE COPY STEP *
/* ***** *
//DSNTICD EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY',REGION=1024K,
// COND=(4,LT)
//SYSCOPYC DD DSN=DB2V510U.DSNDB06.SYSVIEWS.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYD DD DSN=DB2V510U.DSNDB06.SYSSTATS.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPYC,
// VOL=(,RETAIN,,99,REF=*.DSNTICC.SYSCOPYC),LABEL=(14,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSSTATS COPYDDN SYSCOPYD
/* ***** *
/* SYSLGRNX IMAGE COPY STEP *
/* ***** *
//DSNTICE EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY',REGION=1024K,
// COND=(4,LT)
//SYSCOPYD DD DSN=DB2V510U.DSNDB06.SYSSTATS.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYE DD DSN=DB2V510U.DSNDB06.SYSLGRNX.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPYD,
// VOL=(,RETAIN,,99,REF=*.DSNTICD.SYSCOPYD),LABEL=(15,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB01.SYSLGRNX COPYDDN SYSCOPYE

```

Figure 161 (Part 6 of 7). Create Image Copies of DB2 System Catalog Tables



```

/* ***** *
/* SYSDDF IMAGE COPY STEP *
/* ***** *
//DSNTICF EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPYE DD DSN=DB2V510U.DSNDB06.SYSLGRNX.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYF DD DSN=DB2V510U.DSNDB06.SYSDDF.RUN1,
// DISP=(NEW,PASS,DELETE),
// UNIT=AFF=SYSCOPYE,
// VOL=(,RETAIN,,99,REF=*.DSNTICE.SYSCOPYE),LABEL=(16,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSDDF COPYDDN SYSCOPYF
/* ***** *
/* SYSCOPY IMAGE COPY STEP *
/* ***** *
//DSNTICG EXEC PGM=DSNUTILB,PARM=' DB2R,IMAGCOPY', REGION=1024K,
// COND=(4,LT)
//SYSCOPYF DD DSN=DB2V510U.DSNDB06.SYSDDF.RUN1,
// DISP=(OLD,KEEP)
//SYSCOPYG DD DSN=DB2V510U.DSNDB06.SYSCOPY.RUN1,
// DISP=(NEW,KEEP,DELETE),
// UNIT=AFF=SYSCOPYF,
// VOL=(,RETAIN,,99,REF=*.DSNTICF.SYSCOPYF),LABEL=(17,SL)
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//SYSIN DD *
 COPY TABLESPACE DSNDB06.SYSCOPY COPYDDN SYSCOPYG
/*
//

```

Figure 161 (Part 7 of 7). Create Image Copies of DB2 System Catalog Tables

## A.1.2 RESTORE TABLESPACE Catalog and Directory

Figure 162 on page 208 contains the JCL to restore the system tables found in the DB2 catalog and directory. In actual execution this JCL was broken into three jobs.

```

// JOB
//* *****
//* *****
//* RECOVERY FOR SYSTEM RESOURCES - RECOVERY JOB *//
//* WARNING: START DB2 IN MAINT MODE BEFORE *//
//* RELEASING THIS JOB *//
//* *****
//* WARNING: THE EXECUTOR OF THIS JOB STEP MUST HAVE DB2 *//
//* INSTALL SYSADM AUTHORITY *//
//* *****
//* DSNUTILB - RECOVER SYSUTIL(X) *//
//* *****
//ARM0029 EXEC PGM=DSNUTILB,PARM=' DB2R' , REGION=4M
//STEPLIB DD DISP=SHR,DSN=DB2V510.SDSNLOAD
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SYSIN DD *
RECOVER TABLESPACE DSNDB01.SYSUTILX
//* *****
//ARM0030 EXEC PGM=DSNUTILB,PARM=' DB2R' , REGION=4M,COND=(4,LT)
//STEPLIB DD DISP=SHR,DSN=DB2V510.SDSNLOAD
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SYSIN DD *
RECOVER TABLESPACE DSNDB01.DBD01
//* *****
//ARM0031 EXEC PGM=DSNUTILB,PARM=' DB2R' , REGION=4M,COND=(4,LT)
//STEPLIB DD DISP=SHR,DSN=DB2V510.SDSNLOAD
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SORTWK01 DD UNIT=3390,SPACE=(CYL,(100,50))
//SORTWK02 DD UNIT=3390,SPACE=(CYL,(100,50))
//SYSUT1 DD UNIT=3390,SPACE=(CYL,(100,50))
//SYSIN DD *
RECOVER INDEX(ALL) TABLESPACE DSNDB01.SYSUTILX

```

Figure 162 (Part 1 of 2). Copy Utility: Initial Image Copy after Install, Image Copy Job 6

```

//* **** *
//ARMO0033 EXEC PGM=DSNUTILB,PARM=' DB2R' , REGION=4M,COND=(4,LT)
//STEPLIB DD DISP=SHR,DSN=DB2V510.SDSNLOAD
//SYSPRINT DD SYSOUT=*
//UTPRINT DD SYSOUT=*
//SORTWK01 DD UNIT=3390,SPACE=(CYL,(100,50))
//SORTWK02 DD UNIT=3390,SPACE=(CYL,(100,50))
//SYSUT1 DD UNIT=3390,SPACE=(CYL,(100,50))
//SYSIN DD *
RECOVER TABLESPACE DSNDB06.SYSCOPY
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSCOPY
RECOVER TABLESPACE DSNDB01.SYSLGRNX
RECOVER INDEX(ALL) TABLESPACE DSNDB01.SYSLGRNX
RECOVER TABLESPACE DSNDB06.SYSDBAUT
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSDBAUT
RECOVER TABLESPACE DSNDB06.SYSUSER
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSUSER
RECOVER TABLESPACE DSNDB06.SYSDBASE
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSDBASE
RECOVER TABLESPACE DSNDB06.SYSGROUP
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSGROUP
RECOVER TABLESPACE DSNDB06.SYSGPAUT
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSGPAUT
RECOVER TABLESPACE DSNDB06.SYSPLAN
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSPLAN
RECOVER TABLESPACE DSNDB06.SYSPKAGE
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSPKAGE
RECOVER TABLESPACE DSNDB06.SYSSTR
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSSTR
RECOVER TABLESPACE DSNDB06.SYSVIEWS
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSVIEWS
RECOVER TABLESPACE DSNDB01.SCT02
RECOVER INDEX(ALL) TABLESPACE DSNDB01.SCT02
RECOVER TABLESPACE DSNDB01.SPT01
RECOVER INDEX(ALL) TABLESPACE DSNDB01.SPT01
RECOVER TABLESPACE DSNDB06.SYSSTATS
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSSTATS
RECOVER TABLESPACE DSNDB06.SYSDDF
RECOVER INDEX(ALL) TABLESPACE DSNDB06.SYSDDF

```

Figure 162 (Part 2 of 2). Copy Utility: Initial Image Copy after Install, Image Copy Job 6

## A.2 DB2AUG JCL Examples

This section contains JCL jobstreams created with DB2AUG.

### A.2.1 DB2AUG JCL for Full Copy

The following JCL is an example of a Full Copy utility jobstream created by DB2AUG.

JSTEP01 contains the utility statements and parameters necessary; the restart parameters are also included as comments in the event of a utility failure.

Step JSTEP01H is an example of DB2AUG's help clist invocation. The help clist will assist in the restart process by determining the type of utility being executed

and the phase in which the utility ended. It then generates utility-specific restart instructions to assist the operator in restarting the job, or it can be used to edit the JCL automatically. It can also send messages containing job failure information to a pre-defined ID.

```

//PETER2 JOB (100,100),'DB2 UTILITY',
// MSGLEVEL=(1,1),MSGCLASS=T,COND=(20,LE),
// REGION=4M,CLASS=A
/*JOBPARM SYSAFF=3090
//*****
//*
//* DB2 AUTOMATED UTILITY GENERATOR (DB2AUG)
//*
//* GENERATION DATE: 97/05/21 TIME: 14:33
//*
//* JSTEP01: EXECUTE THE DB2 FULL COPY UTILITY FOR
//* TABLE SPACE: BTAB07.SBTAB07.000
//*
//*****
//JSTEP01 EXEC DSNUPROC,UID='UTIL0011.FULL',SYSTEM='DB2R',
// UTPROC=''
//* UTPROC='RESTART'
//* UTPROC='RESTART(PHASE)'
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSCOPY1 DD DISP=(MOD,CATLG,CATLG),
// DSN=FULL1.BTAB07.SBTAB07.ICF1L000.HEU02710,
// DCB=(BLKSIZE=8192,BUFNO=30),
// UNIT=3390,LABEL=(, , , ,RETPD=30),
// SPACE=(CYL,(52,13),RLSE)
//SYSIN DD *
COPY TABLESPACE BTAB07.SBTAB07
 DSNUM ALL
 COPYDDN(SYSCOPY1)
 FULL YES SHRLEVEL REFERENCE
/*
//*****
//* JSTEP01H: EXECUTE THE HELP CLIST
//*****
//JSTEP01H EXEC PGM=IKJEFT01,
// COND=((8,GT,JSTEP01.DSNUPROC),EVEN)
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSPROC DD DSN=DSN510.EZK120.CUSTOM.SEZKCLST,
// DISP=SHR
//SYSTSPRT DD SYSOUT=*
//HELPFIL DD DSN=DSN510.EZK120.PETER2.HELPFIL,DISP=(NEW,PASS),
// UNIT=3390,VOL=SER=BAACAT,SPACE=(80,(1))
//SYSTSIN DD *
%EZKHELP DB2ID(DB2R) JOB(PETER2) STEP(JSTEP01) STEPTYPE(U) +
OBJTYPE(T) OBJDATA(BTAB07.SBTAB07) +
UTILID(UTIL0011.FULL) EZKPRE(DSN510.EZK120) HELPFLAG(RESTART) +
RESTART(PHASE) PROCSTEP(DSNUPROC) +
COPYDSN1(FULL1.BTAB07.SBTAB07.ICF1L000.HEU02710) +
GDGLVL1(0) COPYTYPE(6) MEDIA1(D)
/*
//*****
//* JSTEP01A: EXECUTE THE ABEND PROGRAM
//*****
//JSTEP01A EXEC PGM=EZKABND,COND=(8,GT,JSTEP01.DSNUPROC)
//STEPLIB DD DSN=DSN510.EZK120.SEZKLOAD,DISP=SHR

```

## A.2.2 Reorg JCL Created with DB2AUG

The following JCL is an example of a Reorg jobstream.

This Reorg JCL will be created if DB2AUG determines that the object requires a reorg based upon the user-defined criteria contained in the DB2AUG control tables. In this instance, DB2AUG also determined that a Recalc of the storage group-defined tablespace was necessary.

Step JSTEP01H is an example of the help clist that is described in A.2.1, "DB2AUG JCL for Full Copy" on page 209.

```
//PETER1 JOB (100,100),'DB2 UTILITY',
// MSGLEVEL=(1,1),MSGCLASS=T,COND=(20,LE),
// REGION=4M,CLASS=A
/*JOBPARM SYSAFF=3090
//*****
//*
/* DB2 AUTOMATED UTILITY GENERATOR (DB2AUG)
/*
/* GENERATION DATE: 97/05/21 TIME: 14:33
/*
/* JSTEP01L: EXECUTE THE DB2 STOP, ALTER, AND START COMMANDS FOR
/* TABLE SPACE: BTAB00.BBTAB00
/*
//*****
//JSTEP01L EXEC PGM=IKJEFT01
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
// DD DSN=DSN510.RUNLIB.LOAD,DISP=SHR
//SYSUDUMP DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSTSIN DD *
DSN SYSTEM(DB2R)
 -STOP DATABASE(BTAB00) SPACENAM(BBTAB00)
 RUN PROGRAM (DSNTIAD) PLAN(DSNTIA51)
 -START DATABASE(BTAB00) SPACENAM(BBTAB00) ACCESS(RW)
END
/*
//SYSIN DD *
ALTER TABLESPACE BTAB00.BBTAB00
 PRIQTY 3600;
/*
//*****
/* JSTEP01H: EXECUTE THE HELP CLIST
//*****
//JSTEP01H EXEC PGM=IKJEFT01,COND=((8,GT,JSTEP01L),EVEN)
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSPROC DD DSN=DSN510.EZK120.CUSTOM.SEZKCLST,
// DISP=SHR
//SYSTSPRT DD SYSOUT=*
//HELPFIL DD DSN=DSN510.EZK120.PETER1.HELPFIL,DISP=(NEW,PASS),
// UNIT=3390,VOL=SER=BAACAT,SPACE=(80,(1))
//SYSTSIN DD *
%EZKHELP DB2ID(DB2R) JOB(PETER1) STEP(JSTEP01L) STEPTYPE(C) +
 OBJTYPE(T) OBJDATA(BTAB00.BBTAB00) +
 UTILID(ALTER) EZKPRE(DSN510.EZK120) HELPFLAG(RESTART)
/*
//*****
/* JSTEP01A: EXECUTE THE ABEND PROGRAM *
```

```

//*****
//JSTEP01A EXEC PGM=EZKABND,COND=(8,GT,JSTEP01L)
//STEPLIB DD DSN=DSN510.EZK120.SEZKLOAD,DISP=SHR
//*****
//*
//* JSTEP01: EXECUTE THE DB2 REORG UTILITY FOR
//* TABLE SPACE : BTAB00.BBTAB00
//*
//*****
//JSTEP01 EXEC DSNUPROC,UID=' UTIL0001.REORG', SYSTEM=' DB2R',
// UTPROC=''
//* UTPROC=' RESTART'
//* UTPROC=' RESTART(PHASE)'
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR
//SYSREC DD DISP=(MOD,CATLG,CATLG),
// DSN=REOUNL.BTAB00.BBTAB00.REORG000.HEU02710,
// DCB=(BLKSIZE=8192,BUFNO=25),
// UNIT=3390,LABEL=(,,RETPD=30),
// SPACE=(CYL,(2,1),RLSE)
//SYSUT1 DD DSN=REOWRK.BTAB00.BBTAB00.REORG000.SORTIN,
// DCB=(BLKSIZE=8192,BUFNO=30),
// DISP=(MOD,CATLG,CATLG),
// UNIT=3390,
// SPACE=(CYL,(1,1),RLSE)
//SORTOUT DD DSN=REOSRT.BTAB00.BBTAB00.REORG000.SORTOUT,
// DCB=(BLKSIZE=8192,BUFNO=30),
// DISP=(MOD,CATLG,CATLG),
// UNIT=3390,
// SPACE=(CYL,(1,1),RLSE)
//SORTWK01 DD SPACE=(CYL,(1,1),,CONTIG),
// DCB=(BLKSIZE=4096,BUFNO=25),
// UNIT=3390
//SORTWK02 DD SPACE=(CYL,(1,1),,CONTIG),
// DCB=(BLKSIZE=4096,BUFNO=25),
// UNIT=3390
//SORTWK03 DD SPACE=(CYL,(1,1),,CONTIG),
// DCB=(BLKSIZE=4096,BUFNO=25),
// UNIT=3390
//SORTWK04 DD SPACE=(CYL,(1,1),,CONTIG),
// DCB=(BLKSIZE=4096,BUFNO=25),
// UNIT=3390
//SORTWK05 DD SPACE=(CYL,(1,1),,CONTIG),
// DCB=(BLKSIZE=4096,BUFNO=25),
// UNIT=3390
//SORTWK06 DD SPACE=(CYL,(1,1),,CONTIG),
// DCB=(BLKSIZE=4096,BUFNO=25),
// UNIT=3390
//SYSIN DD *
REORG TABLESPACE BTAB00.BBTAB00
 LOG NO UNLDDN SYSREC
 WORKDDN (SYSUT1,SORTOUT)
 UNLOAD CONTINUE
/*
//*****
//* JSTEP01H: EXECUTE THE HELP CLIST
//*****
//JSTEP01H EXEC PGM=IKJEFT01,
// COND=((8,GT,JSTEP01.DSNUPROC),EVEN)
//STEPLIB DD DSN=DSN510.SDSNLOAD,DISP=SHR

```

```

//SYSPROC DD DSN=DSN510.EZK120.CUSTOM.SEZKCLST,
// DISP=SHR
//SYSTSPRT DD SYSOUT=*
//HELPFIL DD DSN=DSN510.EZK120.PETER1.HELPFIL,DISP=(NEW,PASS),
// UNIT=3390,VOL=SER=BAACAT,SPACE=(80,(1))
//SYSTSIN DD *
%EZHHELP DB2ID(DB2R) JOB(PETER1) STEP(JSTEP01) STEPTYPE(U) +
OBJTYPE(T) OBJDATA(BTAB00.BBTAB00) +
UTILID(UTIL001.REORG) EZKPRE(DSN510.EZK120) HELPFLAG(RESTART) +
RESTART(CURRENT) PROCSTEP(DSNUPROC) +
SORTIN(REOWRK.BTAB00.BBTAB00.REORG000.SORTIN) +
SORTOUT(REOSRT.BTAB00.BBTAB00.REORG000.SORTOUT) +
REORGDSN(REOUNL.BTAB00.BBTAB00.REORG000.HEU02710)
/*
//*****
/* JSTEP01A: EXECUTE THE ABEND PROGRAM *
//*****
//JSTEP01A EXEC PGM=EZKABND,COND=(8,GT,JSTEP01.DSNUPROC)
//STEPLIB DD DSN=DSN510.EZK120.SEZKLOAD,DISP=SHR
//*****
/* JSTEP01B: EXECUTE THE IEFBR14 PROGRAM *
//*****
//JSTEP01B EXEC PGM=IEFBR14,COND=(7,LE,JSTEP01.DSNUPROC)
//DD1 DD DISP=(OLD,DELETE,DELETE),
// DSN=REOUNL.BTAB00.BBTAB00.REORG000.HEU02710
//DD2 DD DISP=(OLD,DELETE,DELETE),
// DSN=REOWRK.BTAB00.BBTAB00.REORG000.SORTIN
//DD3 DD DISP=(OLD,DELETE,DELETE),
// DSN=REOSRT.BTAB00.BBTAB00.REORG000.SORTOUT

```



---

## Appendix B. Useful Scripts

This appendix contains scripts we found useful in monitoring or displaying information.

---

### B.1 Monitoring Table Growth

Since there was no statistical data for table, table space and index growth available, we developed a solution in order to retrieve this data. We show only SQL statements we tested with SPUFI. However, you can invoke them from JCL (see Figure 123 on page 169).

#### B.1.1 SPUFI SQL Script Displaying Table Growth

This SQL script provides an overview of the fastest growing tables (absolute and relative). It compares the sizes in SYSTABLES with those in a statistic table (TB1), which has to be filled periodically (see B.1.3.1, "TB1" on page 218). In order to compare with earlier sizes the tables TB2 through TB5 can also be used. These tables have to be filled in longer time intervals (see B.1.3.2, "TB<x>" on page 218).

**Notes:**

1. These SQL statements compare only TB1. TB1 must be changed to TBx (where x can be 2 thru 5) in order to compare the current sizes with earlier ones.
2. You may add a TIMESTAMP column that is filled automatically at each INSERT with the default value (current time and date).

```
-- *****
-- * TABLES *
-- * ===== *
-- * STRUCTURE *
-- * ----- *
-- * *
-- * TABLE TABLE *
-- * COLUMN COLUMN *
-- * *
-- * SYSTABLES TB1 TB2 .. TB5 *
-- * NAME -----> NAME NAME *
-- * NPAGES -----> SIZE SIZE *
-- * TSNAME *
-- * *
-- * TBDIFF *
-- * NAME *
-- * SIZE *
-- * ----- *
-- * DESCRIPTION *
-- * ----- *
-- * TB1 : CONTAINS SIZE (NPAGES) OF R/3 TABLES AND SHOULD *
-- * BE UPDATED AFTER EACH RUNSTATS. *
-- * * *
-- * TB2..5 : CONTAIN SIZES OF EARLIER DATES *
-- * * *
```

```

-- * TBDIFF : RESULT TABLE FOR CALCULATION OF TABLE GROWTH *
-- * *
-- * *
-- * *
-- * *
-- *****
-- * FILLING OF TABLES (EXAMPLE) *
-- * *
-- * TARGET POINT OF TIME SOURCE *
-- * TABLE TABLE *
-- * *
-- * TB1 : AFTER RUNSTATS SYSTABLES *
-- * TB2 : 8:00 PM, EACH DAY TB1 *
-- * TB3 : 8:00 PM, MO,WH,FR TB2 *
-- * TB4 : 8:00 PM, SA TB3 *
-- * TB5 : 8:00 PM, TB4 *
-- * 1ST DAY OF MONTH *
-- * *
-- *****
-- *****
-- * PART 1 : TABLES WITH DIFFERENCES MORE/LESS THAN AVERAGE *
-- *****
-- * DELETE THE RESULT TABLE *
DELETE FROM TBDIFF;
-- * COPY DIFFERENCE BETWEEN CURRENT TABLE SIZES AND *
-- * SIZES STORED IN THE HISTORY TABLE INTO THE RESULT TABLE *
INSERT INTO TBDIFF (NAME, SIZE)
 SELECT B.NAME, A.NPAGES - B.SIZE
 FROM TB1 B, SYSIBM.SYSTABLES A
 WHERE B.SIZE <> A.NPAGES
 AND B.NAME = A.NAME;
-- * DELETE THE ENTRIES OF TABLES WITH NO GROWTH *
DELETE FROM TBDIFF
 WHERE SIZE = 0;
-- * DISPLAY TABLES GROWN MORE THAN AVERAGE (ABSOLUTE) *
SELECT A.NAME AS TABLE, A.SIZE * C.PGSIZE AS KB,
 B.TSNAME AS TABLESPACE
 FROM TBDIFF A, SYSIBM.SYSTABLES B, SYSIBM.SYSTABLESPACE C
 WHERE SIZE > (SELECT AVG(SIZE)
 FROM TBDIFF)
 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 AND C.NAME = B.TSNAME
 AND A.SIZE <> -1
 AND B.NPAGES <> -1
 ORDER BY KB DESC;
-- * DISPLAY TABLES GROWN LESS THAN AVERAGE (ABSOLUTE) *
SELECT A.NAME AS TABLE, A.SIZE * C.PGSIZE AS KB,
 B.TSNAME AS TABLESPACE
 FROM TBDIFF A, SYSIBM.SYSTABLES B, SYSIBM.SYSTABLESPACE C
 WHERE SIZE <= (SELECT AVG(SIZE)
 FROM TBDIFF)
 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 AND C.NAME = B.TSNAME
 AND A.SIZE <> -1
 AND B.NPAGES <> -1
 ORDER BY KB DESC;
-- *****

```

```

-- * PART 2 : TABLES WITH RATIO MORE/LESS THAN DIFFERENCE *
-- *****
-- * DELETE THE RESULT TABLE *
DELETE FROM TBDIFF;
-- * COPY RATIO BETWEEN CURRENT TABLE SIZES AND *
-- * SIZES STORED IN THE HISTORY TABLE INTO THE RESULT TABLE *
INSERT INTO TBDIFF (NAME, SIZE)
 SELECT B.NAME, FLOAT(A.NPAGES - B.SIZE)/B.SIZE
 FROM TB1 B, SYSIBM.SYSTABLES A
WHERE B.SIZE <> A.NPAGES
AND B.NAME = A.NAME
AND B.SIZE > 0;
-- * DELETE ENTRIES OF TABLES WITH NO GROWTH *
DELETE FROM TBDIFF
 WHERE SIZE = 0;
-- * DISPLAY TABLES WITH GROWING RATIO MORE THAN AVERAGE (IN %) *
SELECT A.NAME AS TABLE , A.SIZE * 100 AS RATIO , B.TSNAME AS TABLESPACE
 FROM TBDIFF A, SYSIBM.SYSTABLES B
 WHERE SIZE > (SELECT AVG(SIZE)
 FROM TBDIFF)
 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 AND A.SIZE <> -1
 AND B.NPAGES <> -1
 ORDER BY RATIO DESC;
-- * DISPLAY TABLES WITH GROWING RATIO LESS THAN AVERAGE (IN %) *
SELECT A.NAME AS TABLE , A.SIZE *100 AS RATIO , B.TSNAME AS TABLESPACE
 FROM TBDIFF A, SYSIBM.SYSTABLES B
 WHERE SIZE <=(SELECT AVG(SIZE)
 FROM TBDIFF)
 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 AND A.SIZE <> -1
 AND B.NPAGES <> -1
 ORDER BY RATIO DESC;

```

## B.1.2 Creating Tables for Storing Table Statistics

These are the table definitions.

### B.1.2.1 Result Table

```

CREATE TABLE TBDIFF (
 NAME VARCHAR(18),
 SIZE DECIMAL(20,10)
)
CCSID EBCDIC;

```

### B.1.2.2 Statistics Tables

```
-- X : 1..5
CREATE TABLE TBX (
 NAME VARCHAR(18),
 SIZE DECIMAL(20)
)
CCSID EBCDIC;
```

## B.1.3 SQL Statements for Storing the Table Statistics in the Statistics Tables

These are the statements to gather the statistics data.

### B.1.3.1 TB1

```
DELETE FROM TB1;
INSERT INTO TB1 (NAME, SIZE)
 SELECT NAME, NPAGES FROM SYSIBM.SYSTABLES
 WHERE CREATOR = 'SAPR3';
```

### B.1.3.2 TB<x>

x: number between 2 and 5 (or more)

```
DELETE FROM TB<x>;
INSERT INTO TB2
 SELECT * FROM TB<x-1>;
```

## B.1.4 SPUFI SQL Script Displaying Table Space Growth

These are the SQL statements to gather the table space statistics. See B.1, "Monitoring Table Growth" on page 215 for details.

```
DELETE FROM TABDIFF;
INSERT INTO TABDIFF (NAME, SIZE)
SELECT A.NAME, A.NACTIVE - B.SIZE
 FROM SYSIBM.SYSTABLESPACE A, TAB1 B
 WHERE A.NAME = B.NAME
 AND A.NACTIVE <> B.SIZE
 AND A.CREATOR = 'SAPR3';
DELETE FROM TABDIFF
 WHERE SIZE = 0;
-- * DISPLAY TABLE SPACES GROWN MORE THAN AVERAGE (ABSOLUTE) *
SELECT A.NAME, A.SIZE * B.PGSIZE AS KB, B.DBNAME
 FROM TABDIFF A, SYSIBM.SYSTABLESPACE B
 WHERE SIZE > (SELECT AVG(SIZE)
 FROM TABDIFF)
 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 AND A.SIZE <> -1
 AND B.NACTIVE <> -1
 ORDER BY KB DESC;
-- * DISPLAY TABLE SPACES GROWN LESS THAN AVERAGE (ABSOLUTE) *
SELECT A.NAME, A.SIZE * PGSIZE AS KB, B.DBNAME
 FROM TABDIFF A, SYSIBM.SYSTABLESPACE B
 WHERE SIZE <= (SELECT AVG(SIZE)
 FROM TABDIFF)
 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 AND A.SIZE <> -1
 AND B.NACTIVE <> -1
 ORDER BY KB DESC;
DELETE FROM TABDIFF;
```

```

INSERT INTO TABDIFF (NAME, SIZE)
SELECT A.NAME, FLOAT(A.NACTIVE - B.SIZE) / B.SIZE
 FROM SYSIBM.SYSTABLESPACE A, TAB1 B
 WHERE A.NAME = B.NAME
 AND A.NACTIVE <> B.SIZE
 AND A.CREATOR = 'SAPR3';
DELETE FROM TABDIFF
 WHERE SIZE = 0;
-- * DISPLAY TABLE SPACES WITH GROWING RATIO MORE THAN AVERAGE *
SELECT A.NAME, A.SIZE, B.DBNAME
 FROM TABDIFF A, SYSIBM.SYSTABLESPACE B
 WHERE SIZE > (SELECT AVG(SIZE)
 FROM TABDIFF)

 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 ORDER BY A.SIZE DESC;
-- * DISPLAY TABLE SPACES WITH GROWING RATIO LESS THAN AVERAGE *
SELECT A.NAME, A.SIZE, B.DBNAME
 FROM TABDIFF A, SYSIBM.SYSTABLESPACE B
 WHERE SIZE <=(SELECT AVG(SIZE)
 FROM TABDIFF)

 AND A.NAME = B.NAME
 AND B.CREATOR = 'SAPR3'
 ORDER BY A.SIZE DESC;

```

## B.1.5 Creating Tables for Storing Table Space Statistics

These are the table definitions.

### B.1.5.1 Result Table

```

CREATE TABLE TABDIFF (
 NAME VARCHAR(18),
 SIZE DECIMAL(20,10)
)
CCSID EBCDIC;

```

### B.1.5.2 Statistics Tables

```

-- X : 1..5
CREATE TABLE TAB1 (
 NAME VARCHAR(18),
 SIZE DECIMAL(20)
)
CCSID EBCDIC;

```

## B.1.6 SQL Statements for Storing the Table Space Statistics in the Statistics Tables

These are the statements to gather the statistics data.

### B.1.6.1 First Table TAB1

```

DELETE FROM TAB1;
INSERT INTO TAB1 (NAME, SIZE)
 SELECT NAME, NACTIVE FROM SYSIBM.SYSTABLESPACE
 WHERE CREATOR = 'SAPR3';

```

### B.1.6.2 Next Tables

```
DELETE FROM TAB<x>;
INSERT INTO TAB<x>
 SELECT * FROM TAB<x-1>;
```

---

## B.2 Sample ABAP/4 Report for Querying the DB2 Catalog

This report performs SELECTs on the DB2 catalog and stores the data in an R/3 table (ZSTRU1) for further processing (only first select; to display the statistics, see B.3, "Sample ABAP/4 Report for Displaying the Statistics" on page 222).

```
REPORT ZJPS0001.
* TABLE THAT CONTAINS HISTORIC STATISTIC DATA
TABLES: ZSTRU1.

PARAMETERS:
 UPDATE(1) DEFAULT 'N'.

DATA: BEGIN OF STRU1,
 NAME(18) TYPE C,
 SIZE TYPE I,
END OF STRU1.

DATA: BEGIN OF STRU2,
 TSNAME(8) TYPE C,
 SIZE TYPE I,
 CARD TYPE I,
 PARTITION TYPE C,
END OF STRU2.

DATA: BEGIN OF STRU3,
 NAME(18) TYPE C,
 NPAGES TYPE I,
 CARDF TYPE I,
END OF STRU3.

* main
* QUERY 1
WRITE : /,'RUNSTATS Space Info For Table Spaces'.
ULINE.
WRITE : 'Name Size'.
ULINE.
EXEC SQL PERFORMING PROC1.
 SELECT Z.NAME, Z.NACTIVE * Z.PGSIZE
 FROM SYSIBM.SYSTABLESPACE Z
 WHERE CREATOR = 'SAPR3'
 ORDER BY NAME
 INTO :STRU1
ENDEXEC.

* QUERY 2
WRITE : /,/,/, 'RUNSTATS Space Info For Partitioned Table Spaces'.
ULINE.
WRITE : /, 'Name Part Size Rows'.
ULINE.
EXEC SQL PERFORMING PROC2.
 SELECT A.TSNAME, B.PGSIZE*A.NACTIVE, CARD, PARTITION
```

```

FROM SYSIBM.SYSTABSTATS A, SYSIBM.SYSTABLESPACE B
WHERE CREATOR = 'SAPR3'
AND TSNAME=B.NAME
ORDER BY A.TSNAME, PARTITION
INTO :STRU2
ENDEXEC.

```

```

* QUERY 1
WRITE : /,/,/'RUNSTATS Number Of Pages With Rows For Tables',/,
'Only Valid Right After RUNSTATS Without Update Of NPAGES'.

```

```

ULINE.
WRITE : /,'Name Pages Rows'.
ULINE.

```

```

EXEC SQL PERFORMING PROC3.
SELECT NAME, NPAGES, CARDF
FROM SYSIBM.SYSTABLES WHERE CREATOR = 'SAPR3'
ORDER BY NAME
INTO :STRU3
ENDEXEC.

```

\*\*\*\*\*

\* forms

```

* FORM PROC1 *

* Display stru1 and update statistics *

```

```

FORM PROC1.
* OUTPUT stru1
* OUTPUT stru1
WRITE : / STRU1-NAME,STRU1-SIZE.
IF UPDATE = 'Y'.
* UPDATE STATISTIC TABLE.
 ZSTRU1-NAM = STRU1-NAME.
 ZSTRU1-DAT = SY-DATUM.
 ZSTRU1-TIM = SY-UZEIT.
 ZSTRU1-SIZ = STRU1-SIZE.
 INSERT ZSTRU1.
ENDIF.
ENDFORM.

```

```

* FORM PROC2 *

* Display stru2 *

```

```

FORM PROC2.
WRITE : / STRU2-TSNAME,STRU2-PARTITION,
 STRU2-SIZE, STRU2-CARD.
ENDFORM.

```

```

* FORM PROC3 *

* Display stru3 *

```

```

FORM PROC3.
WRITE : / STRU3-NAME, STRU3-NPAGES, STRU3-CARDF.
ENDFORM.

```

### B.3 Sample ABAP/4 Report for Displaying the Statistics

This report displays the table space statistics stored in the R/3 table ZSTRU1.

```
REPORT ZJPS0002.
TABLES: ZSTRU1.
SELECT * FROM ZSTRU1.
 WRITE : /, ZSTRU1-NAM, ZSTRU1-DAT, ZSTRU1-TIM, ZSTRU1-SIZ.
ENDSELECT.
```

The DDIC-definition of table ZSTRU1 is shown in Figure 163 (R/3 transaction SE11).

|                   |                                                                |                   |                   |        |            |                                |
|-------------------|----------------------------------------------------------------|-------------------|-------------------|--------|------------|--------------------------------|
| Name              | ZSTRU1                                                         | Transparent table |                   |        |            |                                |
| Short text        | Table for Storing Table Space Sizes                            |                   |                   |        |            |                                |
| Last changed      | PETER                                                          | 21.05.1997        | Master language   | E      |            |                                |
| Status            | Act.                                                           | Saved             | Development class | Z001   |            |                                |
| -----             |                                                                |                   |                   |        |            |                                |
| Delivery class    | C Customizing table, maintenance only by cust., not SAP import |                   |                   |        |            |                                |
| Tab.Maint.Allowed |                                                                |                   |                   |        |            |                                |
| Field name        | Key                                                            | Data elem.        | Type              | Length | CheckTable | Short text                     |
| NAM               |                                                                | D2TSNAME          | CHAR              | 8      |            | Column TSNAME of table SYSIBM. |
| DAT               |                                                                | SYDATUM           | DATS              | 8      |            | System: Date                   |
| TIM               |                                                                | SYUZEIT           | TIMS              | 6      |            | System: Time                   |
| SIZ               |                                                                | INT4              | INT4              | 10     |            | Natural number                 |

Figure 163. Definition of Statistics Table ZSTRU1

### B.4 Sample Program for Consistency Check

This report compares the tables defined in the DB2 catalog with those defined in the R/3 Data Dictionary (see 2.4.4.2, "Consistency Check" on page 32).

```
REPORT ZJPS0003.
TABLES: DD02L, DD06L, DBDIFF.

* data definition
DATA: BEGIN OF STRU1 OCCURS 1000,
 NAME(18) TYPE C,
END OF STRU1.

DATA: BEGIN OF STRU2 OCCURS 1000,
 NAME(10) TYPE C,
END OF STRU2.

DATA: N(10) TYPE C.

* main program
* select DB2 R/3 tables
PERFORM FILLSTRU1.
* select DDIC tables
SELECT * FROM DD02L
 WHERE TABCLASS = 'TRANSP' AND AS4LOCAL = 'A'.
 STRU2-NAME = DD02L-TABNAME.
```



```

APPEND STRU2.
ENDSELECT.

SELECT * FROM DD06L WHERE AS4LOCAL = 'A'.
 STRU2-NAME = DD06L-SQLTAB.
 APPEND STRU2.
ENDSELECT.
* delete tables, that are defined in ddic
LOOP AT STRU2.
 DELETE STRU1 WHERE NAME = STRU2-NAME.
ENDLOOP.
* delete other tables, that are not needed
SELECT * FROM DBDIFF.
 DELETE STRU1 WHERE NAME = DBDIFF-OBJNAME.
ENDSELECT.
* output
WRITE : / 'Tables defined in DB2 and not in DDIC',/.
LOOP AT STRU1.
 WRITE : STRU1-NAME.
ENDLOOP.

WRITE : /.
ULINE.
* select DB2 tables
PERFORM FILLSTRU1.
* delete DB2 tables from DDIC tables
LOOP AT STRU1.
 DELETE STRU2 WHERE NAME = STRU1-NAME.
ENDLOOP.

WRITE : /,/, 'Tables defined in DDIC and not in DB2',/.
LOOP AT STRU2.
 WRITE : STRU2-NAME.
ENDLOOP.

* FORM FORM1 *

* *

FORM FORM1.
 APPEND STRU1.
ENDFORM.

* FORM FILLSTRU1 *

* *

FORM FILLSTRU1.
 EXEC SQL PERFORMING FORM1.
 SELECT NAME
 FROM SYSIBM.SYSTABLES
 WHERE CREATOR = 'SAPR3'
 AND TYPE = 'T'
 INTO :STRU1
 ENDEXEC.
ENDFORM.

```



## Appendix C. Tables with Size Category 4 and Data Class APPL1

Table 13 shows all tables with size category 4 and data class APPL1 (see 6.2.2, "Size Category and Data Class in SAP R/3" on page 177 for more information) in the standard SAP R/3 installation. The tablespace shown is the one where the table is located during SAP R/3 standard installation. Table descriptions are taken directly from the SAP R/3 product documentation.

| <i>Table 13 (Page 1 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3</i> |                   |                                                                      |
|--------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------|
| <b>Table</b>                                                                               | <b>Tablespace</b> | <b>Table Description</b>                                             |
| AABLG                                                                                      | SCLU00            | Cluster for settlement document                                      |
| ACCTCR                                                                                     | SBTAB00           | Compressed data from FI/CO document - currencies                     |
| ACCTHD                                                                                     | SBTAB00           | Compressed data from FI/CO document - header                         |
| ACCTIT                                                                                     | SBTAB00           | Compressed data from FI/CO document                                  |
| AFRU                                                                                       | SBTAB00           | Order completion confirmations                                       |
| AFVC                                                                                       | SBTAB00           | Operation within an order                                            |
| AFVU                                                                                       | SBTAB00           | DB structure of the user fields of the operation                     |
| AFVV                                                                                       | SBTAB00           | DB structure of the quantities/dates/values in the operation         |
| ANEA                                                                                       | SBTAB00           | Asset-line items proportionate values                                |
| ANLP                                                                                       | SBTAB00           | Asset periodic values                                                |
| ANLQ                                                                                       | SBTAB00           | Period values from dep. posting run per posting level                |
| ARIX_BKPF                                                                                  | SBTAB00           | FI_DOCUMNT: Header-oriented document index for archive               |
| ARIX_BSEGA                                                                                 | SBTAB00           | FI_DOCUMNT: Line-oriented index for archiving asset accounts         |
| ARIX_BSEGD                                                                                 | SBTAB00           | FI_DOCUMNT: Line-oriented indx for archiving customer accounts       |
| ARIX_BSEGK                                                                                 | SBTAB00           | FI_DOCUMNT: Line-oriented index for archiving vendor accounts        |
| ARIX_BSEGM                                                                                 | SBTAB00           | FI_DOCUMNT: Line-oriented index for archiving material accounts      |
| ARIX_BSEGS                                                                                 | SBTAB00           | FI_DOCUMNT: Line-oriented index for archiving GL accounts            |
| ASSHR                                                                                      | SBTAB00           | Assignment of HR to AFRU/ASSOB                                       |
| ASSOB                                                                                      | SBTAB00           | Assignment objects                                                   |
| AUAK                                                                                       | SBTAB00           | Document header for settlement                                       |
| AUBF                                                                                       | SBTAB00           | Document flow R/3 Retail (allocation table, promotions...)           |
| AUFM                                                                                       | SBTAB00           | Goods movements for order                                            |
| AUSP                                                                                       | SBTAB00           | Characteristic values                                                |
| BDCP                                                                                       | SBTAB00           | Change pointer                                                       |
| BDSER                                                                                      | SBTAB00           | Serialization: last date of object at sender                         |
| BFIT_A                                                                                     | SBTAB00           | FI subsequent BA/PC adjustment: G/L account items                    |
| BFIT_A0                                                                                    | SBTAB00           | FI subsequent BA/PC adjustment: Zero bal. postings for business area |
| BFOD_A                                                                                     | SBTAB00           | FI subsequent BA/PC adjustment: Customer items                       |
| BFOD_AB                                                                                    | SBTAB00           | FI subsequent BA/PC adjustment: Valuation difference in customer OIs |
| BFOK_A                                                                                     | SBTAB00           | FI subsequent BA/PC adjustment: Vendor items                         |
| BFOK_AB                                                                                    | SBTAB01           | FI subseq.BA/PC adjustmnt: Valuatn difference in vendor OIs          |
| BSAS                                                                                       | SBTAB01           | Accounting: Secondary index for G/L accounts (cleared items)         |
| BSIS                                                                                       | SBTAB01           | Accounting: Secondary index for G/L accounts                         |

Table 13 (Page 2 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3

| Table     | Tablespace | Table Description                                      |
|-----------|------------|--------------------------------------------------------|
| CATM      | SBTAB01    | CATT: Log for model and function data                  |
| CEAEERROR | SBTAB02    | CO-PA: Incorrect records from SD                       |
| CEERROR   | SBTAB02    | CO-PA: Incorrect records from SD                       |
| CF001     | SBTAB02    | Profitability analysis                                 |
| CF050     | SBTAB02    | Balance sheet/P&L (FI/FILC)                            |
| CFIS      | SPOOL36    | SAP Purch.Info.Sys.: Structure table                   |
| CFNNN     | SBTAB02    | Reference structure for aspect tables SAP-EIS          |
| CKBOB     | SBTAB02    | KKB: OBJect Record (fixed data base portion)           |
| CKIS      | SBTAB02    | Unit costing: Items/Product costing: Itemization       |
| CKMI1     | SBTAB02    | Index for accounting documents for material            |
| CKML1     | SBTAB02    | Material ledger period totals records                  |
| CNDB      | SBTAB02    | File to save selection versions (INDX)                 |
| COEJ      | SBTAB02    | CO object: year-related line items                     |
| COEP      | SBTAB02    | CO object: period-related line items                   |
| COFP      | SBTAB02    | Document lines (cashflow)                              |
| COFVP     | SBTAB02    | PI sheet - process instr. charact. values/ctrl. recipe |
| COIFT     | SBTAB02    | Interface to activity allocation                       |
| COIX      | SBTAB02    | Controlling: Info system cluster tables                |
| COIX_DATA | SBTAB02    | Controlling: Info system cluster tables                |
| COSP      | SBTAB02    | CO Object: Cost totals - External postings             |
| COSPD     | SBTAB02    | CO Object: Settled primary cost totals                 |
| COSS      | SBTAB02    | CO Object: Cost totals - Internal postings             |
| COSSD     | SBTAB02    | CO Object: Settled secondary cost totals               |
| CVDPH     | SBTAB03    | DDS: DDOC log, header record                           |
| DOKCLU    | DOKCLU     | Document lines                                         |
| DSYAD     | SBTAB03    | Structures: Display structure without text             |
| DSYAS     | SBTAB03    | Structures: Maintenance structure without text         |
| DSYAT     | SBTAB03    | Structures: Texts for maintenance structure            |
| DSYAX     | SBTAB03    | Structures: Parameters for views on a book             |
| ECMCA     | SBTAB03    | EC-MC: Journal entry table (actual)                    |
| ECMCT     | SBTAB03    | EC-MC: Totals table                                    |
| EDI30C    | SCLU00     | Intermediate document cluster (data records) from 3.0C |
| EDID3     | SBTAB03    | Data segment table (EDI IDocs) from 3.0                |
| EDIDC     | SBTAB03    | Control record (EDI Intermediate Document)             |
| EKEH      | SBTAB04    | Scheduling agreement release documentation             |
| ESLL      | SBTAB04    | Lines of service package                               |
| FCABK     | SBTAB04    | FI-CA: Document header                                 |
| FCABP     | SBTAB04    | FI-CA: Document item                                   |
| FILCA     | SBTAB04    | FI-LC: Actual journal entry table with 2 object tables |
| FILCT     | SBTAB04    | FI-LC: Global totals table with 2 object tables        |

| <i>Table 13 (Page 3 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3</i> |                   |                                                          |
|--------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------|
| <b>Table</b>                                                                               | <b>Tablespace</b> | <b>Table Description</b>                                 |
| FMBE                                                                                       | SBTAB04           | FI-FM cash levels                                        |
| FMCFBPAKS                                                                                  | SBTAB04           | FM-FYC: Budget/Planning Updates (Interim Storage)        |
| FMEP                                                                                       | SBTAB04           | FI-FM line items                                         |
| FMIA                                                                                       | SBTAB04           | Actual line item table                                   |
| FMICOHD                                                                                    | SBTAB04           | FM/CO integration: Document header                       |
| FMICOIT                                                                                    | SBTAB04           | FM/CO integration: Line item                             |
| FMIFIHD                                                                                    | SBTAB04           | FI header table, funds management                        |
| FMIFIIT                                                                                    | SBTAB04           | FI line item table in funds management                   |
| FMIOI                                                                                      | SBTAB04           | Funds management commitment documents                    |
| FMIP                                                                                       | SBTAB04           | Plan line items table                                    |
| FMIT                                                                                       | SBTAB04           | Totals table                                             |
| FMSP                                                                                       | SBTAB04           | Copy FMSU table order to project                         |
| FMSU                                                                                       | SBTAB04           | FI-FM totals records                                     |
| FMSUV                                                                                      | SBTAB04           | FI-FM totals records summarized                          |
| FMSUVS                                                                                     | SBTAB04           | Change information for table FMSUV                       |
| GGREFA                                                                                     | SBTAB05           | Example for global FI-SL line items (actual)             |
| GGREFP                                                                                     | SBTAB05           | Example for global FI-SL line items (plan)               |
| GGREFT                                                                                     | SBTAB05           | Example for global FI-SL summary table                   |
| GLFUNCA                                                                                    | SBTAB05           | Actual line items table with function area for IDES      |
| GLFUNCP                                                                                    | SBTAB05           | Plan line items table with function area for IDES        |
| GLFUNCT                                                                                    | SBTAB05           | Totals table with functional area for IDES               |
| GLFUNCU                                                                                    | SBTAB05           | Rollup line item tables with function area for IDES      |
| GLFUNCV                                                                                    | SBTAB05           | Rollup plan line items table with function area for IDES |
| GLPCA                                                                                      | SBTAB05           | EC-PCA: Actual line items                                |
| GLPCP                                                                                      | SBTAB05           | EC-PCA: Plan line items                                  |
| GLPCT                                                                                      | SBTAB05           | EC-PCA: Totals table                                     |
| GLREFA                                                                                     | SBTAB05           | Example for local FI-SL line items (actual)              |
| GLREFP                                                                                     | SBTAB05           | Example for local FI-SL line items (plan)                |
| GLREFT                                                                                     | SBTAB05           | Example for local FI-SL summary table                    |
| GLREFU                                                                                     | SBTAB05           | Example for FI-SL rollup line items (actual)             |
| GLREFV                                                                                     | SBTAB05           | Example for rollup FI-SL line items (plan)               |
| HIKO                                                                                       | SBTAB05           | Order master data history                                |
| HIMA                                                                                       | SBTAB05           | PM Order history - materials                             |
| HIVG                                                                                       | SBTAB05           | PM Order history - operations                            |
| INOB                                                                                       | SBTAB05           | Link between internal number and object                  |
| ISEG                                                                                       | SBTAB05           | Physical inventory document items                        |
| JCDS                                                                                       | SBTAB05           | Change documents for system/user statuses (table JEST)   |
| JVOO1                                                                                      | SBTAB05           | Object table for FI-SL table JVTO1                       |
| JVOO2                                                                                      | SBTAB05           | JV billing FI-SL object table                            |
| JVSO1                                                                                      | SBTAB05           | JV LI table with objects for JVTO1                       |

Table 13 (Page 4 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3

| Table   | Tablespace | Table Description                                           |
|---------|------------|-------------------------------------------------------------|
| JVSO2   | SBTAB05    | JV billing FI-SL line item                                  |
| JVTO1   | SBTAB05    | JV summary table with objects                               |
| JVTO2   | SBTAB05    | JV billing FI-SL summary table                              |
| KANZ    | SBTAB05    | Assignment of sales order items - costing objects           |
| KBED    | SBTAB05    | Capacity requirements records                               |
| KBKO    | SBTAB05    | Header record for capacity requirements                     |
| KEKO    | SBTAB06    | Product costing - header                                    |
| KSSK    | SBTAB06    | Allocation table: object to class                           |
| LWRKKEY | SBTAB06    | Key for work lists                                          |
| LWRKOBJ | SBTAB06    | Object lists for work lists                                 |
| MCAFKOV | SBTAB06    | Versions: Order header data - PP orders                     |
| MCAFPOV | SBTAB06    | Versions: Order item                                        |
| MCAFVGV | SBTAB06    | Versions: Order procedure                                   |
| MCDX    | SBTAB06    | Compressed consolidation transaction data                   |
| MCKALKW | SBTAB06    | Versions: Cost itemization                                  |
| MCS0    | SBTAB06    | Reference structure for generating info structures          |
| MCVSRFK | SBTAB06    | Statistically relevant fields for order and delivery header |
| MDKP    | SBTAB07    | Header data for MRP document                                |
| MDSM    | SBTAB07    | Simulative dependent requirements                           |
| MDTB    | SBTAB07    | MRP table                                                   |
| MONI    | SBTAB07    | Monitor table MONI                                          |
| MSEG    | SBTAB07    | Document segment: Material                                  |
| NAST    | SBTAB07    | Message status                                              |
| PBED    | SBTAB08    | Independent requirements data                               |
| PBIM    | SBTAB08    | Independent requirements for material                       |
| PDSNR   | SBTAB08    | Sequential number for PDC messages                          |
| PLAF    | SBTAB08    | Planned order                                               |
| PLAS    | SBTAB08    | Task list - selection of operations/activities              |
| PLSR    | SBTAB08    | Scheduling results                                          |
| PMPL    | SBTAB08    | PM: Print log                                               |
| QAES    | SBTAB08    | Sample unit table                                           |
| QAKL    | SBTAB08    | Results table for value classes                             |
| QALS    | SBTAB08    | Inspection lot record                                       |
| QALT    | SBTAB08    | Partial lot                                                 |
| QAMB    | SBTAB08    | QM: Link between inspection lot and material document       |
| QAMR    | SBTAB08    | Characteristic results during inspection processing         |
| QAMV    | SBTAB08    | Characteristic specifications for inspection processing     |
| QAPP    | SBTAB08    | Inspection point                                            |
| QASE    | SBTAB08    | Results table for the sample unit                           |
| QASR    | SBTAB08    | Sample results for inspection characteristics               |

Table 13 (Page 5 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3

| Table | Tablespace | Table Description                                            |
|-------|------------|--------------------------------------------------------------|
| QAVE  | SBTAB08    | Inspection processing: Usage decision                        |
| QDQL  | SBTAB08    | Quality level                                                |
| QMIH  | SBTAB08    | Quality message - maintenance data excerpt                   |
| REGUH | SBTAB08    | Settlement data from payment program                         |
| RESB  | SBTAB08    | Reservation/dependent requirements                           |
| RFBLG | SCLU00     | Cluster for accounting document                              |
| RPSCO | SBTAB08    | Project info database: Costs, revenues, finances             |
| S003  | SBTAB09    | SIS: SalesOrg/DistCh/Division/District/Customer/Product      |
| S006  | SBTAB09    | SIS: Sales Rep/SalesOrg/DistCh/Division/Customer/Product     |
| S015  | SBTAB09    | Subsequent settlement: Evaluation                            |
| S021  | SBTAB09    | SFIS: Order item data for material                           |
| S022  | SBTAB09    | SFIS: Order operation data for work center                   |
| S023  | SBTAB09    | SFIS: Cumulative records for material                        |
| S024  | SBTAB09    | Totals records for work center                               |
| S025  | SBTAB09    | SFIS: Run schedule                                           |
| S026  | SBTAB09    | Material usage                                               |
| S027  | SBTAB09    | Product costs                                                |
| S028  | SBTAB09    | Reporting point statistics                                   |
| S029  | SBTAB09    | KANBAN                                                       |
| S031  | SBTAB09    | Statistics: Movements for current stocks                     |
| S032  | SBTAB09    | Statistics: Current stock and grouping terms                 |
| S033  | SBTAB09    | Statistics: Movements for current stock (individual records) |
| S039  | SBTAB09    | Statistics: Inventory controlling                            |
| S061  | SBTAB09    | Location and planning                                        |
| S062  | SBTAB09    | Object type and manufacturer                                 |
| S063  | SBTAB09    | Damage analysis                                              |
| S065  | SBTAB09    | Object statistics                                            |
| S068  | SBTAB09    | Vendor statistics                                            |
| S069  | SBTAB09    | Material statistics (QM)                                     |
| S070  | SBTAB09    | Breakdown statistics                                         |
| S074  | SBTAB09    | Subsequent settlement: Condition                             |
| S076  | SBTAB09    | Sales and operations planning                                |
| S077  | SBTAB09    | STRPS: Movements                                             |
| S078  | SBTAB09    | STRPS: Stocks                                                |
| S079  | SBTAB09    | STRPS: Movements + Stock                                     |
| S080  | SBTAB09    | Purchasing: Movements                                        |
| S081  | SBTAB09    | Purchasing: Stock                                            |
| S082  | SBTAB09    | Purchasing: Movements + Stock                                |
| S083  | SBTAB09    | Material: Movements                                          |
| S084  | SBTAB09    | Material: Stock                                              |

Table 13 (Page 6 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3

| Table      | Tablespace | Table Description                                        |
|------------|------------|----------------------------------------------------------|
| S085       | SBTAB09    | Material: Movements + Stock                              |
| S086       | SBTAB09    | Promotion                                                |
| S087       | SBTAB09    | Material/Add-on: Movements                               |
| S090       | SBTAB09    | WM: Stock placement/Stock removal                        |
| S091       | SBTAB09    | WM: Quantity flows                                       |
| S092       | SBTAB09    | Resource requirements: Material                          |
| S093       | SBTAB09    | Resource requirements: Material                          |
| S094       | SBTAB09    | Stock/Requirements Analysis                              |
| S096       | SBTAB09    | Distribution scenario                                    |
| S097       | SBTAB09    | QM notifications: Material analysis                      |
| S098       | SBTAB09    | QM notifications: Vendor analysis                        |
| S099       | SBTAB09    | QM notifications: Customer analysis                      |
| S100       | SBTAB09    | Problems: Material analysis                              |
| S102       | SBTAB09    | Problems: Vendor analysis                                |
| S103       | SBTAB09    | Problems: Customer analysis                              |
| S104       | SBTAB09    | Customer statistics                                      |
| S115       | SBTAB09    | Cost evaluation                                          |
| S116       | SBTAB09    | Customer analysis                                        |
| S125       | SBTAB09    | Forecast history for ex. system                          |
| S126       | SBTAB09    | Open variants - Basis 1                                  |
| S127       | SBTAB09    | Open variants - Basis 2                                  |
| S128       | SBTAB09    | Open variants - SIS                                      |
| S129       | SBTAB09    | Open variants - Planning                                 |
| S140       | SBTAB09    | Product allocations                                      |
| SCAPPT     | SBTAB10    | User-specific appointments                               |
| SCGENAPPT  | SBTAB10    | Generated appointments (regular or group appointments)   |
| SCPARTICIP | SBTAB10    | Group appointment participants table                     |
| SCSTATUS   | SBTAB10    | Appointment status information                           |
| SERPLISTS  | SBTAB10    | Reporting: Lists                                         |
| SOC3       | SBTAB10    | SAPoffice: DB for objects (import/export)                |
| SODM       | SBTAB10    | SAPoffice: Distribution list contents                    |
| SOFM       | SBTAB10    | SAPoffice: Folder contents                               |
| SOOD       | SBTAB10    | SAPoffice: Object definition                             |
| SOOS       | SBTAB10    | SAPoffice: Send process                                  |
| SWPNODELOG | SBTAB11    | Workflow: Instance data of nodes of a workflow execution |
| SWPSTEPLOG | SBTAB11    | Workflow: Instance data of steps of a workflow execution |
| SWWLOGHIST | SBTAB11    | History of a work item                                   |
| SWWLOGPARA | SBTAB11    | WIM log table: Actions on WIs - parameters               |
| SWWORGTASK | SBTAB11    | Assignment of WIs to org.units and tasks                 |
| SWWWIDEADL | SBTAB11    | Deadline data for work items                             |



| <i>Table 13 (Page 7 of 7). Tables with Size Category 4 and Data Class APPL1 in SAP R/3</i> |                   |                                                                |
|--------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------|
| <b>Table</b>                                                                               | <b>Tablespace</b> | <b>Table Description</b>                                       |
| SWWWIHEAD                                                                                  | SBTAB11           | Header table for all work item types                           |
| SWWWIRET                                                                                   | SBTAB11           | Table for return values of method call of a work item          |
| SWW_CONT                                                                                   | SBTAB11           | Container contents for work item data container                |
| SWW_CONTOB                                                                                 | SBTAB11           | Container contents for work item data container (only objects) |
| T51R8                                                                                      | SBTAB12           | Transfer request - Payroll result - Grouping                   |
| T5A1Q                                                                                      | SBTAB12           | No information                                                 |
| TEVEN                                                                                      | SBTAB15           | Time events                                                    |
| TEXLGA                                                                                     | SBTAB15           | Canteen data                                                   |
| TEXTLOG                                                                                    | SBTAB15           | Log of text changes in DW                                      |
| TOADL_OL                                                                                   | SBTAB15           | Online section archived print list                             |
| TST01                                                                                      | SBTAB16           | TemSe: List of objects and parts                               |
| VBAP                                                                                       | SBTAB17           | Sales document: Item data                                      |
| VBEX                                                                                       | SBTAB17           | SD document: Export control: Data at item level                |
| VBFA                                                                                       | SBTAB17           | Sales document flow                                            |
| VLB                                                                                        | SBTAB17           | Sales document: Release order data                             |
| VEKP                                                                                       | SBTAB17           | SD document: Shipping unit header                              |



## Appendix D. Detailed Index Recovery Statistics

Table 14 provides detailed job-by-job timings of the individual index recovery jobs summarized in 4.9.1, "Sample JCL: RECOVER INDEX ALL" on page 153.

*Table 14 (Page 1 of 2). Index Recovery Statistics (Detail)*

| <b>Job</b>   | <b>Tablespaces</b> | <b>Indexes</b> | <b>Elapsed Min<br/>NOREUSE</b> | <b>Elapsed Min<br/>REUSE</b> |
|--------------|--------------------|----------------|--------------------------------|------------------------------|
| RECI1A       | 237                | 1760           | 98.2                           | 61.9                         |
| RECI1B       | 238                | 331            | 20.7                           | 22.7                         |
| RECI1C       | 238                | 374            | 21.1                           | 21.3                         |
| RECI1D       | 238                | 319            | 18.9                           | 20.1                         |
| RECI1E       | 238                | 275            | 15.4                           | 16.5                         |
| RECI1F       | 12                 | 12             | .9                             | .8                           |
| RECI1G       | 1                  | 7              | 5.9                            | 6.1                          |
| Total Stream | 1202               | 3078           | 181.0                          | 149.4                        |
| RECI2A       | 11                 | 557            | 18.6                           | 12.2                         |
| RECI2B       | 238                | 301            | 19.3                           | 16.8                         |
| RECI2C       | 238                | 1280           | 52.5                           | 28.9                         |
| RECI2D       | 238                | 331            | 18.3                           | 15.9                         |
| RECI2E       | 1                  | 1              | 5.6                            | 5.5                          |
| RECI2F       | 238                | 344            | 17.5                           | 19.1                         |
| RECI2G       | 238                | 325            | 17.2                           | 19.8                         |
| Total Stream | 1202               | 3139           | 149.0                          | 118.2                        |
| RECI3A       | 238                | 2014           | 115.2                          | 62.4                         |
| RECI3B       | 238                | 320            | 19.3                           | 17.9                         |
| RECI3C       | 238                | 392            | 21.9                           | 20.8                         |
| RECI3D       | 238                | 337            | 22.3                           | 21.9                         |
| RECI3E       | 238                | 285            | 19.7                           | 18.1                         |
| RECI3F       | 12                 | 13             | .8                             | .8                           |
| Total Stream | 1202               | 3361           | 199.2                          | 141.9                        |
| RECI4A       | 238                | 1924           | 125.3                          | 69.3                         |
| RECI4B       | 238                | 323            | 25.5                           | 22.0                         |
| RECI4C       | 238                | 300            | 16.7                           | 17.0                         |
| RECI4D       | 238                | 409            | 30.4                           | 21.2                         |
| RECI4E       | 238                | 324            | 22.4                           | 21.1                         |
| RECI4F       | 11                 | 11             | .9                             | .6                           |
| Total Stream | 1201               | 3291           | 221.2                          | 151.2                        |
| RECI5A       | 238                | 1523           | 116.8                          | 81.7                         |
| RECI5B       | 238                | 339            | 27.6                           | 23.8                         |
| RECI5C       | 238                | 382            | 32.0                           | 23.1                         |
| RECI5D       | 238                | 331            | 27.9                           | 24.1                         |

| <i>Table 14 (Page 2 of 2). Index Recovery Statistics (Detail)</i> |                    |                |                                |                              |
|-------------------------------------------------------------------|--------------------|----------------|--------------------------------|------------------------------|
| <b>Job</b>                                                        | <b>Tablespaces</b> | <b>Indexes</b> | <b>Elapsed Min<br/>NOREUSE</b> | <b>Elapsed Min<br/>REUSE</b> |
| RECI5E                                                            | 238                | 293            | 22.9                           | 21.3                         |
| RECI5F                                                            | 11                 | 11             | .8                             | .5                           |
| Total Stream                                                      | 1201               | 2879           | 228.0                          | 174.5                        |
| RECI6A                                                            | 238                | 1767           | 131.2                          | 59.5                         |
| RECI6B                                                            | 238                | 319            | 27.5                           | 14.4                         |
| RECI6C                                                            | 238                | 356            | 28.5                           | 18.6                         |
| RECI6D                                                            | 238                | 294            | 21.4                           | 15.7                         |
| RECI6E                                                            | 238                | 280            | 25.9                           | 15.9                         |
| RECI6F                                                            | 11                 | 11             | .8                             | .6                           |
| Total Stream                                                      | 1201               | 3027           | 235.3                          | 124.7                        |
| Total All<br>Streams                                              | 7209               | 18775          | 1213.7                         | 859.9                        |

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## Appendix E. APAR PQ19077 Text

This is the text provided with APAR PQ19077. The APAR is available from normal IBM service sources.

The APAR implements a new parameter (REUSE) that is used in index recovery. This REUSE parameter will cause the object to be reset without the necessity of delete and redefine operations. This can save considerable time in index recovery for SAP R/3, since there are many empty indexes.

---

### E.1 APAR Text

```
++ PTF (UQ23002) /*
//UQ23002 JOB 5740-23002,XYR00,MSGLEVEL=(1,1),CLASS=A */ .
++ VER (P115)
FMID(HDB5510)
PRE (UQ22865,UQ22755,UQ22181,UQ21869,UQ21536,UQ21523,
 UQ16690,UQ05841)
SUP (UQ22387,UQ15235,UQ10203,AQ19663,AQ19077,AQ12108,
 AQ07935)
/*
PROBLEM DESCRIPTION(S):
PQ19077 -

* USERS AFFECTED: All DB2 Users *

* PROBLEM DESCRIPTION: REORG on DSNDB06.SYSGROUP fails with *
* RESOURCE UNAVAILABLE with user defined *
* indexes. *

* RECOMMENDATION: Apply corrective PTF when available *

```

When the USING STOGROUP option is specified with a CREATE INDEX statement on indexes for catalog tables SYSSTOGROUP or SYSVOLUMES, running a REORG on DSNDB06.SYSGROUP fails with a RESOURCE UNAVAILABLE. This is because REORG needs to access SYSSTOGROUP and SYSVOLUMES to get information on DB2 managed indexes during the delete and redefine process. A new method of reusing the dataset instead of deleting and redefining the dataset is needed.

In addition, the delete and redefine of the dataset can slow performance and makes it difficult to manage placement of datasets when using SMS. The option of reusing the dataset can improve performance and dataset management.

A new keyword, REUSE, has been added to support a logical reset for DB2-managed objects. The new keyword, REUSE, is a new option for the LOAD, REBUILD, RECOVER and REORG utilities. REUSE indicates that objects will be logically reset without a delete and redefine of the dataset.

If the user specifies the USING STOGROUP option when creating an index on the catalog tables SYSSTOGROUP or SYSVOLUMES, when

the SYSGROUP tablespace is reorganized, the option REUSE should be used to avoid the resource unavailable. If REUSE is NOT specified, REORG will force the REUSE of the dataset and will not delete and redefine the dataset.

The Utility Guide and Reference manual will be changed to add the REUSE keyword to the LOAD, REBUILD, RECOVER and REORG utilities.

## Appendix F. Tablespaces Shipped in SAP R/3 4.5A

Table 15 lists the databases and associated tablespaces in an unmodified SAP R/3 4.5A system.

| <i>Table 15 (Page 1 of 22). Databases and Tablespaces in SAP R/3 4.5A, Format: Database.Tablespace</i> |                   |                    |                   |                   |
|--------------------------------------------------------------------------------------------------------|-------------------|--------------------|-------------------|-------------------|
| A000#AAX.VIEA02                                                                                        | A000#AD6.BTXAUTH  | A000#AFE.EWUSEL    | A000#AGB.ADR10    | A000#AGX.TLSYE    |
| A000#AHT.MCRSV#US                                                                                      | A000#AIA.VIWEGB   | A000#AKS.T260H     | A000#ALN.ADR12S   | A000#ALU.TCME     |
| A000#ALX.VZSORT                                                                                        | A000#AM5.VSPRPS#C | A000#AN2.TCUSGENI  | A000#AN5.TSTATPP  | A000#AOG.WYT4     |
| A000#AOM.TTREETYTP                                                                                     | A000#API.SCPLANE  | A000#AQT.CKML2     | A000#AS7.VIMI23   | A000#AT9.TTXM     |
| A000#AUJ.CUOB                                                                                          | A000#AVI.TZ31     | A000#AWS.TTREE#EX  | A000#AXT.TTXFPT   | A000#AZD.COTPLPT  |
| A000#A49.SCARR                                                                                         | A000#A5Y.MSSSPVER | A000#A51.TTDIRT    | A000#A7Y.T7BR0F   |                   |
| A000#A8B.STERM#DW                                                                                      | A000#A8Y.TRMFDIR  | A000#A9S.IMPUR     | A000#BDA.SCEPRDE  | A000#BFE.VSRSD#C  |
| A000#BFK.SMEALT                                                                                        | A000#BGH.TMCO     | A000#BI6.SCEKB     | A000#BJH.T5QRB    | A000#BLL.NPTX     |
| A000#BMK.LANGGRU                                                                                       | A000#BQT.VIMI45   | A000#BRM.VZPARZA   | A000#BRZ.MWSTOR   | A000#BSO.T5D8D    |
| A000#BS7.T85S2                                                                                         | A000#BTH.TZ29P    | A000#BWS.PLANFLI   | A000#BWV.LFMH     | A000#BXV.TVEE3    |
| A000#BX0.VTPRL                                                                                         | A000#BYJ.MCRSV    | A000#BZ2.KALD      | A000#BZ5.TPI03    | A000#B0L.VIMI09   |
| A000#B0Y.T85B                                                                                          | A000#B2C.SKM1     | A000#B2M.DDSHENTI  | A000#B4H.WYT3     | A000#B45.SXBNFNOD |
| A000#B5G.VIAK21                                                                                        | A000#B5R.JBRRHT   | A000#B5T.MHIO      | A000#B5V.TQ32C#T  | A000#CAV.T7MX14   |
| A000#CC4.USR06                                                                                         | A000#CDG.SWDSMETH | A000#CEP.SADR6     | A000#CE2.COACTV   | A000#CE9.VIMI17   |
| A000#CHF.TTSEGRPRO                                                                                     | A000#CHM.COTPLT   | A000#CIT.TVEU4     | A000#CKD.TER13    | A000#CNH.T160MVAL |
| A000#CPN.TXW#LOCK                                                                                      | A000#CQ9.TZR96A11 | A000#CRE.PNODET    | A000#CRF.T5D8F    | A000#CRU.TOJTL    |
| A000#CSP.USRPDM                                                                                        | A000#CS8.VSPSTX#C | A000#CTZ.T802GU#V  | A000#CUF.VIMI19   | A000#CVB.IVBP     |
| A000#CW0.VMETP                                                                                         | A000#CXL.VSVBAP#C | A000#CXN.WMFHT     | A000#C0R.PMCO     | A000#C20.TIVAF    |
| A000#C7A.ANLT                                                                                          | A000#C7P.T5EA3    | A000#C8H.TVART     | A000#C8R.WMPK     | A000#C81.T51B2    |
| A000#C9E.VIWEGR                                                                                        | A000#DAN.KALV     | A000#DBS.DSYOH     | A000#DCG.T5EA0    | A000#DEB.FMLOG    |
| A000#DE8.FMDECKRG                                                                                      | A000#DFG.SSTARTER | A000#DHW.CABNZ     | A000#DH2.SGEOCITY |                   |
| A000#DKM.CNTLSTRL                                                                                      | A000#DM2.EDPO3    | A000#DNU.WMWKT     | A000#DOO.FMFIPGBP | A000#DQX.SCETASK  |
| A000#DRZ.SCECNT                                                                                        | A000#DR8.CUVTX    | A000#DTC.EQSE      | A000#DW1.T060M    | A000#DXC.T5D2K    |
| A000#DZ5.MSSSOURC                                                                                      | A000#D1M.TFAWG    | A000#D2Q.TROADMAP  | A000#D3V.EWOSS    | A000#D32.MMPX     |
| A000#D4X.STERM#DW                                                                                      | A000#D4Z.T7NZTE   | A000#D5N.STERM#CO  | A000#D5O.T076A    | A000#D8E.FMCF#BCD |
| A000#D81.T440Y                                                                                         | A000#D9D.DB2JU    | A000#D94.IMCEP     | A000#EFB.TSINK    | A000#EFF.PB0396   |
| A000#EGI.SADR9                                                                                         | A000#EG3.T5W5C    | A000#EHI.DS99      | A000#EH3.CCENQ    | A000#EIK.TKCHV    |
| A000#EK7.CSKR                                                                                          | A000#EMK.VIGBA1   | A000#EO8.SFHI      | A000#EPC.SFLIMEAL | A000#EPS.FM01N    |
| A000#EP4.ESLT                                                                                          | A000#EVD.VIGBZAB  | A000#EVP.TMCM      | A000#EWS.KCD#SEAF | A000#EYE.TKCODT   |
| A000#EZZ.BTABL#C#                                                                                      | A000#EZ6.BSBMT    | A000#EZ8.LDLH      | A000#E32.SMLS     | A000#E46.TTOBJECT |
| A000#E5G.T260U                                                                                         | A000#E7R.HLPSTAT# | A000#E7W.T5F6R     | A000#E93.VIMI47   | A000#FEH.ATO1T    |
| A000#F0J.BLPP                                                                                          | A000#FEN.E070A    | A000#EFB.TZA11R    | A000#FG8.WORKL#LO | A000#FIW.VIMI14   |
| A000#F14.MLTX                                                                                          | A000#FKQ.BCKVWVOR | A000#FLG.TKAR2     | A000#FLP.T5M7Z    | A000#FMX.T5DC1    |
| A000#FND.VIAK08                                                                                        | A000#FO2.BTCUED   | A000#FPD.T85C      | A000#FPR.T5M8U    | A000#FPW.TKAR1    |
| A000#FRH.SEUDEPTY                                                                                      | A000#FT1.WMQK     | A000#FTY.DDICNV    | A000#FUS.SCEDECOM | A000#FVC.VSAFFL#C |
| A000#FWC.VIMI40                                                                                        | A000#FW0.TTREE#EX | A000#FW2.TZA11R1   | A000#FYE.T5EA2    | A000#FZA.DSYAA    |
| A000#F02.EWUP                                                                                          | A000#F1F.T85CT    | A000#F3N.VSMLST#C  | A000#F3Z.NBNK     | A000#F4Z.VSFPLT#C |
| A000#F6L.SYNTA                                                                                         | A000#F8Q.VSPLAF#C | A000#GA8.SETUSE#B  | A000#GBS.TKCOD    | A000#GCL.TIVA7    |
| A000#GCR.COTPLP                                                                                        | A000#GCY.VWPAKTI  | A000#GDQ.VTVSZWPK  | A000#GEL.CKMLRUNT | A000#GE9.T242P    |
| A000#GIT.TOAER                                                                                         | A000#GK4.TOJMB    | A000#GND.SHDCF     | A000#GNI.TMR91    | A000#GN0.S401     |
| A000#GN5.SCOUNTER                                                                                      | A000#GOY.TCAURL   | A000#GP2.LANG#LOC  | A000#GRH.FM01S    |                   |
| A000#GSR.MDRP#NOD                                                                                      | A000#GTG.MDRP#NOD | A000#GTH.ESTLP     | A000#GVN.VIAK13   | A000#GVR.VSPRTX#C |
| A000#GV9.EWUTMSF                                                                                       | A000#GXI.VIAK10   | A000#GYF.VWPBUKR   | A000#GZT.TDRXX    | A000#GZY.SCECHAIN |
| A000#G12.TIMG1                                                                                         | A000#G15.VIMI21   | A000#G2D.T5QGM     | A000#G2R.PLTX     |                   |
| A000#G2W.STU3COTA                                                                                      | A000#G4P.TLSYOBJ  | A000#G4S.COBR      | A000#G6D.TLSYS    | A000#G7G.VTB#FRGS |
| A000#G7Q.TKCHVT                                                                                        | A000#G8V.VIVW01   | A000#G8Z.VIMI31    | A000#HAH.SCUSTOM  | A000#HAN.ADR11S   |
| A000#HA3.VSAFV#C                                                                                       | A000#HA9.TZ36     | A000#HCJ.VERIDBTA  | A000#HEE.VSYNC    | A000#HE3.T5KTC    |
| A000#HG0.T7VEEC                                                                                        | A000#HHD.SCEHASDE | A000#HI6.TCCPR     | A000#HKF.ESTLU    | A000#HKM.E070M    |
| A000#HK7.SMEN#OBN                                                                                      | A000#HLE.TWX1     | A000#HND.VIVSTI    | A000#HNM.T5EA1T   |                   |
| A000#HNV.TSTASETW                                                                                      | A000#HQI.TZ30     | A000#HRZ.T5QSG     | A000#HVN.VSAFIH#C | A000#HXG.TSST3    |
| A000#HX8.EDCMT                                                                                         | A000#HYL.VSAFPO#C | A000#HYN.EWUTMPSF  | A000#HYW.TMCOT    | A000#HY7.T5M5C    |
| A000#H0W.FMCFRULE                                                                                      | A000#H1D.SMENU    | A000#H1X.MTST10    | A000#H10.PTRV#F#C | A000#H4S.MCKZST   |
| A000#H7A.TROADMAP                                                                                      | A000#H71.FMFREPO  | A000#H7W.T5QTM     | A000#H99.TVEE1    | A000#IAM.SDESSERT |
| A000#IBL.SCEINVE                                                                                       | A000#IB1.IMPS     | A000#ICA.CUVTAB    | A000#ICY.TCUSPXRE | A000#IFT.VIOB14   |
| A000#IG6.EWUPAKT                                                                                       | A000#IIY.VIMI35   | A000#II7.PNHD      | A000#IMC.LANGUMS  | A000#IMD.TBDBH    |
| A000#IM6.CUVT                                                                                          | A000#IQU.HROBJ    | A000#IRY.VZDTXT    | A000#IW6.BTXINF   | A000#IXR.TDL3T    |
| A000#IY5.IMAKA                                                                                         | A000#IZZ.TKCOU    | A000#I0F.VSR#SADD# | A000#I2V.VIMI37   | A000#I4S.MCKZST   |
| A000#I5Z.IMCEPT                                                                                        | A000#I7Y.TABAS    | A000#I95.CKMLMV01  | A000#JAY.IMPZ     | A000#JCS.SCEHAVI  |
| A000#JCU.SMLT                                                                                          | A000#JFH.RSBENFTA | A000#JFZ.SWU#WLSC  | A000#JF2.VIAKT5   | A000#JG4.VTBMA    |
| A000#JH.T5UF6                                                                                          | A000#JJ6.VIOB04   | A000#JPH.VERIDBTA  | A000#JPV.ADR15    | A000#JSH.SFHIM    |

Table 15 (Page 2 of 22). Databases and Tablespaces in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                    |
|-------------------|-------------------|-------------------|-------------------|--------------------|
| A000#JS0.EDIDOT   | A000#JT7.VTBFININ | A000#JUM.WAPPTV   | A000#JWQ.TZ41     | A000#JW3.VIMI29    |
| A000#JXB.LFTYPES  | A000#JYH.VSAFVC#C | A000#JYQ.VIMI34   | A000#J1L.WMWK     | A000#J3H.VIAK01    |
| A000#J40.SREPOCNT | A000#J5D.T5S0A    | A000#J6D.COSRV    | A000#J6P.TECS     | A000#J7G.EDPO1     |
| A000#KAI.FMFIPGP  | A000#KCS.PROJ     | A000#KCU.BGTM     | A000#KCY.SCITAIRP | A000#KDC.T85AT     |
| A000#KG8.ADR12    | A000#KIO.T7MX30   | A000#KJY.TCUSNOTE | A000#KLU.T5KV3    | A000#KL1.TSKTZ     |
| A000#KMQ.T7MX12   | A000#KO3.TMR94    | A000#KP0.T5QRA    | A000#KP9.ANGT     | A000#KQF.PNODE     |
| A000#KQG.T028M    | A000#KQQ.STERM#MU | A000#KUC.T5QLA    | A000#KVL.T5S1T    | A000#KVN.IWTESTUS  |
| A000#KZF.MIMETYPE | A000#KZ2.T5M7X    | A000#KZ3.COVAB    | A000#KZ7.VIAK06   | A000#K0T.LDLBH     |
| A000#K11.T804FU#S | A000#K14.BERECHT  | A000#K2T.T5D8E    | A000#K3M.MKAL#AEN | A000#K4V.D0GEN     |
| A000#K5U.CDMMT    | A000#K5X.PA0200   | A000#K6F.T5QGT    | A000#K8F.SCECNFP  | A000#K8P.PRPSS     |
| A000#K82.TFAWA    | A000#K83.EWUFI#IN | A000#LAS.TSTAPRTW | A000#LCR.IVBZ     |                    |
| A000#LEB.ADOWNERR | A000#LFO.TTSEGPRO | A000#LGH.PKSL     | A000#LIH.PA0271   | A000#LIM.CD0VB1PF  |
| A000#LKQ.TEXTTRL  | A000#LK4.TZ24T    | A000#LK8.T001#CON | A000#LM4.CD0ENT4T | A000#LPN.F000      |
| A000#LRI.HRPADNN  | A000#LR0.SHIE#PRO | A000#LSR.FLJET    | A000#LSV.EDP11    | A000#LTR.VIMI20    |
| A000#LUY.KOTF006  | A000#LU9.TZ29T    | A000#LV3.AMRH     | A000#LXB.E070L    | A000#LXH.IMTP      |
| A000#LYX.A098     | A000#LZG.TIVA8    | A000#L10.SAIRPORT | A000#L18.VSKOPF   | A000#L2B.VTBMACR   |
| A000#L3Q.PROJVS#E | A000#L4P.SADR12   | A000#L9I.NHRPRS   | A000#MCQ.BSIUDES  | A000#MDN.TTRETYPT  |
| A000#MDU.T7IEP    | A000#MEL.TUCON    | A000#ME6.TIMG2    | A000#MH2.EWUTIMET | A000#MKV.T85S1     |
| A000#MK9.T7MX13   | A000#MLZ.TROADMAP | A000#MMF.PA0396   | A000#MMN.EWUTABCT | A000#MPD.WMQP      |
| A000#MPT.VIAK14   | A000#MQC.PZPE     | A000#MQ8.MQ3      | A000#MQ8.FDD1     | A000#MSK.VSPROJ#C  |
| A000#MUG.VIVW02   | A000#MVO.TVER1    | A000#MWJ.KOTF002  | A000#MWL.EWUPT    | A000#MWO.TSKTU     |
| A000#MWT.NHAUFK   | A000#MW4.BUT150   | A000#MXM.VSNPTX#C | A000#MXV.UKRTB    | A000#MX2.VIMI24    |
| A000#MYS.EWUPGTAB | A000#MY4.TMCW1    | A000#M0E.TKCOM    | A000#M0T.PROJS    | A000#M1A.KONDN     |
| A000#M3I.VSVBAK#C | A000#M5C.MDRP#NSE | A000#M58.SCEPROF  | A000#M6N.TVEU5    | A000#M6S.FMEINDEC  |
| A000#M7V.VAWA     | A000#M80.NULLCOLS | A000#M9U.KOTF003  | A000#NCC.BGMK     | A000#NFQ.PRHIS     |
| A000#NG1.TKCKT    | A000#NHK.SCECNTDE | A000#NLB.USCOMPAN | A000#NLE.E072C    |                    |
| A000#NNN.MSSPROCS | A000#NQZ.T5D8A    | A000#NRK.IMAKPW   | A000#NRT.KOTF004  | A000#NUT.SPH#ATIC  |
| A000#NV7.TMR92    | A000#NW0.TWMWQ    | A000#NYM.FMVORTR  | A000#N0H.T5KRC    | A000#N0I.T85A      |
| A000#N0R.FMDECK3  | A000#N1T.KALT     | A000#N10.TTZRT    | A000#N2Q.VSKBKO#C | A000#N3M.TSKTY     |
| A000#N4W.LTYPESTE | A000#N5E.SWP#SUSP | A000#N6G.T415B    | A000#N65.TTXMTT   | A000#N7Q.T5W5B     |
| A000#N8S.VIEIGE   | A000#N80.EWUPAKO  | A000#N92.IMAKPS   | A000#OAF.IMAKPP   | A000#OAN.ESLA      |
| A000#OAP.BGMZ     | A000#ODD.SADR13   | A000#OF4.EWUPGFAC | A000#OHH.PA0368   | A000#OI2.TKEPSA    |
| A000#OJY.USR21S   | A000#OJ4.USR02    | A000#OKL.SHIE#PRO | A000#ONP.T5QLP    | A000#OO3.PSJGNREP  |
| A000#OP6.TZDV98   | A000#OQY.VIEIGT   | A000#ORN.ESST     | A000#OR8.SAMTX    | A000#OSC.T7NZGM    |
| A000#OSE.MCCMDE   | A000#OTD.TCOBB    | A000#OUQ.ADR16    | A000#OVA.TPFWE    | A000#OVB.VIM130    |
| A000#OVI.KBEROBJ  | A000#OVL.VIOBOV   | A000#OV4.T5EA2T   | A000#OV8.SADR14   | A000#OXM.TABA      |
| A000#O1D.SCEEVENT | A000#O4N.TZ38     | A000#O7X.T5JA3    | A000#O8D.EWUPGSTA | A000#PA3.VIAK09    |
| A000#P0A.VIGBSTD  | A000#P0N.TZ40     | A000#P0R.KOTF001  | A000#P2A.ESTLV    | A000#P2H.BTXCOMP   |
| A000#P2U.TF590    | A000#P5N.VSKBEZ#C | A000#P61.FMFIPGR  | A000#P79.CUVFX    | A000#0FG.CURSADD   |
| A000#0FP.CKBT     | A000#0GT.T5EA1    | A000#0JM.VZKNA1   | A000#0J8.T7NZSM   | A000#0L1.LDLBP     |
| A000#0OA.VIWI04   | A000#0OZ.TVEU3    | A000#0O4.CD0BAS1V | A000#0QK.EWUFZSF  | A000#0QY.T5EA0T    |
| A000#0RX.T5QSR    | A000#0R1.EWUTABZ  | A000#0R2.VIAK12   | A000#0R5.TOJRT    | A000#0TV.VSRESB#C  |
| A000#0VT.PREL     | A000#0XX.MCKZS    | A000#000.A077     | A000#011.VIAK22T  | A000#02L.TZ37T     |
| A000#028.SEUDEPTT | A000#03B.EDSEG    | A000#05X.T85YT    | A000#07K.INDEXD   | A000#09D.VIOB20    |
| A000#09G.TKEPP52# | A000#1BC.SMACOURS | A000#1CG.ONRIM    | A000#1CH.TNOTEED  | A000#1C8.HRP1218   |
| A000#1FF.QPRVK    | A000#1HZ.TKCOH    | A000#1JB.OBJSJL   | A000#1KL.SPPLANE  | A000#1MP.DSYOI     |
| A000#1M4.TVEU2    | A000#1PQ.BGMS     | A000#1PS.DBCHK    | A000#1Q5.SFHH     | A000#1R4.SDPROTTY  |
| A000#1T5.FMDECKHK | A000#1U9.ADR11    | A000#1VP.TIVB2    | A000#1V2.SCEKBOBJ | A000#1WI.VSJEJST#C |
| A000#1XB.T5EA3T   | A000#1XW.T51RV    | A000#1YE.SCECNTTX | A000#1YN.HRP1027  | A000#1YV.T5D8G     |
| A000#1ZQ.PA0317   | A000#127.SFHG     | A000#17F.VSVBKD#C | A000#171.PB0395   | A000#18Y.T5EA4     |
| A000#2BD.KALA     | A000#2DF.NHPROJ   | A000#2EU.FIALOG   | A000#2HD.SCECHADE | A000#2JU.TOJRB     |
| A000#2KF.VIBEAM   | A000#2LL.KCD#TYVP | A000#2MF.ESTPS    | A000#2NQ.TZR4     | A000#2OF.TZ38T     |
| A000#2PP.CD0MCC4  | A000#2QA.CD0BAS6V | A000#2QS.SFHO     | A000#2QX.ROHIEOBJ | A000#2Q9.SWOTOO    |
| A000#2TL.T5KV1    | A000#2TY.EWUKEYS  | A000#2U1.MCSHIERB | A000#2VF.T770Q    | A000#2VR.ADR13     |
| A000#2YD.TLSYOBJT | A000#2YM.TSPP0    | A000#2ZJ.PA0314   | A000#20B.STPN     | A000#202.VDMEKO    |
| A000#21L.IMAKPI   | A000#22B.VIBEAG   | A000#23H.VIMI55   | A000#24C.T5QRX    | A000#244.TKMPVT    |
| A000#247.VIOB10   | A000#257.TXW#LOCK | A000#264.USR#FLAG | A000#27R.ADR10S   | A000#28O.CEPC#BUK  |
| A000#29B.AEPLST   | A000#3CN.BC430#CO | A000#3EE.MKOP     | A000#3FM.VIAK16   | A000#3GT.J#1AMINF  |
| A000#3HY.PA0395   | A000#3JP.MCRSVT   | A000#3KL.LANGAUS  | A000#3K9.ESTLR    | A000#3OQ.VDUNTR    |
| A000#3PE.VIOB19   | A000#3QA.LTYPES   | A000#3SO.VZKNA15  | A000#3UP.CUKB     | A000#3U2.T5D8C     |
| A000#3VG.TMCW2    | A000#3V6.KOPA     | A000#3WC.VIMI13   | A000#3XV.TUVT2    | A000#3YH.PUTTBEXC  |
| A000#305.T5MRE    | A000#32G.T7BR7C   | A000#322.SFHT     | A000#34J.SPH#TERM | A000#35H.VERSNTAB  |
| A000#35R.TCAVAR   | A000#355.ADR13S   | A000#38H.FLLOG    | A000#385.ESTPT    | A000#386.EKPA      |
| A000#396.SMEN#OBL | A000#398.T5D83    | A000#4CG.CUKN     | A000#4DH.VSVBEP#C | A000#4D6.IMZR      |
| A000#4FT.SFREAC   | A000#4GA.SAPLANE  | A000#4G9.DOCALTLA | A000#4GM.SCPRCOBJ | A000#4HK.VTBMAPA   |
| A000#4IG.PAT04    | A000#4O5.SBUSPART | A000#4PG.T5EA6    | A000#4PL.WBEW     | A000#4PV.T85BT     |
| A000#4QX.ESLZ     | A000#4Q8.EWUFZPSF | A000#4R8.FMDECKRG | A000#4TE.PRTXS    | A000#4T7.FMFIPGRT  |
| A000#4VH.VERIDBTA | A000#4V3.SCEKBTX  | A000#4WU.T5M7L    | A000#4ZS.TOASO    | A000#4ZX.VIGBA3    |



Table 15 (Page 3 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A000#4Z2.STU3COTA | A000#401.T5M8F    | A000#42E.T5QRL    | A000#429.T85Y     | A000#430.VIMIK2   |
| A000#43T.IVBK     | A000#44F.FMAPSTAT | A000#44G.TER15    | A000#45D.VTBMAL   | A000#483.T5D8B    |
| A000#5AP.DSV#MASS | A000#5C9.VIMI36   | A000#5DL.VSSTEU   | A000#5EC.ATABL#C# | A000#5EN.STRAVELA |
| A000#5FS.KONDNS   | A000#5HO.VSAFVU#C | A000#5IM.T5DWK    | A000#5JC.TTREETYP | A000#5J6.BCKVWPAK |
| A000#5LA.T7VETX   | A000#5LV.TSINX    | A000#5SV.SADR11   | A000#5VP.VDVORK   | A000#5V0.VWPANAN  |
| A000#5WO.VIMIK1   | A000#5ZG.VIMI04   | A000#51P.VIZA02   | A000#515.PMCOQT   | A000#53L.OICQP    |
| A000#536.VIMI22   | A000#56S.DSV#MASS | A000#59M.T7BR7B   | A000#591.LDLBT    | A000#6AE.E42T     |
| A000#6AF.BTXCMTH  | A000#6AG.AT16B    | A000#6AP.ATABL#C  | A000#6AU.T7BR7U   | A000#6AY.TSYSTSTC |
| A000#6BX.SYNTC    | A000#6CW.VIVW03   | A000#6EG.DEMOTREE | A000#6EV.SFRETREE | A000#6GP.T7IE6    |
| A000#6HC.JBRREGWT | A000#6HN.CDOBJ    | A000#6KY.EWUFZ    | A000#6LK.SEUDEPTO | A000#6NC.KALS     |
| A000#6N4.SCEMAT   | A000#6SL.LDLBC    | A000#6TO.SCEPROFI | A000#6WA.MPLA     | A000#6XA.TZC3A    |
| A000#6XD.DOKENTRY | A000#6XQ.TTXX     | A000#6ZC.DEMOTREE | A000#6ZG.TSYNC    | A000#61I.ESTLN    |
| A000#61V.PRTX     | A000#62Q.FMCTRNR0 | A000#63F.TSTAACW  | A000#65D.TSTASTTW | A000#65G.TNOBAPI  |
| A000#65J.T001#ARC | A000#65Z.VSAFFH#C | A000#66U.SDBAADAU | A000#66X.TVEE2    | A000#67Q.TSTATACT |
| A000#678.COSC     | A000#69T.VIOB08   | A000#7AM.VSKBED#C | A000#7D9.BGMP     | A000#7E4.TCECPSTA |
| A000#7GU.DSTCL    | A000#7G6.TUVT1    | A000#7IC.SMEAL    | A000#7II.SCETABFU | A000#7KM.ADR14    |
| A000#7NB.SPH#USTO | A000#7NC.TZA11    | A000#7NV.GRPGV    | A000#7N7.TOJMT    | A000#7OW.CD0BAS2V |
| A000#7PZ.RSHIEOBJ | A000#7QE.UAUSL    | A000#7RY.SEOUSER  | A000#7UQ.IMTT     | A000#7XV.SXBNFRUL |
| A000#7YG.SCECHARE | A000#7YX.TZ25T    | A000#7ZY.VIBEME   | A000#7Z8.FSLS     | A000#701.VFORP    |
| A000#727.TVEU6    | A000#74S.LANGZUG  | A000#751.VZKNB1   | A000#76V.VSEBAN#C | A000#77Y.KCDEHEAD |
| A000#777.USR41    | A000#8AC.E072     | A000#8AU.AT90T    | A000#8A4.T5S1S    | A000#8BN.BCA01    |
| A000#8CJ.EWUPGFAC | A000#8DC.VTBACCOU | A000#8ED.LANGGRUT | A000#8FL.VSPRTE#C | A000#8FX.BTXCOMP# |
| A000#8G1.SCARPLAN | A000#8LL.VVZSFELD | A000#8L4.T5M7U    | A000#8O3.TKADPC0  | A000#8O7.VIVW04   |
| A000#8RP.COKEY    | A000#8SQ.T260T    | A000#8SW.VTPRG    | A000#8VF.VTBMADT  | A000#8XK.CD0F4TES |
| A000#8XM.IMAKPU   | A000#8X5.KUSE     | A000#8ZE.T5DC2    | A000#8Z1.AEPREC   | A000#80W.SER02    |
| A000#81H.MCSHIERB | A000#821.T5J64    | A000#842.VZSTXT   | A000#86U.IMPR     | A000#87S.SCPRDOCU |
| A000#883.MSKU     | A000#89J.BC430#UE | A000#9AT.RSBENFTA | A000#9CL.ADIRACCE | A000#9DG.QPRVKT   |
| A000#9EE.APADEF   | A000#9H0.P44V     | A000#9JO.SWOTDO   | A000#9MK.BTABL#C  | A000#9ML.A099     |
| A000#9NK.GLOSSARY | A000#9NQ.SXBNFROL | A000#9PW.TZ32     | A000#9P4.VTVSZVLK | A000#9S2.VIOB30   |
| A000#9W2.VIOB11   | A000#9X9.T5M5B    | A000#9Z1.OJDEFS   | A000#90J.T5M8E    | A000#90Y.KOTF005  |
| A000#910.VSPRHI#C | A000#913.T51B3    | A000#916.PA0309   | A000#93K.T7NZXL   | A000#93M.TKCMVP   |
| A000#937.VERI#DBT | A000#94Z.TSPI0    | A000#95C.LDLT     | A000#97H.TBDBS    | A000#98F.SCEVALDE |
| A000#980.T5QSM    | A001#BF7.#SAP     | A001#EB1.#SAP     | A001#L21.#SAP     | A001#OUJ.#SAP     |
| A001#000.#SAP     | A001#1SK.#SAP     | A001#103.#SAP     | A001#139.#SAP     | A002#IB5.#SAP     |
| A002#000.#SAP     | A002#4H9.#SAP     | A002#5YW.T001K    | A002#9F8.#SAP     | A003#000.#SAP     |
| A010#AE3.MKOLH    | A010#AIV.HRP1019  | A010#AJV.SCECHARA | A010#APU.SWDSWFCO | A010#ASN.CTIMPTAB |
| A010#AUQ.SCESUPER | A010#AW8.KTEST1   | A010#A0V.AKKB     | A010#A44.VWPTERM  | A010#A7V.VIMI15   |
| A010#A86.VIMI27   | A010#A9C.OBJS     | A010#BL9.FLSLW    | A010#BRA.DBABL    | A010#BTE.STXOTFD  |
| A010#BVU.CUSTOMER | A010#B3H.HRP1018  | A010#B3I.VIWIGK   | A010#B3N.TTREEN   |                   |
| A010#B30.MARM#TMP | A010#B4J.VIAK24   | A010#B40.HRPADNXN | A010#B54.VWPDEPO  | A010#B7Z.MSSA     |
| A010#B9I.CUSAC    | A010#B9R.DSYDL    | A010#CCI.SQ3008#D | A010#CDC.T076B    | A010#CJK.USTUD    |
| A010#CPI.VIOB40   | A010#CR5.SQHVAR#D | A010#CV0.VWPANLE  | A010#CWX.MAKT#TMP | A010#CXX.MDIP     |
| A010#CYQ.SCEOCLAS | A010#CZW.DBPRON   | A010#C54.VIGB2A   | A010#C58.SQ3007#D | A010#C7E.TWGFT    |
| A010#C9X.PA0283   | A010#DAS.IMZO     | A010#DDC.ESTDU    | A010#DF4.MAPL     | A010#DIC.VIWIQ2   |
| A010#DMO.JBRREGDT | A010#DPG.VIOB27   | A010#DRD.VIMI42   | A010#DR0.WRF1     | A010#DXE.QMQQPRF  |
| A010#DXT.HRP1006  | A010#DX6.SCESTRIN | A010#DZH.SMENMANU | A010#D0E.CSSL     | A010#D0L.LFZA     |
| A010#D02.PIBA     | A010#D1K.VIAK05   | A010#D50.LFBW     | A010#D51.VIROZ    | A010#D66.KPP1PHPR |
| A010#D7D.SDOKSTT  | A010#D7G.WAAL     | A010#D8U.FLSA     | A010#D81.SETUSE#R |                   |
| A010#ECQ.GLOSSARY | A010#EC2.KPP1PHF  | A010#EEW.SCEPROFT | A010#EIA.SCEDEPVA | A010#EIE.T778P2   |
| A010#EJL.SQ3002#D | A010#ELJ.STXB     | A010#EL2.UBURO    | A010#EPV.CTIMPORT | A010#EUV.BSIUDTA  |
| A010#E0K.PA0382   | A010#E02.HRT1252  | A010#E20.VIVW05   | A010#E21.IMEP     | A010#E43.VIBEBE   |
| A010#E7V.SCEDEPSP | A010#E8S.SWF#POPU | A010#FAV.TIV70T   | A010#FBE.VWPBONO  | A010#FBI.VIOB06   |
| A010#FED.FTP#ITE  | A010#FE5.T5JC4    | A010#FFI.VTBFHA   | A010#FG8.VDSONSI  |                   |
| A010#FHV.SCEHAPO  | A010#FI1.T74AB    | A010#FK8.TAPL     | A010#FLI.PNBK     | A010#FMY.DBSTAIHD |
| A010#FTG.VIGBFLS  | A010#FT7.T5JT1    | A010#FW6.BCKVWPAN | A010#F0K.WRF12    | A010#F46.T7IE3    |
| A010#F7Q.BTXTAX   | A010#GAT.GLOSSARY | A010#GBG.CARRIERS | A010#GCM.APADEFT  | A010#GC8.EBEWH    |
| A010#GDW.T77AU    | A010#GE9.CDCND    | A010#GKF.SMENCA#D | A010#GKV.EVFG     | A010#GLL.VIWI03   |
| A010#GLX.MSKAH    | A010#GM8.SQ3001#D | A010#GNA.BRCGDTA  | A010#GOY.UKRST    | A010#GPJ.T5D15    |
| A010#GRL.EAPL     | A010#GSL.VIWI02   | A010#GSS.CUSAH    | A010#GUQ.CBPT     | A010#GU4.SCECLVAL |
| A010#GVL.KALF     | A010#GWB.VDBLKO   | A010#G28.VMETVOR  | A010#G3B.MAKZ     | A010#G42.SMENCA#N |
| A010#G49.CEPC     | A010#G71.KPP1RE   | A010#G9F.KPP1LOIO | A010#G9O.LFAT     | A010#G9W.WAZW     |
| A010#HAL.SCEDEPTX | A010#HAN.WRF3     | A010#HH0.CAWNT    | A010#HJB.DBABD    |                   |
| A010#HVU.FMACTPOS | A010#HZ7.PA0265   | A010#H0F.SCEHASCH | A010#H01.P445G    | A010#H24.TWX2     |
| A010#H3C.BACT     | A010#H3W.PA0237   | A010#H5H.PA0345   | A010#H7U.FMAVC    | A010#H96.TPMUS    |
| A010#IBO.DBASPAL  | A010#ILI.T076K    | A010#ILM.VDHOBJBL | A010#IL5.SVKO     | A010#IMD.FMFCRBP  |
| A010#IMU.EVOF     | A010#IOP.VIMI26   | A010#IQB.KONDH    | A010#IQM.DBAML    | A010#ISA.SQ1000#D |
| A010#IVE.DBABARL  | A010#IWG.ESTDS    | A010#I1T.DBSTATTD | A010#I4B.SVPOS    | A010#I5L.SCECLVTX |
| A010#I53.TUPROT   | A010#I76.ONRIV    | A010#I8U.VTIDERI  | A010#JB7.FLSLN    | A010#JCE.ESDJD    |

Table 15 (Page 4 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                    |
|-------------------|-------------------|-------------------|-------------------|--------------------|
| A010#JD5.WMPR     | A010#JI1.FMGEBER  | A010#JJY.T007F    | A010#JJ0.SETO2N   | A010#JK4.VIMIO2    |
| A010#JN3.SCECHATX | A010#JQD.SMENSAP  | A010#JQO.SWOTTO   | A010#JRI.SCEDEP   | A010#JRX.KPP1LOIO  |
| A010#JUO.WAZT     | A010#JX9.PROTO    | A010#JYE.KRIF     | A010#J0X.BCKVWPAN | A010#J1J.CSLA      |
| A010#J1W.MKOL     | A010#J2V.TPFET    | A010#J3P.JBRRHBAU | A010#J6B.VIMI54   | A010#J6C.LFINFX    |
| A010#J7E.USR40    | A010#J9D.MYPL     | A010#KAT.USR08    | A010#KB8.SCEDESCR | A010#KCU.HRP1029   |
| A010#KDE.VIMI12   | A010#KF9.ESTMJ    | A010#KGI.HRT1254  | A010#KHB.GLOSSARY | A010#KJN.OJDEFL    |
| A010#KOW.VIWIRT   | A010#KT4.SCECLPRE | A010#KU0.LIPSO1   | A010#KWS.MDRP#DRU |                    |
| A010#KW1.SWDSWFCT | A010#KX5.VIMIUH   | A010#K1P.BCCOM    | A010#K2D.SCEDEPDN | A010#K74.TMCOM#LI  |
| A010#K8D.VTIFHA   | A010#K9G.SWDSHEAD | A010#K91.CKBS     | A010#LA6.MSLB     | A010#LCP.ANLI      |
| A010#LC3.IHSG     | A010#LD2.BRCDTA   | A010#LFC.EDSYN    | A010#LG4.VIVW10   | A010#LHF.PA0313    |
| A010#LHN.VIIVIV4  | A010#LJX.MSLBH    | A010#LKA.IMCEPC   | A010#LN9.IDOCSYN  | A010#LSB.PA0360    |
| A010#LVY.DSYSI    | A010#L0N.SEATBOOK | A010#L1L.PA0483   | A010#L1S.MCKZSF   | A010#L2M.USR21     |
| A010#L42.FMDKSORT | A010#L8G.CUSAL    | A010#L86.UNAMA    | A010#MC7.VIIVIV3  | A010#MD0.LDLP      |
| A010#MD5.VIMI10   | A010#MGC.TFBLK    | A010#MKY.SWDSSTEP | A010#MP7.T5JT3    | A010#MRZ.IBIBT     |
| A010#MSN.T076I    | A010#MS1.ONSTATOP | A010#MT5.KAKO     | A010#MUB.EBEW     | A010#MWY.VIMI07    |
| A010#MW2.VFSCAHT  | A010#M0I.SCECLACO | A010#M16.TERM9    | A010#M2J.MPOS     | A010#M3I.HRP1038   |
| A010#M3R.PA0264   | A010#M4S.VIOB37   | A010#M53.MSCA     | A010#NBV.MYPLM    | A010#NB1.I82NN     |
| A010#NCV.VWPANLA  | A010#NH1.VIMI41   | A010#NJN.HRP1005  | A010#NLA.STERM#IN | A010#NLM.KNBW      |
| A010#NOX.VIOB17   | A010#NS4.KLPA     | A010#NUJ.WAZB     | A010#NVZ.MARA#TMP | A010#NXP.TMP#SPEC  |
| A010#NYL.VIWI05   | A010#NZ0.SQ3003#D | A010#NZ9.USR14    | A010#NZ9.BCKVZSKO | A010#N24.KAKT      |
| A010#N9R.TTREEF   | A010#OBD.KNMT     | A010#OC7.VDAKTE   | A010#OD6.HRP1039  | A010#OIP.TBDRCASTA |
| A010#OO0.VIIVIV1  | A010#OPR.BCTOU    | A010#OPU.T5JT2    | A010#OTU.TLSYHPG  | A010#OVX.WYT2      |
| A010#OV5.DEVACCES | A010#OXA.CRHS     | A010#O63.TNODE02A | A010#O7A.I81NN    | A010#O7R.DSYSL     |
| A010#O8H.BCST     | A010#P0S.RSBIWBEN | A010#P1T.T5JC3    | A010#P8I.KLAT     | A010#P8J.SDOKST    |
| A010#OD0.TKEB2    | A010#0FX.SMENENTN | A010#0G5.T446F    | A010#0HM.VIMI43   | A010#0KS.GEOCITY   |
| A010#0JA.TTREELOA | A010#0KR.PLAB     | A010#0NW.MARD#TMP | A010#0O9.EDISEGT  | A010#0RP.HRP1004   |
| A010#0R2.ONRIA    | A010#0SV.MCYE     | A010#0VD.TKEB1    | A010#0VT.IMCEPCT  | A010#00N.VIMIUI    |
| A010#000.AEHI     | A010#05C.DBAEXTL  | A010#05Y.T076S    | A010#07U.HRT1018  | A010#072.IFLOCUST  |
| A010#075.BRCMESA  | A010#1EP.HRT1019  | A010#1GG.MCYD     | A010#1HO.FM01B    | A010#1OG.DSYADEF   |
| A010#1OK.WRF5     | A010#1SI.VIOB29   | A010#1TQ.PA0337   | A010#1VJ.TTREES   | A010#1VM.WMWVP     |
| A010#1W5.STXOTFR  | A010#122.TIMGIR   | A010#13G.VIMI32   | A010#13N.MFHM#TMP | A010#14Y.QBEWH     |
| A010#15C.SMEN#DAT | A010#154.SMENCA   | A010#195.TCUSU    | A010#2BV.EORD     | A010#2BX.TSKTV     |
| A010#2CL.VZZUSP   | A010#2LK.CUSAB    | A010#2LQ.OIFSPBL  | A010#2LR.SQ3004#D | A010#2MF.TSTCRID   |
| A010#2OB.VIOB23   | A010#2O3.BCSPO    | A010#2RK.MCYC     | A010#2UI.HRT1253  | A010#2UY.FINDOEXC  |
| A010#2YE.TSTATF   | A010#2Z4.SMENCA#D | A010#227.VIAK23   | A010#24W.EDSVRS   | A010#27O.VIOB07    |
| A010#3D5.CKMLRUNP | A010#3EL.GLOSSARY | A010#3IP.IBINT    | A010#3K5.OBJT     | A010#3PK.CUPE      |
| A010#3W3.VIOB12   | A010#3XJ.DFMLH    | A010#3XN.VDMEPOV  | A010#3X8.VIMIO5   | A010#3YA.MSSL      |
| A010#3YL.WSOT     | A010#34C.IMAKZS   | A010#34Q.DBSTATHD | A010#36P.MSPRH    | A010#4BA.LFINF     |
| A010#4CO.FMDKSRGT | A010#4DB.T042R    | A010#4FF.IBIB     | A010#4FZ.USR09    |                    |
| A010#4H1.DGTMD#LK | A010#4KO.VIOB39   | A010#4NS.VIOB28   | A010#4N0.KONDDP   | A010#4SE.T5M7N     |
| A010#4TA.SCEKMTDE | A010#4YA.DBAOPLT  | A010#4ZO.VIMI08   | A010#4Z1.VIOB05   | A010#44Q.BTXPLAN   |
| A010#48B.HRP1008  | A010#493.ESTRR    | A010#5EK.VIMI03   | A010#5IE.VIWI01   | A010#514.VTBSTC1   |
| A010#5KK.WMQKT    | A010#5KR.SQTEXT#D | A010#5K7.WAKHIND  | A010#5LL.IFLOCUST | A010#5MD.OJDEF     |
| A010#5SE.SQ3000#D | A010#5TU.PRHI     | A010#5T2.VIMIEV   | A010#5UH.VDMEPOM  | A010#5VU.OIFMSCAD  |
| A010#5ZJ.MMPT     | A010#5ZR.P0ASB    | A010#5ZZ.DBADFL   | A010#53V.PTRV#ADM | A010#54D.FPMT#POS  |
| A010#543.PA0387   | A010#548.WRS6     | A010#579.CUEX     | A010#58C.HRP1011  | A010#6AW.VIOB13    |
| A010#6EK.ESTPJ    | A010#6EX.VIMI38   | A010#6JE.SMEN#MIG | A010#6J9.HRP1014  | A010#6LC.MCHBH     |
| A010#6NY.SPFLI    | A010#6SY.STERM#RE | A010#6WZ.GUSER    | A010#6ZR.KAZY     | A010#61N.HRP1040   |
| A010#62J.BRCRCP   | A010#65D.WRF6     | A010#65P.SCEOCLTX | A010#69N.VIOB22   | A010#7AO.PA0288    |
| A010#7BE.SCEDEPPA | A010#7EY.SCENUM   | A010#7GA.MCYAT    | A010#7GW.PKHD     | A010#77A.VIMI44    |
| A010#7L6.HRT1218  | A010#7PF.PIBZ     | A010#7TR.BRCGEN   | A010#7UG.ESTVP    | A010#7Z9.PA0399    |
| A010#71G.WAKT     | A010#74B.ESTRH    | A010#76C.KNAT     | A010#8CJ.TROADMAP | A010#8FY.PSERBV    |
| A010#8JC.CBPR     | A010#8JZ.KPP1PHIO | A010#8K9.SWXFORMA | A010#8M8.DBAREOL  | A010#8M9.MSKA      |
| A010#8QO.VDZKP    | A010#8SW.TFBKT    | A010#8S0.PTDW#WPB | A010#8V1.VTBLV    | A010#8XF.VIOB38    |
| A010#8XG.T802GU#S | A010#8YC.TMENUTAB | A010#8Y8.EBOX     | A010#84K.LIPSO2   | A010#850.DBARCL    |
| A010#879.MCSMETT  | A010#9DT.KPP2D    | A010#9D5.VZSKOKO  | A010#9EB.VDBED    | A010#9K4.CRTX      |
| A010#9K8.CEPC     | A010#9LH.MSKUH    | A010#9LU.GRPGA    | A010#9OK.STERM#US | A010#9P1.HRP1216   |
| A010#9QS.DSYSH    | A010#9Q2.T5JSY    | A010#9R4.J#1AINFM | A010#9UM.WAPPT    | A010#9V1.TIVMI     |
| A010#9Z4.SERBL    | A010#90P.VIAK25   | A010#903.DBSTATID | A010#94V.MEA1#TMP | A010#95X.MSCAH     |
| A010#96A.BTXTAXT  | A010#99A.IMEL     | A010#99J.HRUS#D2  | A010#99P.EDSAPPL  | A010#99Z.TREE      |
| A011#E66.#SAP     | A011#000.#SAP     | A012#000.#SAP     | A012#3L7.#SAP     | A012#9P3.SWOTLV    |
| A013#JHO.T134M    | A013#000.#SAP     | A020#AAK.FMDECKHK | A020#ABT.PA0090   | A020#AB1.VDHINT    |
| A020#AB9.CUVTLN   | A020#ADG.DWINACTI | A020#AFO.HRP1047  | A020#AH3.S272E    | A020#AH6.VSEVOF#C  |
| A020#AKA.PA0302   | A020#AL0.S053E    | A020#AL8.VIMI18   | A020#AML.PA0499   | A020#ANW.QCVMT     |
| A020#ANY.HRP1037  | A020#AOL.PA0026   | A020#AP1.TNOTFTW  | A020#AQZ.LFM1     | A020#ATR.PA0058    |
| A020#AUP.CUXREF   | A020#AWF.VIAK03   | A020#AXF.PB0009   | A020#AY5.IMAKZ    | A020#AZA.HRP1049   |
| A020#AZP.PA0323   | A020#AZS.S086E    | A020#AZY.PA0374   | A020#A0J.ANLK     | A020#A1L.FMUDREL   |
| A020#A2P.S087E    | A020#A38.PA0085   | A020#A46.IMAVT    | A020#A60.PA0476   | A020#A6V.CRCO      |

Table 15 (Page 5 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A020#A65.PA0218   | A020#A7F.PA0057   | A020#A76.PB0002   | A020#A78.VIAK04   | A020#A8P.VIGB3A   |
| A020#A82.PA0140   | A020#A9F.HRP1035  | A020#BCC.HRP1205  | A020#BCX.AKKP     | A020#BDW.PA0278   |
| A020#BEH.TER12    | A020#BKF.PA0354   | A020#BNO.PA0007   | A020#BNS.PA0400   | A020#BN0.PA0129   |
| A020#BN2.PA0035   | A020#BON.PA0210   | A020#BRB.PA0233   | A020#BS2.PA0460   | A020#BT1.PA0450   |
| A020#BWW.ADR3S    | A020#BYE.PA0201   | A020#BZK.PA0276   | A020#BZZ.PB4000   | A020#B19.PB4002   |
| A020#B37.PA0320   | A020#B4B.PA0073   | A020#B4W.ASMD     | A020#B48.PA0203   | A020#B5F.PA0453   |
| A020#B5Q.S082E    | A020#B6E.TSTAFTW  | A020#B7J.QMSP     | A020#B7S.TTREELOA | A020#B8T.PA0184   |
| A020#B85.PA0362   | A020#CAV.HRT1035  | A020#CF6.INET     | A020#CHE.PA0477   | A020#CJG.HRP1251  |
| A020#CJL.VIOB21   | A020#CKF.MYML     | A020#CK6.VIAK02   | A020#CLU.PA0384   | A020#CMC.IMCEFLT  |
| A020#CM7.PA0024   | A020#CPQ.S018E    | A020#DKM.PA0212   | A020#CQR.PA0330   | A020#CRD.IRL0T    |
| A020#CTD.HRPADD3  | A020#CTM.SWDSBIND | A020#CVA.CECUFM   | A020#CVK.PA0144   | A020#CWQ.ADRVS    |
| A020#CYL.PA0081   | A020#C4Z.S162E    | A020#C5O.PA0266   | A020#C7T.S079E    | A020#C7X.PA0022   |
| A020#C8K.PA0104   | A020#C8O.PA0156   | A020#C9F.PA0075   | A020#C9P.PA0100   | A020#DAQ.PA0213   |
| A020#DA1.VIOB24   | A020#DA6.FMSTATUS | A020#DCM.PA0119   | A020#DDR.PA0379   | A020#DGE.PANNNN   |
| A020#DGI.PA0037   | A020#DIT.POSFREI  | A020#DKM.PA0212   | A020#DNP.PB0041   | A020#DQE.PA0096   |
| A020#DQS.VZGPO    | A020#DRV.ONRBP    | A020#DSL.USOBXFLA | A020#DS7.PB0022   | A020#DTA.HRP1033  |
| A020#DVO.S160E    | A020#DXC.PA0157   | A020#DXD.VDBLSS   | A020#DXG.PA0050   | A020#DYN.CURSDNS  |
| A020#DY1.STEU#TMP | A020#DZU.S115E    | A020#DZ4.PA0391   | A020#D0G.S084E    | A020#D2X.PA0274   |
| A020#D4E.PA0208   | A020#D4S.PA0125   | A020#D4U.PA0225   | A020#D6C.KSML     | A020#D63.S163E    |
| A020#D75.FMEINDEC | A020#EAI.PA0336   | A020#EBC.CUSDT    | A020#EBW.PA0186   | A020#EC4.PA0227   |
| A020#EEY.PA0078   | A020#EFD.HRPAD48  | A020#EGF.QMTB     | A020#EGV.PA0008   | A020#EG1.HRP1023  |
| A020#EG6.PA0235   | A020#EH3.HRP1250  | A020#EJZ.PA0305   | A020#EK9.PA0048   | A020#ELW.HRP1503  |
| A020#EMI.PA0312   | A020#EMJ.VTIFHAZU | A020#EMN.PA0236   | A020#ENW.SCENUMDO | A020#EOV.VFKONX   |
| A020#EQF.HRP1519  | A020#EQY.S172E    | A020#EQ6.PB0024   | A020#ESM.PA0001   | A020#EVH.ESTPP    |
| A020#EVP.HRP1240  | A020#EV2.IMCECC   | A020#E0P.QMAT     | A020#E0W.PA0220   | A020#E1H.SWZAIENT |
| A020#E13.PA0389   | A020#E2N.PA0198   | A020#E2Q.PA0454   | A020#E5K.FMSNRULE | A020#E7I.MAKG     |
| A020#E7N.TZFO1    | A020#E75.S152E    | A020#E9M.S302E    | A020#FCL.PA0440   | A020#FCV.BTXPLNX  |
| A020#FDK.PA0269   | A020#FDP.PA0388   | A020#FD9.PA0107   | A020#FE9.PA0358   | A020#FF2.RSADD    |
| A020#FF5.S137E    | A020#FGF.PA0000   | A020#FHC.#1AAOLD  | A020#FJX.AEPF     | A020#FJ7.PA0032   |
| A020#FLM.T606Y    | A020#FMT.MCYB     | A020#FOR.PA0457   | A020#FSI.HRP1043  | A020#FTL.VDZSB    |
| A020#FTS.DRAZ     | A020#FTT.ADR7S    | A020#FU0.PA0315   | A020#FW4.FMZUGR   | A020#FXX.PA0332   |
| A020#FY3.PA0428   | A020#F0B.S150E    | A020#F0J.PSGR     | A020#F1I.S117E    | A020#F2H.LAGP     |
| A020#F2V.PA0071   | A020#F26.SNAP     | A020#F3R.SEOSPECT | A020#F4U.HRP1003  | A020#F6M.PA0221   |
| A020#F6W.PA0028   | A020#F7D.S020E    | A020#F7F.PA0143   | A020#F7H.PA0146   | A020#F7Z.VDDAST   |
| A020#F80.EINA     | A020#GBY.S083E    | A020#GB9.S121E    | A020#GDQ.HRP1020  | A020#GGA.PA0005   |
| A020#GHI.PA0170   | A020#GH4.S198E    | A020#GI2.VIEA05   | A020#GJI.PA0202   |                   |
| A020#GJW.SCEVARVA | A020#GJY.PA0070   | A020#GJ1.BTXTTAX  | A020#GK3.PA0029   | A020#GLE.S052E    |
| A020#GLW.PA0347   | A020#GL6.POS00    | A020#GMR.IMCECCT  | A020#GOY.S164E    | A020#GOZ.PA0130   |
| A020#GPF.S016E    | A020#GP4.PA0033   | A020#GP6.PA0390   | A020#GQJ.PA0038   | A020#GSS.TSTAHTW  |
| A020#GTD.PA0016   | A020#GUY.QCVM     | A020#GVH.ADRCS    | A020#G0B.PB0185   | A020#G2O.PA0109   |
| A020#G3Y.PA0217   | A020#G36.PA0410   | A020#G4S.PA0042   | A020#G4Y.PA0273   | A020#G43.EINE     |
| A020#G45.PA0359   | A020#G54.PA0207   | A020#G57.VIOB41   | A020#G6O.PA0067   | A020#G73.SWDSEXPR |
| A020#HAG.PA0196   | A020#HAH.PA0456   | A020#HAS.HRT1041  | A020#HCX.PA0204   | A020#HFF.ESTPO    |
| A020#HFZ.S122E    | A020#HGF.PA0141   | A020#HWG.ADR4S    | A020#HHT.PNDREL   | A020#HJI.VIOB18   |
| A020#HJT.PA0094   | A020#HLE.TTREET   | A020#HNL.HRPAD47  | A020#HNS.PA0423   | A020#HNX.PA0471   |
| A020#HNZ.PA0234   | A020#HQW.PA0403   | A020#HRI.PA0355   | A020#HSB.PA0191   | A020#HUE.HRP1010  |
| A020#HU2.PA0003   | A020#HV3.ESTRL    | A020#HWE.VIGBUCH  | A020#HXR.PA0392   | A020#HYY.PA0376   |
| A020#HZP.T606Z    | A020#HZR.PA0421   | A020#HZ3.MYMS     | A020#H1W.PA0277   | A020#H2F.S015E    |
| A020#H2X.HRPAD21  | A020#H2Z.PA0437   | A020#H3E.PA0427   | A020#H3Y.PB0077   | A020#H7K.PA0110   |
| A020#H8V.S136E    | A020#H8Z.PA0103   | A020#IC9.SCEVALTX | A020#IFB.HRP1032  | A020#IG3.PA0241   |
| A020#IG7.PA0015   | A020#IHJ.JCDO     | A020#IIA.PA0054   | A020#IK3.PA0045   | A020#ILO.PA0079   |
| A020#IND.PA0021   | A020#INT.PB0023   | A020#IOX.PLPH     | A020#IP1.ADR2S    | A020#IQP.S305E    |
| A020#ISC.S111E    | A020#IVX.PA0329   | A020#IVZ.HRP1404  | A020#IXW.S170E    | A020#IYO.PA0411   |
| A020#IZ0.TSTATH4  | A020#I0C.ANIA     | A020#I0E.E070C    | A020#I2I.BTXERES  | A020#I4Q.EMBK     |
| A020#I5D.PA0394   | A020#JBG.S120E    | A020#JCC.HRP1002  | A020#JCZ.MPOP#TMP | A020#JC1.S129E    |
| A020#JDR.ESTPH    | A020#JD8.CKMLPR   | A020#JF2.HRPAD27  | A020#JHD.PA0409   | A020#JHK.PA0155   |
| A020#JHN.VDBLEW   | A020#JIY.HRP1028  | A020#JMD.PA0115   | A020#JOA.PA0093   | A020#JPX.PA0160   |
| A020#JQL.MVEG#TMP | A020#JRP.PA0111   | A020#JS2.BTXBLOK  | A020#JVU.AEEF     | A020#JVY.PA0342   |
| A020#JWM.SADR5    | A020#JW6.PA0472   | A020#JXM.VDBLBAW  | A020#JXT.WSAH     |                   |
| A020#JZC.MBEW#TMP | A020#J09.VDBLBOW  | A020#J1M.PA0126   | A020#J2H.ADRGS    | A020#J3B.PA0501   |
| A020#J5I.VIVW07   | A020#J59.KALC     | A020#J80.HRP1502  | A020#KDZ.RWSLINE  | A020#KFI.PA0311   |
| A020#KG8.S127E    | A020#KHI.PA0452   | A020#KIC.PA0496   | A020#KIT.VWPZUSA  | A020#KI7.PA0023   |
| A020#KNJ.PA0480   | A020#KP7.S130E    | A020#KQS.PA0448   | A020#KRK.PA0122   | A020#KSO.S119E    |
| A020#KSS.ESTLS    | A020#KUR.PA0062   | A020#K0Y.CUKBT    | A020#K25.PA0446   | A020#K65.PA0138   |
| A020#K71.PA0412   | A020#K8W.PA0474   | A020#K88.TNODE02# | A020#K9Y.PA0372   | A020#LEK.PA0053   |
| A020#LGA.ADR8S    | A020#LHN.PA0083   | A020#LKO.S123E    | A020#LLV.S226E    | A020#LL3.PA0344   |
| A020#LOA.HRP1505  | A020#LRQ.PA0159   | A020#LR0.PA0135   | A020#LSS.PA0352   | A020#LTT.KNKKF1   |
| A020#LVH.PA0183   | A020#LWV.HRPAD51  | A020#LW6.S227E    | A020#LXL.PA0900   | A020#LX6.PA0052   |

Table 15 (Page 6 of 22). Databases and Tablespaces in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A020#LZ2.VDARLOBJ | A020#L0I.PB0001   | A020#L0R.PLFT     | A020#L0W.PA0061   | A020#L00.MYMLM    |
| A020#L03.PA0469   | A020#L1F.MARC#TMP | A020#L3M.S200E    | A020#L4D.TEPSIN   | A020#L4K.PA0161   |
| A020#L5F.S173E    | A020#L53.BSIP     | A020#L6T.PA0036   | A020#L7V.S078E    | A020#L7Z.PA0215   |
| A020#L8Q.KONDI    | A020#L8X.KNKKF2   | A020#L96.PA0408   | A020#MA4.PA0335   | A020#MCI.T242D    |
| A020#MC2.HRP1013  | A020#MFM.S110E    | A020#MG9.PA0092   | A020#MKW.FMUDRELC | A020#MLN.PA0025   |
| A020#ML4.S080E    | A020#MMN.BSIUDTT  | A020#MPD.PA0192   | A020#MRZ.ADRCOMCS | A020#MS7.PB0108   |
| A020#MXJ.HRP1045  | A020#MYF.S197E    | A020#MZK.PA0197   | A020#MZ4.S054E    | A020#M0C.HRP1048  |
| A020#M1E.HRPAD22  | A020#M2M.PA0318   | A020#M22.ERG001   | A020#M23.TTREETP  | A020#M58.STEUMM#T |
| A020#M6N.ANLE     | A020#M6O.HRP1507  | A020#M6Y.PA0095   | A020#NCG.CUSF     | A020#NCP.S159E    |
| A020#NEF.PA0080   | A020#NE1.VZPARGPO | A020#M99.PSMERK   | A020#NFL.S304E    | A020#NFP.PA0177   |
| A020#NF4.IMAKPA   | A020#NGE.PA0044   | A020#NIG.PA0131   | A020#NJC.DFMLO    | A020#NJP.PA0108   |
| A020#NJT.PA0475   | A020#NJ9.PA0216   | A020#NK1.PA0040   | A020#NK6.KNEX     | A020#NLY.HRPAD77  |
| A020#NOK.CABNT    | A020#NOL.PA0268   | A020#NPY.PA0063   | A020#NQY.KNZA     | A020#NTH.OBJSUBT  |
| A020#NU0.ADRTS    | A020#NXL.CONTEXTB | A020#NY8.PA0082   | A020#N1Y.PA0209   | A020#N2A.S081E    |
| A020#N2K.S174E    | A020#N2U.OBJSUB   | A020#N3D.S161E    | A020#N5D.PB0028   | A020#N54.CUFM     |
| A020#N6H.PA0077   | A020#N6O.PB0105   | A020#N6W.PA0407   | A020#N9Q.PA0439   | A020#OAU.PLPLAN#P |
| A020#OBN.PA0041   | A020#ODA.KAPA     | A020#OEL.PA0303   | A020#OF6.HRP1030  | A020#OHX.IMCEM    |
| A020#OIG.PA0106   | A020#OJF.PA0030   | A020#OKH.PA0261   | A020#OL8.ADR5S    | A020#OL9.HRP1051  |
| A020#OMN.PA0167   | A020#OM8.PA0348   | A020#ON9.QCVV     | A020#OOH.IMAKT    | A020#ORI.PA0470   |
| A020#ORW.IBSP     | A020#OR1.PA0151   | A020#OSK.S303E    | A020#OSR.VIMI11   | A020#OS6.PA0459   |
| A020#OT5.TNODE02# | A020#OUM.S270E    | A020#OV1.SCECLNDO | A020#OW9.KNKA     | A020#OXA.BUT100   |
| A020#OXD.HRP1050  | A020#OYV.VIOB09   | A020#O1N.PA0006   | A020#O2I.VIMI01   | A020#O5U.PA0404   |
| A020#O7F.PA0219   | A020#O76.CRHD     | A020#O8D.PA0084   | A020#O9B.VDSDV5   | A020#O9T.PA0185   |
| A020#P0A.S273E    | A020#P0R.PA0267   | A020#P1H.S019E    | A020#P1M.PA0168   | A020#P2O.PA0088   |
| A020#P3N.IMAV     | A020#P4U.PA0019   | A020#P5C.PA0173   | A020#P6J.PA0369   | A020#P60.VBTBRA1  |
| A020#P8Z.PA0366   | A020#P88.PA0310   | A020#P89.HRP1036  | A020#P99.PA0136   | A020#0BW.HRPAD63  |
| A020#0DL.PA0165   | A020#0DX.SWOR     | A020#0FK.PA0468   | A020#0FN.HRP1201  | A020#0HO.MCS2     |
| A020#0JW.SCEVALSY | A020#0J0.HRPADD2  | A020#0L7.PA0142   | A020#0MM.PA0098   | A020#0NK.PA0188   |
| A020#0N6.S077E    | A020#0OR.LTX1#TMP | A020#0PL.S051E    | A020#0QT.WAKH     | A020#0RD.S140E    |
| A020#0RQ.SCEDEPCO | A020#0T4.HRP1024  | A020#0UT.PA0497   | A020#0VT.ASMDT    | A020#0VV.PA0426   |
| A020#0X8.PA0275   | A020#0YK.PA0069   | A020#0ZR.M60I     | A020#0Z9.PA0473   | A020#00D.ADRVPS   |
| A020#00E.ADRGP    | A020#000.ADCPS    | A020#030.HRPYYYY  | A020#04F.TEPSOUT  | A020#04Z.PA0402   |
| A020#046.LFBK     | A020#05K.S108E    | A020#09V.PA0401   | A020#1A1.PA0118   | A020#1BX.PA0068   |
| A020#1CI.ADRPS    | A020#1C1.MAKV     | A020#1D9.PA0102   | A020#1EL.PA0349   | A020#1EX.PA0105   |
| A020#1HC.PA0194   | A020#1HX.PA0242   | A020#1ID.BF4INDX  | A020#1KK.HRP1009  | A020#1KQ.FMZUCH   |
| A020#1LN.PA0150   | A020#1L5.PA0231   | A020#1O2.PA0383   | A020#1PR.PA0378   | A020#1PX.T7TW10   |
| A020#1RL.PA0182   | A020#1T4.PA0011   | A020#1UG.S061E    | A020#1XL.PA0137   | A020#1X4.PA0056   |
| A020#11U.FMSNHIN  | A020#12S.S107E    | A020#13O.HRP1504  | A020#16B.S050E    | A020#16H.PA0124   |
| A020#17Y.KONH     | A020#183.PA0199   | A020#198.PA0436   | A020#2AY.PA0381   | A020#2C0.HRT1042  |
| A020#2EQ.CKMLMV01 | A020#2J3.BTXBRAK  | A020#2L4.PA0059   | A020#2M0.PA0116   | A020#2M7.PA0397   |
| A020#2NN.HRPXXXX  | A020#2OC.CAWN     | A020#2O8.PA0341   | A020#2TD.VIAK07   | A020#2TX.PA0333   |
| A020#2T3.PA0145   | A020#2WA.PA0086   | A020#2WM.PA0363   | A020#2XT.PA0447   | A020#2X3.S165E    |
| A020#2X8.PA0097   | A020#2YT.IMAVZ    | A020#2ZD.MYMFT    | A020#2ZP.S271E    | A020#2ZR.PB4005   |
| A020#213.PB4004   | A020#25Q.S196E    | A020#25T.PA0139   | A020#26F.PLWP     |                   |
| A020#27M.MLGN#TMP | A020#287.PA0435   | A020#29Q.DGTMD    | A020#3CG.PB0006   | A020#3DS.WAGU     |
| A020#3EM.MDRP#DRU | A020#3F6.DGTPK    | A020#3HZ.LFB1     | A020#3IP.S225E    | A020#3IZ.UBBP000  |
| A020#3LK.PB4001   | A020#3LO.PA0043   | A020#3MH.PA0901   | A020#3OE.ONRAO    | A020#3QS.PA0353   |
| A020#3Q0.HRP1046  | A020#3RP.SEORELCO | A020#3SA.PA0051   | A020#3S1.SEORELAT | A020#3S9.PA0189   |
| A020#3TA.F4EXTACC | A020#3T5.PA0031   | A020#3U7.CSKS     | A020#3VF.HRP1042  | A020#3VM.PA0049   |
| A020#3WL.HRP1060  | A020#3Y8.S171E    | A020#3Z0.MPGD#TMP | A020#30H.T606X    | A020#30J.PA0386   |
| A020#300.FVERSION | A020#32N.PA0046   | A020#33W.KONP     | A020#330.S085E    | A020#332.PA0230   |
| A020#35V.BNKA     | A020#36C.HRP1601  | A020#36I.PA0169   | A020#36S.PA0365   | A020#370.T5M7V    |
| A020#4CD.PA0179   | A020#4CR.PA0060   | A020#4DM.ADRGPS   | A020#4EU.PA0128   | A020#4E7.PA0180   |
| A020#4FI.PA0174   | A020#4FW.PA0027   | A020#4GF.HRP1501  | A020#4GI.HRPAD31  | A020#4GP.TSTATIMG |
| A020#4IU.PA0380   | A020#4I7.CKMLHD   | A020#4I8.PA0076   | A020#4K8.PA0002   | A020#4LC.SADR4    |
| A020#4LD.MVKE#TMP | A020#4LW.CECUSF   | A020#4L3.ADR6S    | A020#4OD.MPRW#TMP | A020#4OY.KLAH     |
| A020#4PL.PA0120   | A020#4R0.HRP1021  | A020#4SP.PA0478   | A020#4US.CECUSDT  | A020#4VV.SNAPT    |
| A020#4W0.SADR7    | A020#4W9.QMTT     | A020#4XG.PA0232   | A020#40F.ADRCTS   | A020#40I.CLST     |
| A020#431.PA0364   | A020#438.HRP1500  | A020#452.CUCVRNT  | A020#48O.PSVR     | A020#487.PA0346   |
| A020#49Y.HRP1209  | A020#5BF.PA0422   | A020#5C5.SCECLSDO | A020#5GC.HRP1260  | A020#5G0.HRP1253  |
| A020#5MN.CUSFT    | A020#5OA.PA0014   | A020#5PB.INDEXW   | A020#5PL.PA0321   | A020#5PU.PA0147   |
| A020#5P1.ADR9     | A020#5RP.MFRES#TM | A020#5RQ.PA0334   | A020#5TG.PA0498   | A020#5TK.HRP1041  |
| A020#5VR.PA0149   | A020#5ZG.PA0133   | A020#51C.PA0211   | A020#54T.PA0123   | A020#55H.T7TW1L   |
| A020#564.PA0009   | A020#59F.MLEA     | A020#6BB.ANIB     | A020#6BI.S075E    | A020#6DL.AKKD     |
| A020#6DU.PA0134   | A020#6D4.PA0171   | A020#6J3.PA0114   | A020#6LH.PA0356   | A020#6LV.MCYM     |
| A020#6ME.PA0449   | A020#6M4.PA0074   | A020#6NF.PA0148   | A020#6NT.PA0162   | A020#6N3.MVEU#TMP |
| A020#6PB.S195E    | A020#6QJ.PA0370   | A020#6Q0.PA0187   | A020#6SG.ADR9S    | A020#6S9.PA0132   |
| A020#6VN.CECUSFT  | A020#6VP.PA0405   | A020#6V0.ANLU     | A020#6WN.PA0117   | A020#62W.PA0195   |

Table 15 (Page 7 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A020#64I.CABN     | A020#646.SREPOUSE | A020#65A.PA0482   | A020#655.PA0158   | A020#657.PA0072   |
| A020#66I.PA0181   | A020#66T.S055E    | A020#67N.HRP1026  | A020#680.PA0066   | A020#681.PA0304   |
| A020#698.TWGLVT   | A020#7AP.PA0112   | A020#7BI.PA0065   | A020#7DA.VTIOF    | A020#7D3.S105E    |
| A020#7EG.HRP1254  | A020#7E1.PA0442   | A020#7KL.PA0222   | A020#7LB.HRP1252  | A020#7NY.HRPAD53  |
| A020#7N9.HRP1403  | A020#7SF.E070DEP  | A020#7SL.SETLINET | A020#7VB.IMAK     | A020#7WP.PA0121   |
| A020#7Y6.SCEDEPDO | A020#7ZS.HRP1215  | A020#711.PA0398   | A020#72I.PA0319   | A020#736.PA0099   |
| A020#77F.PEGQTY   | A020#78F.PA0064   | A020#79W.PA0034   | A020#79Y.PBNNNN   | A020#8AP.PA0010   |
| A020#8CA.MERRDAT# | A020#8DI.HRPAD44  | A020#8G2.S301E    | A020#8L4.PA0101   | A020#8MJ.HRP1600  |
| A020#8N9.E070TC   | A020#8OD.HRP1061  | A020#8P3.PA0012   | A020#8RC.E071KFIN | A020#8R9.PA0331   |
| A020#8SJ.CRCA     | A020#8S2.S106E    | A020#8VH.PA0020   | A020#8VQ.IMCEFL   |                   |
| A020#8WZ.VDHOBJGT | A020#8YX.S017E    | A020#8Y5.PA0224   | A020#80J.HRP1044  | A020#82D.PA0393   |
| A020#82M.VIZA01   | A020#82W.PA0113   | A020#829.PA0004   | A020#83Y.CD0BAS3V | A020#834.VDLVABL  |
| A020#835.QCVK     | A020#84Z.PA0361   | A020#842.WSOH     | A020#850.S128E    | A020#870.PA0055   |
| A020#876.SCEHASPR | A020#88V.VDBLREW  | A020#896.PA0190   | A020#9BR.VDSDV4   | A020#9DN.IRLOTX   |
| A020#9EC.PA0017   | A020#9ED.S126E    | A020#9FF.S300E    | A020#9H0.PA0455   | A020#9H9.SCESTRDO |
| A020#9IR.S166E    | A020#9I7.PBVPV    | A020#9KY.S138E    | A020#9LA.MLGT#TMP | A020#9MN.PA0039   |
| A020#9OG.CURSSPS  | A020#9OJ.VDBLBEWI | A020#9OP.PA0351   | A020#9RX.PA0306   | A020#9SU.PA0458   |
| A020#9T7.PA0500   | A020#9UJ.PA0154   | A020#9XY.PA0451   | A020#9YH.ESLH     | A020#9YQ.PA0375   |
| A020#9Y8.CNTLSTRI | A020#922.PA0357   | A020#926.VSEVFG#C | A020#941.HRP1520  | A020#95N.SWZAI    |
| A020#95V.PA0438   | A020#954.PA0013   | A020#96Q.HRP1506  | A020#97Z.S074E    | A020#98P.PA0127   |
| A020#99W.PA0343   | A021#000.#SAP     | A022#000.#SAP     | A023#000.#SAP     | A030#ADG.CATX     |
| A030#AGU.TECN     | A030#AIT.TLDPS#LO | A030#ALP.MLGN     | A030#ANH.PA0322   | A030#ANX.SADR2    |
| A030#APM.VIARMV   | A030#AV5.IFLOTX   | A030#A3G.MVKE     | A030#BBA.WLMT     |                   |
| A030#BEO.MDRP#POC | A030#BE0.TTREEI   | A030#BF9.EQST     | A030#BLK.SDOKLOIO | A030#BSR.IWB2LOIO |
| A030#BWR.MKAL     | A030#BW0.SDOKLOIO | A030#B7F.VFSCAR1  | A030#B0K.PA2005   | A030#B3Y.ATRAS    |
| A030#B6Y.MEAN     | A030#B7L.IMCER    | A030#CES.VFSCAIF0 | A030#CFT.KNKK     | A030#CGS.DSYS#PHF |
| A030#CO5.MDVL     | A030#CRI.HRP1213  | A030#CY7.IWB2PHIO | A030#CZQ.IWB2LOIO | A030#C36.DSYS#LOH |
| A030#C7H.GLOSSARY | A030#C7I.VSEBKN#C | A030#DAA.IMPTT    | A030#DBG.PA0377   | A030#DBR.PGAN     |
| A030#DDG.HRT1210  | A030#DGG.SCEDEPSR | A030#DI5.TSKTW    | A030#DRG.TNODE02# | A030#DS0.ILOA     |
| A030#DS7.DSYS#PHH | A030#DTK.QPMZ     | A030#D0M.WBBP     | A030#D3L.VDHGRPF  |                   |
| A030#D3W.DSYS#PHH | A030#D39.DSYS#PHF | A030#D6B.BTXFDOC  | A030#D9G.MVER     | A030#EEO.IWB1RE   |
| A030#EEX.VDARLDVS | A030#E11.TNODEIMG | A030#EKY.HRP1212  | A030#ES6.ANLZ     | A030#E0J.PA0272   |
| A030#E3G.TERM5    | A030#E70.PRPS     | A030#E9S.HRP1217  | A030#FB0.SADR3    |                   |
| A030#FDQ.SDOKPHPR | A030#FFE.TBPW1    | A030#FGN.ESTRI    | A030#FJ9.KNVP     | A030#FNX.VSHIST#N |
| A030#FPJ.SDOKPHIO | A030#FQX.PLFL     | A030#FS1.IFLOT#VS | A030#FXG.QPMK     | A030#FYH.CRVE#A   |
| A030#F0K.HRT1214  | A030#GD4.PLFV     | A030#GJ6.ANLC     | A030#GL2.HRT1221  | A030#GSK.BTXEERR  |
| A030#GTY.SDOKRE   | A030#GV2.IWB1PHF  | A030#G46.PTRV#ARC | A030#G8Z.HRT1220  |                   |
| A030#HBN.CKMLMV01 | A030#HDO.TLDPS#PH | A030#HE9.TNODE01  | A030#HGG.DSYS#PHF | A030#HHJ.SEORELAT |
| A030#HRF.VDDUNNPA | A030#HU3.IWB2PHPR | A030#HVM.CNUM     | A030#H11.TOADL    | A030#ICQ.PSERBZ   |
| A030#IDS.HRP1214  | A030#IEK.WMFF     | A030#IHT.IFLOS#VS | A030#IQ4.PA2006   | A030#IR2.EVOP     |
| A030#ISJ.MCH1     | A030#IVB.ECMCC    | A030#I2V.VFSCAIS  | A030#I2Y.PA0406   | A030#I4H.EKBO     |
| A030#I7S.VFSCAH   | A030#JFZ.SETNODE  | A030#JF7.EQBS     | A030#JLT.MDVM     | A030#JLX.IMCHIE   |
| A030#JM3.HRP1208  | A030#JUS.DSYS#LOH | A030#JWH.RSDSQOBJ | A030#JYR.PA2012   | A030#JY3.KNKO     |
| A030#JZQ.VSAUFK#C | A030#J11.VFSCAIL2 | A030#J21.VSHIST#P | A030#J21.CKMLMV01 | A030#J89.SDOKLONM |
| A030#KAR.VIGBA2   | A030#KBQ.VDBLSWT  | A030#KD3.FMUDRULE | A030#KEM.IWB1LOIO | A030#KHJ.EVPOC    |
| A030#KR4.VSAFAB#C | A030#KV7.VFSCAIL0 | A030#KYW.MCHA     | A030#K2I.VSHIST#O | A030#K6C.VSHIST#O |
| A030#LBP.DSYS#LOD | A030#LEC.SEORLCMP | A030#LFF.WLBM     | A030#LFH.IFLOS    | A030#LG8.COMPMSG  |
| A030#LIF.IMCERT   | A030#LIW.TLDPS#PH | A030#LL6.WEWU     | A030#LO8.FMUDRULE | A030#LQD.SERPTUSE |
| A030#LSA.BTXFORM  | A030#LV5.VCKUN    | A030#LWK.KNVH     | A030#MAH.VTIFHAPO | A030#MQU.VFSCAIT0 |
| A030#MQ0.VFSCAIR  | A030#MUC.TLDPS#PH | A030#MUJ.VIOB01   | A030#MWG.VFSCAIS0 | A030#MWV.HRP1220  |
| A030#M2W.ILOA#VS  | A030#M3H.PA0326   | A030#M5T.ANLB     | A030#M97.DSYS#LOH | A030#NGN.KNBK     |
| A030#NLW.DSYS#LOD | A030#NNQ.HRT1250  | A030#NO3.KNVK     | A030#N3P.CKMLMV00 | A030#N5O.E071C    |
| A030#OAX.BXTERR   | A030#OIC.VSHIST#O | A030#ONN.PA0416   | A030#OQM.EQKT     | A030#OZS.EWUCCO   |
| A030#OZ3.VFSCAIS1 | A030#O0G.SETLEAF  | A030#O13.AENR     | A030#O6Y.VFSCAID  | A030#P2M.HRPAD34  |
| A030#P3N.IWB1LOIO | A030#P5H.MARCH    | A030#P59.LFA1     | A030#P6J.HRP1206  | A030#P70.VIAK20   |
| A030#P71.BXTTRES  | A030#0A8.ESTDF    | A030#0B7.DVER     | A030#0EB.BAPIUSW0 | A030#0EF.MAST     |
| A030#018.STZU     | A030#0PO.MAPE     | A030#0TX.MPOI     | A030#0ZF.RSINFDIR | A030#000.AEDT     |
| A030#09Z.MLGT     | A030#1BQ.HRT1211  | A030#1B1.PSERB    | A030#1D7.CRFH     | A030#1YL.AMPL     |
| A030#119.VDLV     | A030#2A0.ESTDH    | A030#2BB.BTXEMPT  | A030#2JF.TCUS#XRE | A030#20V.MARDH    |
| A030#2QX.E070     | A030#2Q4.VFSCAIF  | A030#248.HRT1505  | A030#25J.STST     | A030#25L.STPF     |
| A030#27N.IWB1PHIO | A030#3AF.MAEX     | A030#3GA.STERM#CO | A030#3KT.CMFK     | A030#3MT.EVOP#VS  |
| A030#3T1.MABW     | A030#3VD.MLST     | A030#3Z1.MAW1     | A030#308.PLFH     | A030#32Z.IHPA     |
| A030#340.HRPADP2  | A030#39W.TPST     | A030#4AA.TLDPS#PH | A030#4CF.KNA1     | A030#4FR.STPU     |
| A030#4IA.VFSCAIL4 | A030#4LU.HRP1221  | A030#4QH.DOST     | A030#4QV.CKMLMV01 | A030#4TE.GLPCC    |
| A030#4ZJ.MAMT     | A030#40X.ONRDO    | A030#5AV.HRP1211  | A030#5JX.QPMT     | A030#5J0.CATP     |
| A030#5K5.IMCEPPT  | A030#5MP.HRP1210  | A030#5MR.EVPOC#VS | A030#5WN.VSHIST#N | A030#5WW.HRP1007  |
| A030#5XB.SDOKPHF  | A030#6B5.CRVE#B   | A030#6EP.WSOF     | A030#6IU.PA2007   | A030#6LA.KNB1     |
| A030#6S0.SWWWIDH  | A030#6TE.MALG     | A030#6UW.TNODE02# | A030#6X2.CKMLMV01 | A030#6ZO.TNODE02  |

Table 15 (Page 8 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A030#6Z8.IFLOT    | A030#611.PLMW     | A030#675.WAKP     | A030#7J9.ECMCO    | A030#7K8.EWUANLAV |
| A030#7LQ.PEGOB    | A030#7NH.E07T     | A030#7NW.VDARLSIC | A030#7TH.LFM2     | A030#7VI.IWB2PHF  |
| A030#7ZJ.PTRV#ARC | A030#70V.AUFG     | A030#70X.TMENU01  | A030#75F.CKMLMV00 | A030#762.VSHIST#P |
| A030#79D.IFLOTX#V | A030#79E.VIOB03   | A030#8AA.IWB2RE   | A030#8C3.TCUS#XRE | A030#8FO.TLDPS#LO |
| A030#8GC.WTADDI   | A030#8HX.VSAFKO#C | A030#8N0.IWB1PHPR | A030#8O9.SREPOVAR | A030#8VM.KNVV     |
| A030#84T.DSYS#LOD | A030#87O.ESTAUSP  | A030#9JJ.WTREE    | A030#9JW.PA0371   | A030#9LE.IMCEMT   |
| A030#9M8.MLAN     | A030#9NI.PRST     | A030#9OV.BMTNODE0 | A030#9OW.PA2004   | A030#9TO.COBRB    |
| A030#9YB.TCBP#PLI | A030#9ZA.HRT1213  | A030#97A.VFSCAIL6 | A030#976.VIOB02   | A031#000.#SAP     |
| A032#000.#SAP     | A033#000.#SAP     | A040#AMR.ADRV     | A040#ANT.VDARL#EU | A040#AQH.S002E    |
| A040#AW3.ADR6     | A040#BBH.ADRG     | A040#BIA.STAS     | A040#BX3.TNODEIMG | A040#BX9.PA2001   |
| A040#B3V.BP1020   | A040#CFM.PLMK     | A040#CFR.KPP1CONT | A040#CFZ.BUT050   | A040#CH6.DRAW     |
| A040#CKQ.E071     | A040#CNS.S097E    | A040#CQV.ADR7     | A040#CQ9.TMENU01T | A040#CZP.DRZOF    |
| A040#C0T.S033E    | A040#C1O.STERM#LI | A040#C3L.S092E    | A040#DBY.PTRV#PER | A040#DE6.DRZA     |
| A040#DHQ.TNODE01T | A040#DHU.HRP1017  | A040#DJY.VDARL    | A040#DK5.S098E    | A040#DLC.ADR4     |
| A040#DMC.HRP1016  | A040#DM6.ADR3     | A040#DNM.STXH     | A040#DNQ.S070E    | A040#DOI.HRP1000  |
| A040#DU5.HRP1001  | A040#DWS.E071K    | A040#D2C.PA2003   | A040#D2F.S099E    | A040#D3S.BL01#IND |
| A040#D4T.S094E    | A040#D5Y.ARCID#P# | A040#EE6.PLKO     | A040#EGK.S006E    | A040#EPA.HRT1212  |
| A040#EQN.VIMIMV   | A040#EVB.HRPAD25  | A040#EX5.DRZAT    | A040#EZR.S100E    | A040#E00.CKMLMV00 |
| A040#FBW.MARA     | A040#FCT.HRT1017  | A040#FD9.VFSCAR3  | A040#FEU.MBEW     | A040#FML.KEPH     |
| A040#F0N.VFSCAR2  | A040#F45.BUT020   | A040#F6X.STERM#HE | A040#GBR.S068E    | A040#GML.PA2010   |
| A040#GIO.VZZKOPO  | A040#GN2.MCHB     | A040#GPT.SETDATA  | A040#GQD.S116E    | A040#GRN.VZPARUS  |
| A040#GSQ.S032E    | A040#GS9.HRPAD23  | A040#G2Q.MDMA     | A040#G3D.BUT010   | A040#G79.S026E    |
| A040#HDH.ESTVH    | A040#HDY.CATF     | A040#HG8.PNDALTT  | A040#HPS.E071KF   | A040#HZ6.ADR5     |
| A040#H18.KDST     | A040#H3X.DRZAO    | A040#H40.BP030    | A040#H9O.S063E    | A040#IAL.ARCID#S# |
| A040#IA9.PA0373   | A040#IPL.SETS     | A040#IQ3.ADRP     | A040#ITN.P445E    | A040#IV8.ESTDR    |
| A040#IY8.HRP1025  | A040#I19.BP1010   | A040#I3T.INDX#HIE | A040#I4B.BUT021   | A040#I8O.VTBSTA3  |
| A040#JDK.S038E    | A040#JFN.S012E    | A040#JN2.BP1040   | A040#JS4.HRT1251  | A040#J4L.S021E    |
| A040#J42.SMENUSER | A040#KBK.EQUI     | A040#KDS.HRP1031  | A040#KVH.HRT1049  |                   |
| A040#KW8.VDKOPO#E | A040#K03.AENV     | A040#K2F.ESTVA    | A040#LOP.CVDDH    | A040#LRV.S062E    |
| A040#LR7.MSEGO2   | A040#L02.CKRCT    | A040#L5B.S102E    | A040#L8F.WMFH     | A040#L93.HRPAD50  |
| A040#MFN.WMFP     | A040#MKH.PA0279   | A040#MNO.S076E    | A040#MN6.ADRT     | A040#MRD.BUT052   |
| A040#MRY.PLPO     | A040#MV8.SADR     | A040#MW5.VZZKOPO# | A040#MXR.VTBLS    | A040#M2M.PLOGI#DE |
| A040#M61.STPO     | A040#M7L.PA2002   | A040#M7O.PTRV#HEA | A040#M7X.S096E    | A040#NAA.S004E    |
| A040#NCM.S027E    | A040#NEX.ADR2     | A040#NJJ.S069E    | A040#NLH.TMENU01R | A040#NMM.BP3000   |
| A040#NUN.HRT1002  | A040#NX3.S104E    | A040#N3B.S124E    | A040#N4M.T5UT1    | A040#N64.S001E    |
| A040#OA0.VTBSTA4  | A040#OBG.PLOG     | A040#OFZ.BCKVZZKO | A040#OF4.S023E    | A040#OIF.SPBB1    |
| A040#OKD.CVDDP    | A040#OKM.HRT1016  | A040#OKU.S011E    | A040#ONC.PLOGI    | A040#OQI.BP021    |
| A040#ORD.PLKZ     | A040#OWM.PA0425   | A040#OX6.MARD     | A040#O2M.WLK2     | A040#O5F.VIMIWB   |
| A040#O5V.BP011    | A040#O7L.S005E    | A040#O8N.BUT001   | A040#O87.ADRC     | A040#O9A.VZZKOPA  |
| A040#0GP.S125E    | A040#0IU.HRP1015  | A040#0Q1.FTGKLA   | A040#0R1.PLMZ     | A040#0T1.HRPADTI  |
| A040#0YS.MARC     | A040#00T.SPKR1    | A040#000.ADCP     | A040#06M.CKRCO    | A040#07T.CMFP     |
| A040#08L.HRITABNR | A040#087.MARM     | A040#1AJ.BP1060   | A040#1KC.S013E    | A040#1KK.S028E    |
| A040#1PL.BUT000   | A040#1PT.PA0424   | A040#1X4.ARCID#VB | A040#1YN.KALO     | A040#1Z0.HRIADATA |
| A040#2FQ.TNODEIMG | A040#2JL.BP000    | A040#2KX.ADRVP    | A040#2MX.S064E    | A040#2SG.S090E    |
| A040#2ST.HRPADPM  | A040#24G.USRBF    | A040#27G.S022E    | A040#3AD.ANLA     | A040#3BS.LEIN     |
| A040#3FV.HRP1034  | A040#3IW.AEOI     | A040#3MP.HRT1048  | A040#3N5.S003E    | A040#3RC.TNODE02T |
| A040#3ZS.WLK1     | A040#3ZW.S103E    | A040#36U.BMTNODE0 | A040#39X.MAKT     | A040#4E2.CHVW#IDX |
| A040#4HH.BUT051   | A040#4LM.S093E    | A040#4U2.ADR8     | A040#4VU.ADRCOMC  | A040#4X6.TB210A   |
| A040#40E.VSRPSCO# | A040#5R2.BP1050   | A040#500.PLZU     | A040#54L.HRT1047  | A040#590.HRPADP1  |
| A040#593.CKMLMV00 | A040#6J8.TNODE01R | A040#6Q5.VIZNRN   | A040#6V2.FTGKL    | A040#60D.TNODE02R |
| A040#7AJ.VBBE     | A040#7S6.ADRCT    | A040#7VY.BUT0BK   | A040#7WG.FTPT#PLA | A040#70X.BP1030   |
| A040#71M.S091E    | A040#71V.HRT1060  | A040#75G.S024E    | A040#79M.KONA     | A040#8AA.MBEWH    |
| A040#8FM.SANS1    | A040#8HG.PNDALT   | A040#8KA.STKO     | A040#8KC.PTRV#ARC | A040#8ZE.VTBSTA1  |
| A040#83T.S065E    | A040#859.HRT1045  | A040#9AD.BMTNODE0 | A040#9BL.VRS#AR#I | A040#9IC.FTPT#VAR |
| A040#9JE.HRTYYYY  | A040#9JN.S039E    | A040#9KV.CKMLMV00 | A040#9O3.KALM     | A040#9SZ.HRT1043  |
| A040#9Y9.CNTLSTRE | A040#908.VZROLLE  | A040#946.WMFU     | A040#98K.CNTLSTRA | A042#000.#SAP     |
| A043#000.#SAP     | A100#ACO.S051     | A100#AEK.TVEU10   | A100#AHY.AFRP1    | A100#ALY.MARCO1   |
| A100#AMC.KPP1CHKF | A100#ARO.TATOPAB  | A100#ASF.SFLIGHT1 | A100#A0J.ADMI#RJO | A100#A1H.INFCFGRE |
| A100#A3D.LL02     | A100#A3F.MKOLO1   | A100#A4X.TATOPB   | A100#A7M.ITSTEST  | A100#A8X.MCKALKV  |
| A100#BCJ.LL03     | A100#BCU.TSKT4    | A100#BDT.TVEU1    | A100#BF1.VTVSZVER | A100#BHL.LISPLT   |
| A100#BI4.DB2JOB   | A100#BN3.GINTERF  | A100#BT7.S078     | A100#BUG.TVEU11   | A100#BVY.USR20    |
| A100#BWP.AVIR     | A100#BXI.E070CREA | A100#BXX.MCHBO1   | A100#BZC.AVIT     | A100#B3Q.TCPFS3   |
| A100#B5A.S052     | A100#B8Q.FTPT#PNR | A100#CCX.EBES     | A100#CC8.TNODES   | A100#CJC.FIBKOR   |
| A100#CQ6.SFLIGHT0 | A100#CRG.SFLIGHT0 | A100#CVG.STRAN    | A100#CW1.MASSRUNS | A100#C21.FTPT#PNR |
| A100#C20.TF665    | A100#C27.TATOPCA  | A100#C4X.PEVSH    | A100#C43.IWTESTFC | A100#C7P.MARVCD   |
| A100#DCU.S130     | A100#DFS.ANEK     | A100#DG4.SCRULES  | A100#DIT.PEVST    | A100#DL6.TVEU12   |
| A100#DMT.KBLK#USE | A100#DNG.DSYS#DOC | A100#DRT.AFRUHR   | A100#DXC.T159W    | A100#DYC.TMEDS    |
| A100#DY7.TBIST    | A100#DY9.LTBK     | A100#D16.EDFI2    | A100#D38.S083     | A100#D5I.VVKMKO   |

Table 15 (Page 9 of 22). Databases and Tablespaces in SAP R/3 4.5A, Format: Database.Tablespace

|                    |                   |                   |                    |                   |
|--------------------|-------------------|-------------------|--------------------|-------------------|
| A100#EA4.T051A     | A100#EFK.HRSM#HEA | A100#EGF.S087     | A100#EH2.SWWEI     | A100#E14.SWWDHMIN |
| A100#E16.TCUSFUBA  | A100#ELW.TBBFATES | A100#EL9.EVVD#VS  | A100#EP5.IMTR      | A100#ERZ.SDBAR    |
| A100#EWN.ESUC      | A100#E2D.TTRAL    | A100#E2J.MYPS3    | A100#E4C.KBVM      | A100#E5N.E43S     |
| A100#FBT.TPFHS     | A100#FFT.FTPT#FLI | A100#FF9.MCS0     | A100#FHH.FTPT#TM#  | A100#FHP.CC2TIM   |
| A100#FLJ.T599T     | A100#FPZ.ESUS     | A100#FRX.FTPT#FLI | A100#FTC.S061      | A100#FVB.VWKMP0   |
| A100#FWV.VTBLIL    | A100#FZX.AFRC     | A100#FZ2.TRELTABS | A100#F2N.AFRP3     | A100#F4K.S084     |
| A100#F68.TXW#DIR   | A100#F7L.TRTYPET  | A100#F8P.MSLBO1   | A100#GBV.TNOTATW   |                   |
| A100#GHG.COSRVAPP  | A100#GI7.FTPT#PNR | A100#GJE.VTVSZIVO | A100#GJW.FTPT#PNR  | A100#GM1.SOOC     |
| A100#GQE.MSKU01    | A100#GST.RSNORMDB | A100#GSU.VDKOREF  | A100#GTF.VBUSTINT  |                   |
| A100#GT4.BATMAN SQ | A100#GYS.T705Z    | A100#GZL.TPFHT    | A100#GZ8.SADLSTAD  | A100#G01.DOSSO    |
| A100#G1G.RLIB#STA  | A100#G19.COFIV    | A100#G5L.LTBP     | A100#G7V.VTBSIANF  | A100#H11.S115     |
| A100#HLZ.CLOIDOWN  | A100#HN4.EWUFICRD | A100#HUJ.SMEN#CON | A100#HV2.S270      | A100#HWT.GLP0     |
| A100#H0M.TBIZU     | A100#H0N.T5M8K    | A100#H2Y.VEXAV    | A100#H36.LL06      | A100#H5H.S198     |
| A100#H7E.USKRIAT   | A100#H98.ESUH     | A100#I1Z.SFLIGHT1 | A100#IKZ.VTVSZCR   | A100#IMH.SFLIGHT1 |
| A100#IOP.S020      | A100#IRZ.IMCH     | A100#IVW.S138     | A100#IX5.KDVM      | A100#IYV.SAMTE    |
| A100#IZK.BDAUDSTA  | A100#IZ3.COVAL    | A100#I5O.SER04    | A100#I6N.VTVSZIN   | A100#I64.ATWVO    |
| A100#JCM.VTVSZYC   | A100#JE4.E40L     | A100#JFA.KBEZ     | A100#JHK.ALE#MCHA  | A100#JH9.TCGC1    |
| A100#JIE.TTXMM     | A100#JKT.VDSTAT   | A100#JMN.TVER833  | A100#JOS.T5DCWT    | A100#JTJ.INFCFGAL |
| A100#JVL.ARFCRSTA  | A100#KBL.SCLASTUS | A100#KEX.TKED2    | A100#KHE.S055      | A100#KHV.S119     |
| A100#KJ5.KDVL      | A100#KK9.LISPL    | A100#KNB.VBREVAC  | A100#KNE.S197      | A100#K05.J#1APROL |
| A100#KP4.S137      | A100#KTO.PSTX     | A100#KTX.EMRP#RUN | A100#KT6.TKED1     | A100#K0U.LUBU     |
| A100#K2D.HRSM#ERR  | A100#K3N.TATOPBA  | A100#K7Y.T5DCW    | A100#LBG.S195      | A100#LCL.VZBAVST  |
| A100#LEY.EWUFI#BA  | A100#LE1.SAPWLSER | A100#LMW.S050     | A100#LO5.PTRV#COU  | A100#LY8.SFLIGHT0 |
| A100#L3S.PPDHD     | A100#L66.SFLIGHT1 | A100#L9L.PPDSH    | A100#MEA.TF635     | A100#MIT.S086     |
| A100#MLN.BATMANDP  | A100#MM7.TIVAR2   | A100#MN8.TABDYNPS | A100#MQ5.S122      | A100#MQ8.PZPP     |
| A100#MR4.SMEN#COU  | A100#MUF.SADLSTWU | A100#MUO.VIAK18   | A100#MVP.SDOKRELO  | A100#MWN.BPGV     |
| A100#M2A.ADMI#JOB  | A100#M2H.SOXP     | A100#M4Z.SAPWLWAM | A100#M5T.S121      | A100#M7T.OPN#J1   |
| A100#M7Y.EWUFI#CD  | A100#M74.ISEGO2   | A100#M81.LINK     | A100#NA8.SFLIGHT0  | A100#NBL.DB2JSTAT |
| A100#NB3.DYNPS     | A100#NC4.TVEU13   | A100#NDO.VIAK17   | A100#NEK.FTPT#PNR  | A100#NGL.SADLSTSO |
| A100#N5.GB903      | A100#NJD.BFO#A#RA | A100#NK1.SWT#LOGC | A100#NU8.CC1ERH    | A100#NXB.SFLIGHT1 |
| A100#NYX.WWMV      | A100#NZR.VWBWKM   | A100#NZT.S034     | A100#N01.TCUSHIST  | A100#N1Z.T7PMY3   |
| A100#N2L.TADIR#TM  | A100#N4V.PTRV#SBA | A100#N61.T045DTA  | A100#N7G.MYPS1     | A100#N8U.TCUSDAT  |
| A100#N8V.TF655     | A100#N9P.AT16     | A100#OBE.VDPN     | A100#ODE.WYT5      | A100#ODT.MSKAO1   |
| A100#OFO.PARCT     | A100#OF8.SAPWLSFI | A100#OHO.FTPT#HOT | A100#OJ.J.BDAUDQUE |                   |
| A100#OKQ.MCSLOGDI  | A100#OOH.LL07     | A100#OQ3.VTIAFINK | A100#ORI.S081      | A100#OY4.VTVSZIDX |
| A100#OY5.AUBF      | A100#OY9.SFLIGHT1 | A100#O0L.DB2JSINF | A100#O2U.SXPGHIST  | A100#O4S.VDHOKO   |
| A100#O5S.WVFB      | A100#O91.RFSCASH  | A100#P3Z.LISAKT   | A100#0D4.SWVERRES  | A100#0FH.SFLIGHT1 |
| A100#0PC.SSM#STAT  | A100#0QW.LL05     | A100#0W0.ESUP     | A100#0Z0.S053      | A100#000.ACTFLI   |
| A100#005.REGUV     | A100#01J.KBLKKRED | A100#054.USKRIA   | A100#06X.RFCLIST   | A100#060.HOTPACKE |
| A100#08C.FTPT#CAR  | A100#08E.SADLSTFI | A100#080.FTPT#TRA | A100#088.EWUFI#BA  | A100#1CC.COBK#IND |
| A100#1C7.T5M7K     | A100#1D9.EVVDOR#V | A100#1EQ.VDORDER# | A100#1FL.KFPK      | A100#1MP.LL01     |
| A100#1OS.VEKAA     | A100#1OY.EWUFIAAS | A100#1SK.S271     | A100#1T2.CD0FRK1T  | A100#1WS.SOSC     |
| A100#10C.DELDYNPS  | A100#12M.FTIND    | A100#15M.TATOPC   | A100#15V.KBLPAYP   | A100#16L.MASSVART |
| A100#16P.PGWIL     | A100#2CD.S272     | A100#2EY.AVIK     | A100#2IH.TCUSSYSL  | A100#2K0.COCC     |
| A100#2L2.PGMTVMFL  | A100#2L4.MWZMBUZ  | A100#2L9.ISEGO1   | A100#2NC.T5M5J     | A100#2PT.SOXSTEST |
| A100#2SC.CICCFGTI  | A100#2SD.DBSTATIM | A100#2S1.SUKRI    | A100#2T2.RSVEPRUN  | A100#2V4.FTPT#PNR |
| A100#2WI.SWWWILIS  | A100#2XU.TXW#VWLO | A100#2X8.TODOS    | A100#2YY.CE4S001   | A100#2Y1.SFLIGHT2 |
| A100#20X.MLDZ4     | A100#21C.VERIRUNS | A100#274.S072     | A100#29Z.TNODEE    | A100#3FY.USER#CAT |
| A100#3NI.S054      | A100#3O5.TPMT#DEP | A100#3R2.T7050    | A100#3TG.TADIR#MO  | A100#3T4.S111     |
| A100#3T9.FTPT#FLI  | A100#3WE.J#1A102  | A100#3W4.TNODEH   | A100#3YL.TKED3     | A100#31Z.SER03    |
| A100#319.VEKAB     | A100#33K.S136     | A100#36B.FTPT#FLI | A100#39D.EKEK      | A100#4A3.VDPNS    |
| A100#4B3.ESLP      | A100#4DA.SWWHRIND | A100#4IP.S196     | A100#410.IHGNS     | A100#4JC.SSM#RELE |
| A100#4JI.MYPS2     | A100#4KT.BCKVWBWK | A100#4L9.S273     | A100#4N7.S120      | A100#4RE.SFLIGHT0 |
| A100#4S5.ATIVO     | A100#4TO.OPDEV    | A100#4UP.TSLLT    | A100#4WY.SCRULEDA  | A100#40J.VTVSZWPK |
| A100#410.CYOPR#MO  | A100#446.SFLIGHT  | A100#474.TNODET   | A100#481.SKTAOBJ   | A100#488.T77INT   |
| A100#49M.S060      | A100#49R.PRGN#STA | A100#499.EWUCOKAL | A100#5BP.S117      | A100#5B5.PEVAT    |
| A100#5C7.LL04      | A100#5DJ.S305     | A100#5ER.SFLIGHT0 | A100#5EW.FTPT#FAR  | A100#5JO.KBLPAYK  |
| A100#5OM.PKEC      | A100#5O9.TMCW3    | A100#5S9.COMQ     | A100#5Y1.SWWSWPRE  | A100#5Y9.TREEROAD |
| A100#50S.SWT#LOGE  | A100#52R.SUKRIT   | A100#57F.DBSTATTM | A100#58D.TF650     | A100#58M.VDDUNN   |
| A100#6AP.TATOPA    | A100#6CJ.S106     | A100#6DP.MCSMET   | A100#6E8.CORP      | A100#6HO.TXW#DIRS |
| A100#6JP.PSTT      | A100#6J4.SFLIGHT1 | A100#6KR.SKTAHEAD | A100#6LN.SWF#WFPC  | A100#6MW.T875D    |
| A100#6NJ.BTCCTL    | A100#6N5.S174     | A100#6OR.S108     | A100#6RX.OAPRI     |                   |
| A100#6SY.PROGRAMS  | A100#6T9.SFLIGHT0 | A100#62R.AFRH     | A100#67T.ICNV      | A100#7E1.COEPB    |
| A100#7EU.DYNPFIEL  | A100#7GT.TSLE4    | A100#7H4.SFLIGHT0 | A100#7JO.ALIINCL   | A100#7NR.TCSTC    |
| A100#7NZ.ICRC05    | A100#7N0.VTVSZIDX | A100#7N1.ONRO2    | A100#7RM.ESLB      | A100#7TQ.T875E    |
| A100#7XD.SFLIGHT0  | A100#751.MCCOMPV  | A100#758.SALESTES | A100#785.BPJV      | A100#8B0.RSVEPROF |
| A100#8EU.OIB03     | A100#8GI.BLPK     | A100#8KP.SMESGT   | A100#8L2.E41S      | A100#8MZ.FMDOC    |
| A100#8UH.SFLIGHT1  | A100#8VN.KEYWORD  | A100#8WW.AMPL#REJ | A100#8XK.ADMI#VAR  | A100#8YO.BOOKINGS |

Table 15 (Page 10 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                    |                   |
|-------------------|-------------------|-------------------|--------------------|-------------------|
| A100#80J.KBVL     | A100#846.ADMI#SKI | A100#88U.SDBAH    | A100#893.KPP1CHKO  | A100#9L6.MARDO1   |
| A100#9PY.VTUSZCVO | A100#9SO.GTABLES  | A100#9WT.TNODERTY | A100#9XG.AFRP2     | A100#901.MCS1     |
| A100#95D.AFRP4    | A100#95J.PKPR     | A101#D5R.BTCOMSDL | A101#000.#SAP      | A102#000.#SAP     |
| A103#000.#SAP     | A110#AAV.SXRETRY  | A110#ACJ.TRS35    | A110#ACU.FM01C     | A110#AEQ.TVEN6    |
| A110#AFI.TST02    | A110#AF8.CRHH     | A110#AGD.TKCQ     | A110#AGS.UFBBI     | A110#AID.AT15     |
| A110#AOT.T5D2A    | A110#AQE.USKRI    | A110#ATP.TSTPH    | A110#AVA.DM48T     | A110#AVE.BGPROT   |
| A110#AVR.NKUK     | A110#AV8.COFIO2   | A110#AYA.MHND0    | A110#AYU.TBTCI     |                   |
| A110#AZE.MWZDM07M | A110#A09.T51RJ    | A110#A3I.RESCO    | A110#A59.S073      | A110#A7J.EVHR     |
| A110#BCK.ANGA     | A110#BDW.VZWVA    | A110#BD0.PFALV    | A110#BEH.PFMSG     | A110#BEO.J#1AIMML |
| A110#BGG.TSKT6    | A110#BJ4.COANZ    | A110#BLC.FOH01    | A110#BOJ.ONRPD     | A110#BQS.T5P2I    |
| A110#BRH.MKUB     | A110#BSK.T5M7J    | A110#BSW.S004     | A110#BTH.LINP      |                   |
| A110#BTM.TMSBUFTX | A110#BXV.VDBEL    | A110#B0H.SWOTDQ   | A110#B1R.GLPO1     | A110#B10.TSTATHT4 |
| A110#B2P.TSKTN    | A110#B3D.TSTAHTTW | A110#B3H.EREN     | A110#B39.TDM30     | A110#B4B.NKAP     |
| A110#B5Y.EST07    | A110#B52.SQ3006#D | A110#B6R.T822T    | A110#CA1.VARINUM   |                   |
| A110#CA9.SWWWIAGE | A110#CBF.GSBLCA   | A110#CB9.TATAF    | A110#CCV.BTCSED    | A110#CDN.VBSP     |
| A110#CG3.TKEPTRK  | A110#CIL.ERKOT    | A110#CIV.VGTST    | A110#CKC.VBKPA     | A110#CLT.TPFVX    |
| A110#CQF.IXDIT    | A110#CQV.FTPT#TRA | A110#CR1.S009     | A110#CWK.GCLIENTS  | A110#CW6.GWFEODE  |
| A110#CXA.VERFK    | A110#CXH.ONRQA    | A110#C1X.T100V    | A110#C3R.P444V     | A110#C3T.PBIV     |
| A110#C4H.WPXST    | A110#C46.CC1ERP   | A110#C73.TOHR     | A110#C95.ST05RESU  | A110#DAY.T77QB    |
| A110#DBX.MBPR     | A110#DCJ.SKPF     | A110#DCO.S014     | A110#DDA.PKEK      | A110#DD8.TXMILOG  |
| A110#DIA.PFSEL    | A110#DLY.BSIA     | A110#DM4.P445H    | A110#DNI.OIB01     | A110#DNJ.TVEN4    |
| A110#DNU.TEMSI    | A110#DO2.TVEN1    | A110#DQA.CKPT     | A110#DQM.T51G2     | A110#DQ4.COTPLS   |
| A110#DSZ.EST0B    | A110#DTB.PSLI     | A110#DTF.CATQ     | A110#DTQ.VKAWV     | A110#DVO.TDM06    |
| A110#DVT.S197BIW1 | A110#DWY.GLTO1    | A110#DYK.T5PFV    | A110#DZC.TMCIR     | A110#DZ7.VTBFIOR  |
| A110#D10.VBSN     | A110#D2F.SORP     | A110#DGT.TDM28    | A110#D3U.KONR1     | A110#D4H.EBSEG    |
| A110#D6Z.EARLY    | A110#D78.T684     | A110#EB7.J#1AWITN | A110#EEU.VBKA      | A110#EHD.TPFVQ    |
| A110#EJZ.TSCMSTAT | A110#EQL.TLOCK    | A110#ERY.TMAGE    | A110#ETE.E070P     | A110#EUB.FREF     |
| A110#EUZ.ONRVB    | A110#EWP.CATL     | A110#EXF.KNVT     | A110#EXM.MKLN      | A110#EZE.EQUK     |
| A110#EZ9.PGMI     | A110#E3S.DSYDS    | A110#E6X.TSTATRS  | A110#FBB.COCHP     | A110#FBN.AFFW     |
| A110#FEF.P445V    | A110#FFQ.COCOA    | A110#FF3.PAHI     | A110#FHC.VFORK     |                   |
| A110#FHO.HRMSRVI  | A110#FIO.KNOB     | A110#FLA.DBPROF   | A110#FLX.PDERR     | A110#FNI.TKEPE    |
| A110#FOJ.TF660    | A110#FO8.EWUDUPRE | A110#FPN.TBTCR    | A110#FQ7.VBLK      | A110#FRN.INFCFGRE |
| A110#FSL.COSPP    | A110#FST.BKORA    | A110#FTL.TSKSM    | A110#FTU.BP1000    | A110#FUB.MHIS     |
| A110#FVY.PFFLD    | A110#FWK.TAFWD    | A110#FW0.WBTABLE  | A110#FXU.SOST      | A110#FY1.TER10    |
| A110#FY8.SERI     | A110#FZD.BCRES    | A110#F0P.T703T    | A110#F37.TSPTB     | A110#F4J.CLRK     |
| A110#F5M.TRPUT    | A110#F51.TKKAS#L  | A110#F7Y.CCMCLBD  | A110#F8O.INETX     | A110#GAI.T5W2N    |
| A110#GAY.PFPAR    | A110#GCE.TSST1    | A110#GCJ.BVOR     | A110#GDT.VTPPOLI   | A110#GDX.TDM27    |
| A110#GD5.VMETV    | A110#GFS.TDM31    | A110#GGA.FLAPP    | A110#GGD.JBRRHBAU  | A110#GGO.VTIOFZU  |
| A110#GHU.FTPT#CAR | A110#GH2.SOCVPC   | A110#GIZ.J#1AAWAY | A110#GJV.WIND      | A110#GKC.COVAD    |
| A110#G6A.MCVSRFP  | A110#GOP.VTBRATE  | A110#GPT.PR0AF    | A110#GPV.REFON     | A110#GR4.WOSAV    |
| A110#GTU.FEBPI    | A110#GTV.CD0T200T | A110#GUB.MPRP     | A110#GUI.CKMLRUNT  | A110#GVJ.PRON     |
| A110#GVV.EWUCUSA2 | A110#GYC.E42L     | A110#GYJ.ONRHP    | A110#GYM.TFSAVE    | A110#GZM.VDPOKO   |
| A110#GZ9.FDAU     | A110#G0C.CKMLRUNP | A110#G0I.MCY1     | A110#G1R.SWWRUNME  | A110#G1U.VMETT    |
| A110#G16.TLOCKTST | A110#G30.TVENT3   | A110#G3P.TBILOG   | A110#G4J.TVARV     | A110#G5I.T100W    |
| A110#G6A.MCVSRFP  | A110#G8J.VBSS     | A110#G8Y.EST0D    | A110#G85.E070USE   | A110#G86.E070N    |
| A110#HBO.TDM10    | A110#HB2.LFB5     | A110#HDI.BPCJ     | A110#HF7.FMCFSI    | A110#HGU.TSTAMK   |
| A110#HHP.WOSA     | A110#HJC.T044HT   | A110#HNV.TABBR    | A110#HOG.MWZMSEG   |                   |
| A110#HP2.USZBVPRO | A110#HSM.PUMS     | A110#HTH.PLPW     | A110#HT7.SDOKCHKO  | A110#HXH.VBBS     |
| A110#H2U.SLGSK    | A110#H36.FMRC07   | A110#H5D.PKCH     | A110#H7D.PRTE      | A110#H8N.GREP#VAR |
| A110#H9D.FAPW     | A110#H9I.PBHI     | A110#IAB.VVNVSTBE | A110#IA3.IXTYP     | A110#IC3.S001     |
| A110#IDH.EKPB     | A110#ID4.TPFST    | A110#IGM.PKSD     | A110#IJ0.VTBPFFHAP | A110#IKE.VTBTEKAL |
| A110#IKX.PGPLE    | A110#ILO.FPLTC    | A110#INL.OBGV     | A110#INP.WDLSO     | A110#IPX.VMETW    |
| A110#IP4.BCEXC    | A110#IQD.EWUCOK   | A110#IQT.MHNKA    | A110#IRL.TESTFB    | A110#IR6.EIPA     |
| A110#IR9.TDM29    | A110#ITD.CKKT     | A110#IVI.REUL     | A110#IWU.TF586     | A110#IYA.LFAS     |
| A110#IZF.AT15B    | A110#I1N.TDM23    | A110#I1S.PGPL     | A110#I33.ONROV     | A110#I5M.TVENT2   |
| A110#I6R.LFC3     | A110#I9B.TC78     | A110#JAW.WRPE     | A110#JA5.TOA01     | A110#JCV.WPLST    |
| A110#JDP.SADR10   | A110#JD9.TBTCA    | A110#JFP.SDOKCHKF | A110#JIL.SWZAIRET  | A110#JN5.T022Q    |
| A110#JOQ.CATCU    | A110#JSB.VBKOF    | A110#JSC.CATDO    | A110#JUR.DSYSX     | A110#JUT.DM99L    |
| A110#JW8.MSEGO1   | A110#JYD.EDMAP    | A110#JZ0.BAPIXMLO | A110#J69.BSIW      | A110#J8H.SORF     |
| A110#KAN.TSOFA    | A110#KA5.S064     | A110#KBT.KNVS     | A110#KDG.IBINDOMA  | A110#KDR.S194     |
| A110#KGQ.FMCFISIF | A110#KHE.TRBAT2   | A110#KI6.T881IS   | A110#KJA.WFQUE     | A110#KJE.T750X    |
| A110#KJ2.CEERROR  | A110#KMO.SFHX     | A110#KMT.COSBD    | A110#KO6.UKSD      | A110#KSN.EBUB     |
| A110#KUT.EKAN     | A110#KU5.SOEP     | A110#KW1.T515V    | A110#KXK.SDBAD     | A110#KYH.T7791    |
| A110#KY1.TDMV1    | A110#KZT.VTBKORTM | A110#KZ2.CCCFINI  | A110#K0K.BATMANTD  | A110#K4B.T045T    |
| A110#K61.TF651    | A110#K7B.SAIN     | A110#K80.ANAR     | A110#LAS.GLTO3     | A110#LEU.ONRFS    |
| A110#LFF.T5PP2    | A110#LFM.VBUV     | A110#LFZ.WFERR    | A110#LF5.TAI10     | A110#LG0.SDBAP    |
| A110#LIY.MCEKS    | A110#LJB.CF005    | A110#LLD.T5P3E    | A110#LLU.SOREORG   | A110#LM6.RBSELLIF |
| A110#LPE.T5M8H    | A110#LPK.SYNTB    | A110#LPR.VKAOF    | A110#LRA.DOKCR     | A110#LSP.EDFIL    |



Table 15 (Page 11 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                    |
|-------------------|-------------------|-------------------|-------------------|--------------------|
| A110#LTM.SLGSR    | A110#LWD.S011     | A110#LWT.GB02C    | A110#LW2.DBSTATTI | A110#LXK.MAHNS     |
| A110#LZH.FMCOPI   | A110#LZ0.T751D    | A110#LZ8.SEUDEPEN | A110#L0Q.BKORM    | A110#L1G.TVENT4    |
| A110#L1M.MERGEOBJ | A110#L17.SOOD     | A110#L2T.T446H    | A110#L89.EKUB     | A110#MEW.GLSO3     |
| A110#ME7.NKLV     | A110#MJQ.CATDA    | A110#MM0.RZLLICLA | A110#MNK.DOSSI    | A110#MNX.TDM13     |
| A110#MQ1.DOKALTLA | A110#MSW.T752F    | A110#MS7.MSSQH    | A110#MUO.T5M7T    | A110#MU3.FINV      |
| A110#MV4.ONRAN    | A110#MWP.K002     | A110#MXJ.EKKI     | A110#MYV.TDM01    | A110#MY8.WWMI      |
| A110#MZ.F.UMSV    | A110#M1K.WPTOTLIU | A110#M2W.TC74     | A110#M21.TMCSG    | A110#M8R.CBPL      |
| A110#NBP.OBGD     | A110#NGM.HRSM#DAT | A110#NG1.GLTPC    | A110#NH1.BPCG     | A110#NIQ.TVENT1    |
| A110#NJY.ONROR    | A110#NJ6.GLPO2    | A110#NJ7.KOND     | A110#NKM.SLGST    |                    |
| A110#NKN.CCRFCTAB | A110#NKV.TPAKL    | A110#NLX.BTCJSTAT | A110#NMS.TF630    | A110#NNS.REGUPO    |
| A110#NRR.TOA02    | A110#NSA.RFCSTXTA | A110#NTU.TMSBUFRE | A110#NU3.T5M7Y    | A110#NZD.P0SUT     |
| A110#NZ0.EQUP     | A110#N0A.TRDIRE   | A110#N0D.FLEMP    | A110#N2K.COVAT    | A110#N2Q.RBSELEFRB |
| A110#N3A.CDOT210T | A110#N3F.BSEGC    | A110#N3P.TOA03    | A110#N4R.VBERROR  | A110#N73.LISPLF    |
| A110#N89.TKKH2    | A110#N99.WDLSF    | A110#OCK.HRARCENQ | A110#ODQ.OIB02    | A110#OEK.BLPR      |
| A110#OEW.RBSELWER | A110#OFM.CCMCLBS  | A110#OHJ.TDM05    | A110#OLB.BALM     | A110#OLT.COFT      |
| A110#OOK.KNVL     | A110#OO5.TCDRP    | A110#OPB.J#1AIFSK | A110#OQJ.TSEGWS01 | A110#OQ0.TC77      |
| A110#OS3.WFSTO    | A110#OUM.DOSSH    | A110#OUT.T5P1F    | A110#OVV.TSP04    |                    |
| A110#OWA.BTCEVTJO | A110#OW5.T095P    | A110#O2M.ERET     | A110#O3V.BPVK     | A110#O98.CESETS    |
| A110#PA7.PAPL     | A110#P0B.TDM21    | A110#P0F.T800AIS  | A110#P0Y.IXTYT    | A110#P2K.LIPSDG    |
| A110#P2L.TDM09    | A110#P3L.ONRKS    | A110#P4H.CATM     | A110#P46.BTM#TDAT | A110#P50.LQUAB     |
| A110#P59.COCH     | A110#P6L.MASE     | A110#P6Z.VTBKORES | A110#P68.VRSLI    | A110#P7C.UMSVZ     |
| A110#P82.SADLSTDI | A110#0AP.B032     | A110#0AV.EREF     | A110#0CC.TXMILOGR |                    |
| A110#0CM.TOADL#KE | A110#0CZ.TBIER    | A110#0D1.ALMONISE | A110#0ED.KONR     | A110#0J0.T022A     |
| A110#0O0.TVEN5    | A110#0PD.VERFT    | A110#0Q0.MAHNV    | A110#0Q8.WRPR     | A110#000.AFBP      |
| A110#01A.VFORT    | A110#01E.EANQ     | A110#051.CE3S001  | A110#06Q.OIB05    | A110#06Z.INHB      |
| A110#081.TTDUS    | A110#1AM.TF585    | A110#1AQ.FDTL     | A110#1AT.T515T    | A110#1B6.TKKAE     |
| A110#1CL.CATK     | A110#1CV.SSPUMK   | A110#1EL.CD0TBSH0 | A110#1FB.CD0MC5   | A110#1HS.EQUZ      |
| A110#1I7.DVERS    | A110#1KI.TCMEMO   | A110#1NM.MWYMBUZ  | A110#1O2.TOPRK    | A110#1O3.SUMS      |
| A110#1RX.USZBVPRO | A110#1S1.BTCUEV   | A110#1WF.RBSELBES | A110#1YB.S194BIW1 | A110#1YR.IWB2CHKF  |
| A110#117.T515S    | A110#12V.APQI     | A110#13R.S002     | A110#15K.CE1S001  | A110#15X.TDM11     |
| A110#158.TPFVA    | A110#16O.EBKPF    | A110#19F.PGZU     | A110#19H.PCL5     | A110#19J.T445Y     |
| A110#194.WFMCMSGE | A110#2AO.PCALAC   | A110#2BQ.TER11    | A110#2CQ.S071     | A110#2DB.T515R     |
| A110#2ET.EKBEH    | A110#2FM.TPFVD    | A110#2GF.FLPAS    | A110#2IA.KPER     | A110#2IG.IWB#ADMI  |
| A110#2LY.SOSTAT   | A110#2NW.S135     | A110#2N2.FMSD07   | A110#2PQ.T823T    | A110#2QB.PKER      |
| A110#2RB.T445C2   | A110#2TN.AIND#STA | A110#2T2.TFPT#FLI | A110#2WP.SPH#USNO | A110#2WU.TOBAE     |
| A110#2WV.TTDIR    | A110#2XY.GRIX#VAR | A110#2YC.WWMIT    | A110#2YS.FEBKO    | A110#2Y4.CORE      |
| A110#20D.OSMON    | A110#21V.T51G1    | A110#22I.TPFVE    | A110#23Q.GLSO2    | A110#230.SLGSY     |
| A110#232.GLTO2    | A110#24B.T022B    | A110#264.LSHR     | A110#3BS.CATR     | A110#3EX.BWKS      |
| A110#3EZ.TC72     | A110#3F2.VSKPER#C | A110#3GP.CF003    | A110#3KT.TC76     | A110#3K1.VBEH      |
| A110#3K8.ANEV     | A110#3LQ.COKAA    | A110#3QH.UKSV     | A110#3QN.ONRPR    | A110#3RA.CRID      |
| A110#3SJ.VVNOPT   | A110#3S1.TQ01E    | A110#3TP.COTPLFC  | A110#3TS.ONRQB    | A110#3TV.TCN4T     |
| A110#3T4.T5W2O    | A110#3T9.VMETK    | A110#3UF.P01CVH   | A110#3XJ.REFCC    | A110#3X3.VESED     |
| A110#32G.VTBMMOR  | A110#32R.RBSELERF | A110#32U.TSKT7    | A110#320.COMD     | A110#33X.AUVT      |
| A110#35Q.SFIWP    | A110#358.TUCHK4   | A110#385.CATDB    | A110#396.REGUT    | A110#4AP.VFKP      |
| A110#4AT.SLGSM    | A110#4BG.TBTCB    | A110#4D2.PFACT    | A110#4E5.ANLX     | A110#4HU.MLIB      |
| A110#4H5.CKPP     | A110#4JV.MENTREE1 | A110#4J9.TPFES    | A110#4KN.ONRQM    | A110#4L6.TABVO     |
| A110#4MD.ANLV     | A110#4MT.COSLD    | A110#4NS.TVENT5   | A110#4NX.MGEF     | A110#4PK.VERME     |
| A110#4RP.ONRKL    | A110#4R0.CKPS     | A110#4SI.BTCSEV   | A110#4TR.COFIO1   | A110#4T6.ERZUT     |
| A110#4UI.CKKS     | A110#4WJ.ALPERFOB | A110#4XF.TVEN2    | A110#4XZ.MSOA     | A110#4YD.TOABC     |
| A110#4ZK.RDDRFCST | A110#4Z7.WFPRC    | A110#41Q.QIWL     | A110#41V.SEUDEPEN | A110#42W.RF180     |
| A110#421.SWWWIRET | A110#43Q.VBFS     | A110#45X.VIAK22   | A110#49D.SBOOK    | A110#49H.CD0BAS5V  |
| A110#5KY.VTBMOR   | A110#5LR.GLPO3    | A110#5LX.EWUARCHI | A110#5L4.TC75     | A110#5NK.FMALLOC   |
| A110#5OV.WWVT     | A110#5PI.TINSO    | A110#5QV.COMPH    | A110#5SV.WFAS     | A110#5TV.TSP05     |
| A110#5UF.CD0BAS4V | A110#5UT.CC1ERM   | A110#5V0.CKHT     | A110#50T.TDM02    | A110#51V.MSSAH     |
| A110#516.KMKPF    | A110#53J.TDM07    | A110#54G.SWP#JOIN | A110#55M.PA2013   | A110#551.SWL#ST#T  |
| A110#575.PA0367   | A110#58G.VTBRELE1 | A110#58K.BKORR    | A110#59V.WARNG    | A110#6CS.RBSELLBL  |
| A110#6E1.IWB2CHKO | A110#6HT.KAPE     | A110#6LG.IBINOBS  | A110#6LH.JVT1     | A110#6NN.T5G6T     |
| A110#6NT.TDM08    | A110#6OL.VBSET    | A110#6OT.VIVW06   | A110#6O7.KDPL     | A110#6QF.KNAS      |
| A110#6RP.MEIK     | A110#6R5.P445X    | A110#6SF.TPFVR    | A110#6SL.ONROF    | A110#6TF.MWXMSEG   |
| A110#6ZF.TPFVP    | A110#6ON.TC73     | A110#604.TRORD    | A110#61P.EST0F    | A110#620.TBTCJSTE  |
| A110#67P.PSPL     | A110#7AA.REGUS    | A110#7A0.ONROS    | A110#7A5.HLPNA    | A110#7DZ.T515U     |
| A110#7D2.TOAV2    | A110#7EJ.VFORS    | A110#7E7.EWUCUSAK | A110#7GI.ANLW     | A110#7GL.TBTCS     |
| A110#7HJ.T5M8G    | A110#7IR.TMAC     | A110#7M9.TF661    | A110#7NG.TERRD    | A110#7P3.TFAX1     |
| A110#7QN.DM48L    | A110#7R0.DOKSI    | A110#7TL.KONAIND  | A110#7TT.T5W2M    | A110#7UA.DLIX      |
| A110#7UP.PUMK     | A110#7UY.FMCFISIO | A110#7WE.TRCL     | A110#7WY.MSSQ     | A110#7XC.PA0467    |
| A110#7YH.IWB1CHKO | A110#7YP.TPFVI    | A110#7Y5.MWMKPF   | A110#70H.PFSWP    | A110#71K.IBINOWN   |
| A110#71P.ONROK    | A110#71T.TDM22    | A110#76Q.BSBW     | A110#77M.DSYCR    | A110#79C.UBIBL     |
| A110#8BL.RSMPTRNS | A110#8CQ.SWWLOGHI | A110#8DB.MWZDM07M | A110#8DL.TVEN7    | A110#8E7.TVEN8     |

Table 15 (Page 12 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A110#8FH.VBAG     | A110#8IV.CC1TEV   | A110#8LS.IBIBOBS  | A110#8N6.EWUFI#SC | A110#8OL.CSSK     |
| A110#8OQ.REGUHO   | A110#8PY.PFBTC    | A110#8RE.SKTADEV  | A110#8WD.PBIC     | A110#8XO.WRPD     |
| A110#8XY.REGUA    | A110#8Z4.ONR00    | A110#8Z7.TDM03    | A110#80A.DBSTATHI | A110#801.KNMTK    |
| A110#81K.TZ43     | A110#82O.TDM04    | A110#85L.GLS01    | A110#86K.T5PTC    | A110#9DD.DOKSH    |
| A110#9ED.TVEN9    | A110#9E4.EDIE5    | A110#9HO.KNVI     | A110#9HR.ANLH     | A110#9LI.TVEN3    |
| A110#9MC.SKMT     | A110#9MS.MSET     | A110#9NN.TQ01D    | A110#9OH.TKEPTRT  | A110#9PH.TF620    |
| A110#9R3.TDM14    | A110#9S5.TKKH1    | A110#9VW.TRMIDX   | A110#9WV.BSBM     | A110#9XD.IWB1CHKF |
| A110#9ZL.MZDAT    | A110#915.BALHDR   | A110#92A.VERTE    | A110#92M.CE2S001  | A110#932.T5G64    |
| A110#96B.T5PP3    | A110#97C.E072P    | A110#97G.TPROT    | A110#972.T5URU    | A110#99H.BKDF     |
| A111#JLZ.#SAP     | A111#000.#SAP     | A112#LQT.#SAP     | A112#000.#SAP     | A113#000.#SAP     |
| A120#ACA.VTBAFINK | A120#ACK.HRAAERR  | A120#AF2.USLA04   | A120#AKV.KOSA#BAL | A120#AL1.TKEPTRF  |
| A120#ASU.DSYAV    | A120#AU9.PROP     | A120#AV2.GRIX#AUT | A120#A5V.J#1BNFCP | A120#BDN.STXRDIR  |
| A120#BE9.RBKP     | A120#BHA.SORD     | A120#BJE.VWVORTR  | A120#BKC.S066     | A120#BLU.VTBSI    |
| A120#BNK.LINV     | A120#BP0.EBKN     | A120#BQ7.VIEA03   | A120#BW6.WBPA     | A120#B45.VAKGU    |
| A120#B58.EKPV     | A120#B7B.SAPWLSFI | A120#B8P.VIEPOS   | A120#B8Z.VWPWP KU | A120#CCR.VITAXR   |
| A120#CFG.BSIK     | A120#CPM.P01CABR  | A120#CV7.PTDW#COS | A120#CXB.CD0ENT5T | A120#C13.GRIX#VAR |
| A120#C2L.RSDBS    | A120#C28.ERPO     | A120#DBJ.HRINTE30 | A120#DFV.VIMI56   | A120#DWY.PFLOG    |
| A120#DZS.VFPLA    | A120#D2E.RKWA     | A120#D4H.VRKPA    | A120#D52.KFPPW    | A120#EDJ.TBIG     |
| A120#EDZ.TPMT#LOT | A120#EKU.VTB#MARK | A120#EMH.KBLPW    | A120#EMT.DBVM     | A120#ENK.USROBJEC |
| A120#EQE.EIKP     | A120#ES6.PAYRQ    | A120#EYU.VIMITH   | A120#EY1.COWORK11 | A120#EZZ.RBWS     |
| A120#E0W.PTRV#KMS | A120#E2D.KNC3     | A120#E32.AFRV     | A120#FC2.PCMO2    | A120#FFR.VRPMA    |
| A120#FGL.SBSE     | A120#FGU.VIAK11   | A120#FIZ.VTTS     | A120#FJW.VTSP     | A120#FJ5.TPMT#DED |
| A120#FKU.SWEINSTC | A120#FMY.ERKO     | A120#FRO.TSEGH    | A120#FSY.QMFE     | A120#FT8.VBRK     |
| A120#FW7.FUNOCM   | A120#F2F.DM50T    | A120#F5X.ICRC01   | A120#F54.COWORK13 | A120#GBA.BWPOS    |
| A120#GB4.VDDAB    | A120#GD8.PTRV#RPR | A120#G18.VIMI28   | A120#GQA.S005     | A120#GQZ.STXRDIR  |
| A120#GWT.SADLSTIA | A120#G1Q.MDKPDB   | A120#G3L.PCMO3    | A120#HBR.VTVBAR   |                   |
| A120#HMB.TSPQSTAT | A120#HPE.MSSCNTDE | A120#HPY.CKIP     | A120#H4S.COMH     | A120#H41.PTDW#ACT |
| A120#IB2.EKAB     | A120#IDT.TC71     | A120#IFV.CALLER   | A120#IGH.VIMI46   | A120#IL1.TERRF    |
| A120#IM0.VTFA     | A120#IN3.T52OCG   | A120#IOJ.PKPS     | A120#IUN.DRAOZ    | A120#I4F.DM50S    |
| A120#I4L.FTPT#VAR | A120#I9J.MWXVM07M | A120#JCH.EIEI     | A120#JCV.ESKL     | A120#JD5.DBSTATHM |
| A120#JD6.RKPF     | A120#JG4.VDAVIS   | A120#JH2.REFH     | A120#JMK.KMZEI    | A120#JPI.AUVDI    |
| A120#JSQ.TPMT#DED | A120#JSU.VBKK     | A120#J19.GRIX#TXT | A120#J7G.PQDATA   | A120#KA5.EKRS     |
| A120#KDK.COME     | A120#KE2.GLT0     | A120#KE6.COEPT    | A120#KFM.IKPF     | A120#KL0.EKKN     |
| A120#KSG.SVUP     | A120#KUP.REGUHH   | A120#KUT.VTBFINKO | A120#KV5.PCL4     | A120#KX3.BPPE     |
| A120#K4U.KNB4     | A120#K81.KBLEW    | A120#LIM.SOCS     | A120#LWA.VFZP     | A120#L2L.ANEP     |
| A120#L3Q.AUKO     | A120#L6N.RSPSP    | A120#L8B.VAKPA    | A120#L9W.TRACOLH  | A120#MDE.FPLTPO   |
| A120#MGW.FPLA     | A120#MHF.VTTK     | A120#MHT.VDPOPO   | A120#MI5.RBVS     | A120#MJQ.LFC1     |
| A120#MOU.P01CUA   | A120#MT2.VIVSTB   | A120#M0J.RBWT     | A120#M0W.FUNREQ   | A120#M2U.BPIJ     |
| A120#M3F.COKR     | A120#M56.ORDCOM   | A120#NNZ.VIBEOS   | A120#NPD.VIVW09   | A120#NQV.COMHR    |
| A120#NR1.LISR     | A120#NVO.VIEA06   | A120#N07.QMEL     | A120#N53.AVIP     | A120#ODH.AUAI     |
| A120#OEI.VWPOSTDO | A120#OFJ.COVLV    | A120#OKB.VLPMA    | A120#OLK.WVFB2    | A120#OMJ.VIMI16   |
| A120#ONI.MENTREE1 | A120#ONX.IBIN     | A120#OOM.QSTRE    | A120#OSM.COEP     | A120#OTH.VDBLPO   |
| A120#O02.CATJ     | A120#O2J.LTAP     | A120#O48.KNB5     | A120#O65.T52OCL   | A120#O9V.VSFPLA#C |
| A120#P0J.PCMO1    | A120#P0R.FTPT#HOT | A120#P01.TSEGR    | A120#P2W.VBAK     |                   |
| A120#P3R.TPMT#DED | A120#P6U.CD0ENT1T | A120#P9Q.COFTP    | A120#0DL.TRACOLP  | A120#0DU.RQHD     |
| A120#0LZ.TBTCO    | A120#0L6.CATDH    | A120#0Q7.EBAB     | A120#0RV.VLPKM    | A120#0YC.APQL     |
| A120#0YX.DSYAI    | A120#000.AFFL     | A120#068.OBJK     | A120#1C1.USL04    | A120#1D5.COMHP    |
| A120#1SS.KFPP     | A120#1TX.VLKPA    | A120#1VB.MDKP     | A120#1ZZ.QTVB     | A120#10X.VETVG    |
| A120#15C.DBVL     | A120#16S.EKET     | A120#2HI.ECCN     | A120#2H9.FPLT     | A120#2KS.AUWEI    |
| A120#2MD.VTTP     | A120#2OX.VFKK     | A120#2P7.BALMP    | A120#2QM.T569B    | A120#2R9.MCIPMIS  |
| A120#2SW.EKETH    | A120#2WZ.VIMI25   | A120#2ZO.AFFT     | A120#247.BPHI     |                   |
| A120#25N.SROBJGRO | A120#255.SER01    | A120#287.PCL1     | A120#29R.PTDW#ACT | A120#3AD.PCMH     |
| A120#3AT.TSPJSTAT | A120#3A3.VFPA     | A120#3FF.KFPEW    | A120#3FP.LIKP     | A120#3HD.VWZUORD  |
| A120#3I2.P01CKA   | A120#3LJ.SWWBINDE | A120#3MF.TOADL#PA | A120#3OC.VZFZE    | A120#30A.MLMST    |
| A120#3SB.TEPSDELI | A120#3V4.ERZU     | A120#3V9.MSSSNAP  | A120#3XG.VIMIRD   | A120#3Z1.SOOF     |
| A120#33C.T52SPS   | A120#33X.P01CSO   | A120#37J.TSEGE    | A120#374.BCKVWZUO | A120#4AF.COMPF    |
| A120#4A7.S013     | A120#4BW.WTADABT  | A120#4CA.VTBSIZU  | A120#4GH.MKPF     | A120#4GX.T811K    |
| A120#4NI.P01CAD   | A120#4SG.VBSK     | A120#4TA.MCSLOG   | A120#4XW.MWZVM07M | A120#48E.PCL3     |
| A120#49Q.VDAUSZ#E | A120#5AF.PABIT    | A120#5AZ.VTPA     | A120#5ID.PCHEAD   | A120#5JB.VEPVG    |
| A120#5LU.FPLAPO   | A120#5SE.BPIG     | A120#5YJ.DSYAW    | A120#52R.VTIFINKO | A120#54T.VFPLT    |
| A120#55N.COCQ     | A120#55T.KNVA     | A120#56G.VIVW08   | A120#58I.VIAKUV   | A120#58T.MAFU     |
| A120#587.COFMA    | A120#6DZ.PKTMP    | A120#6GE.EIPO     | A120#6GW.CCMAUTHP | A120#6IN.ORDLY    |
| A120#6LW.FUNCTION | A120#6L5.QMUR     | A120#6N2.PTRV#DOC | A120#6RJ.SCPROXY  | A120#6RL.VITAXA   |
| A120#6UB.SER00    | A120#6V9.CATSCOSU | A120#6WD.AFWI     | A120#6YL.PROH     | A120#617.COTPR    |
| A120#652.VBRL     | A120#7BG.USOBX#CD | A120#7IV.S067     | A120#7QD.PABHD    | A120#7SF.MLHD     |
| A120#7U2.BALHDRP  | A120#7XM.TSEGEADR | A120#74F.FEBCL    | A120#75E.DBSNP    | A120#76T.PPDST    |
| A120#78D.RSVEPVAL | A120#8EB.AFWIS    | A120#8G0.BSAK     | A120#8HT.PCMO4    | A120#8MG.VFSI     |
| A120#8M9.T7TW1N   | A120#85S.FILCP    | A120#9FU.S035     | A120#9NH.VKDFS    | A120#9P3.SAUF     |

Table 15 (Page 13 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                    |                   |                    |                   |
|-------------------|--------------------|-------------------|--------------------|-------------------|
| A120#9P5.EWUMMFI  | A120#9UZ.FTPT#PNR  | A120#9WB.QTCH     | A120#978.DRAD      | A120#98I.VTRDI    |
| A121#000.#SAP     | A122#000.#SAP      | A123#000.#SAP     | A130#AFX.SODM      | A130#AHB.FDSR     |
| A130#AI7.EIUUV    | A130#AJT.CATO      | A130#AMD.RF048    | A130#ANX.BCKVWBEP  | A130#ASL.FDSBDIST |
| A130#AXC.PPDMSG   | A130#A0E.MLWERE    | A130#A3M.SOCX     | A130#A3Z.CHZP      | A130#A4J.VWORDE   |
| A130#A5G.KNVD     | A130#A9A.VBKPF     | A130#BCO.JEST     | A130#BKZ.GLFUNCO   | A130#BOR.MYMP     |
| A130#BQK.CKHS     | A130#BQQ.ELBK      | A130#BV7.BDRGOUT  | A130#BY0.COMPCMP   | A130#CAU.SADRX5   |
| A130#CB8.CATSPS   | A130#CFK.VBSEGA    | A130#CGA.RBDIFFKO | A130#CHK.DVK01     | A130#CLZ.TCOBJ    |
| A130#CMU.SSCH     | A130#COZ.EKBE      | A130#CRH.COSB     | A130#CWS.FDSRDIST  | A130#CZ5.AQLDB    |
|                   | A130#C1X.FMUDBSEG  | A130#C2V.BDCPS    | A130#C3P.AQSGDB    | A130#DF5.COKL     |
| A130#DMU.LQUA     | A130#DYM.AQDB      | A130#D0V.COEJL    | A130#D46.S038      | A130#D6R.FRETB    |
| A130#EAD.FEBEP    | A130#EBX.FDZA      | A130#EFU.FLSLI    | A130#EF6.RSEG      | A130#EGY.TKETRPRO |
| A130#EJB.CATSPM   | A130#ESJ.FDES      | A130#ESQ.QINF     | A130#ESU.PTEX2000  | A130#EUN.JSTO     |
| A130#EUY.USRSYSAC | A130#EV5.WFIUT     | A130#EX5.QAST     | A130#E0Z.LCOLKEY   | A130#E2P.VBEP     |
| A130#E50.DTELDOKT | A130#E6T.RBCO      | A130#E8K.KFPE     | A130#FAB.MCSA      | A130#FAM.J#1A101  |
| A130#FEB.AGKO     | A130#FM4.VFKN      | A130#FZ5.P01CEF   | A130#F12.PZPS      | A130#F40.SWELOG   |
| A130#F50.TVERM    | A130#F7E.CCMSESSI  | A130#GDK.AQGDB    | A130#GFA.COFIP     | A130#GIN.EKKO     |
| A130#GI9.P01CCV   | A130#GJ9.SADRO     | A130#GPJ.GLREFO   | A130#GSA.PTRV#DOC  | A130#GSH.FILCC    |
| A130#GST.AFFH     | A130#GTV.COFIS     | A130#GU0.FMIOICCN | A130#GV0.SOCY      | A130#GV2.COKS     |
| A130#GYV.LCOLOBJ  | A130#GZY.GLPCO     | A130#GZ3.LWRKTRAN | A130#G0Z.BSIX      | A130#G1U.RBTX     |
| A130#G2C.EKPO     | A130#G2F.BCKVWORD  | A130#G3P.FMUDKBLP | A130#G6W.SOADRBUF  | A130#G7J.EBII     |
| A130#G7V.RFDT     | A130#HDK.AUUMI     | A130#HEK.SKTYREMK | A130#HGB.FDESDIST  | A130#HHA.EWUFI#SO |
| A130#HNO.SORS     | A130#HX9.P01CIX    | A130#HYO.COMER    | A130#H34.VTBFKTLO  | A130#IBU.KBLP     |
| A130#IDN.WBO4     | A130#IDO.DLFLD     | A130#IWN.KFPPI    | A130#IOB.SROBJJING | A130#I17.VBPA     |
| A130#I4A.RFRR     | A130#JAN.ARFCSSSTA | A130#JDB.FILCO    | A130#JDT.CLBUF     | A130#JFM.PCL2     |
| A130#JHV.P01CVD   | A130#JLJ.FRET      | A130#JMJ.TC71D    | A130#JND.ARFCRDAT  | A130#JPZ.TBTCPC   |
| A130#JQJ.LPDX     | A130#JR9.SOID      | A130#JVQ.FMCFABS  | A130#JV3.VBREVK    | A130#JYP.CF006    |
| A130#JYS.USOBT#CD | A130#J5M.PPOPX     | A130#J5R.BDRGIN   | A130#J90.COST      | A130#KA4.KNC1     |
| A130#KIE.PCMP     | A130#KJF.WALE      | A130#KRD.COKP     | A130#KUR.SWWINDX   | A130#KVV.ESKN     |
| A130#KV7.LSEG     | A130#KYJ.COMPHDR   | A130#KZX.IMRG     | A130#K0P.ARFCSDAT  | A130#K2N.EKES     |
| A130#K21.MLBECE   | A130#K3K.COEPBR    | A130#K38.COMPPRT  | A130#K53.VITAXD    |                   |
| A130#LEX.FMUDBSEG | A130#LHP.TTXY      | A130#LJQ.COFIT    | A130#LNM.P01CGP    | A130#LNY.FDSB     |
| A130#LP9.COEPD    | A130#LS0.SADRF     | A130#LWO.SOC2     | A130#L4C.RBKPB     | A130#L8J.P01CBE   |
| A130#L8Y.IBSYMBOL | A130#MBW.QMSM      | A130#MEB.AQSLDB   | A130#ME1.PLPR      | A130#MFP.WBO1     |
| A130#MHR.COMPSQU  | A130#MIG.P01CBF    | A130#MQ1.TTXI     | A130#MRT.ELBM      | A130#MR0.SMET01   |
| A130#MTD.FDM1     | A130#MUW.P01CSL    | A130#MXQ.COES     | A130#M4S.BPEG      |                   |
| A130#M5Q.FMUDKBLP | A130#NCA.ALALERTD  | A130#NIS.AUPO     | A130#NJX.COSR      | A130#NJ6.ESTOH    |
| A130#NLI.SOATT    | A130#NLW.LIPSRF    | A130#NL0.VBRP     | A130#NOO.EKBZH     | A130#NO4.AFKO     |
| A130#NP4.FDM2     | A130#NQO.CPZP      | A130#NSP.SCAPPTIN | A130#NWR.VITAXU    | A130#NZ9.COEJT    |
| A130#N0F.TRMWRK   | A130#N4J.AFRP0     | A130#N5O.CKIT     | A130#N6Q.TOA#L03   | A130#N62.VEKAC    |
| A130#N9V.TAQTS    | A130#OFW.COMPOPR   | A130#OLZ.RUECK    | A130#OL1.SADRU     | A130#OPI.FMBUD    |
| A130#OQA.GGREFO   | A130#OS3.SADLSTRE  | A130#OUI.COEPL    | A130#OVD.CATSM     | A130#OWU.GLFUNCC  |
| A130#O19.USRSYSAC | A130#O9A.SAMT      | A130#O9X.GLT3     | A130#P02.GLREFC    | A130#P10.COBK     |
| A130#P24.P01CEE   | A130#P39.BPBK      | A130#P41.MLBE     | A130#P55.BPTX      | A130#0C5.PPDIX    |
| A130#0M3.UKPF     | A130#009.SADLSTDI  | A130#0PR.IBVALUEC | A130#0WZ.SOFD      | A130#0Y6.QPRN     |
| A130#000.AFAB     | A130#033.HRPM002   | A130#04A.COKA     | A130#07N.AUVW      | A130#1JK.CQPR     |
| A130#10W.VEDAPO   | A130#1UG.WKBK      | A130#1XZ.COVA     | A130#1YC.BPGE      | A130#1YO.VFKGRP   |
| A130#142.AQTDB    | A130#15N.EKBZ      | A130#18X.COEJR    | A130#196.GGREFC    | A130#2FF.DSYAM    |
| A130#2J7.ELBP     | A130#2NB.FDLF      | A130#2NY.DVK02    | A130#2PQ.COMPITM   | A130#2VN.AFPO     |
| A130#2WA.SAMTT    | A130#2YS.MSPR      | A130#2ZG.DTELDOKT | A130#20G.EWUCOSUM  | A130#20P.P01CRP   |
| A130#213.DSYAMRK  | A130#27F.AFRD      | A130#28Z.J#1BNFNA | A130#29I.FDS1      | A130#3AL.LTEX     |
| A130#3DB.GLIDXA   | A130#3D4.AFFV      | A130#3EF.WKBP     | A130#3G6.LIPSP0    | A130#3KI.PPDIT    |
| A130#3LA.KBLE     | A130#3L5.AUBSI     | A130#3OL.USRSYSR  | A130#3SW.QBEW      | A130#3S5.CATSCO   |
| A130#3T9.RSDB     | A130#3WM.LIPS      | A130#338.VBREVR   | A130#34I.VIMIRA    | A130#4A1.COSL     |
| A130#4DW.QASV     | A130#4FZ.INDX      | A130#4GZ.FMCFEAS  | A130#4G2.USEG      | A130#4KX.RBDIFFME |
| A130#4N2.FDS2     | A130#4OV.FEBMS     | A130#4SH.ESSR     | A130#4WQ.BPEP      | A130#4YG.FMIO     |
| A130#40K.PYORDH   | A130#44U.USRSYSR   | A130#46S.EBAN     | A130#5BW.DRZO      | A130#5CC.BPJA     |
| A130#5CM.COSSP    | A130#5EB.VBSEGS    | A130#5E9.QMMA     | A130#5G5.P01CST    | A130#5KY.KBLK     |
| A130#5LR.VAPMA    | A130#5LV.PMSDO     | A130#5MZ.TCGSGP   | A130#5M0.BPTR      | A130#5OQ.VEDA     |
| A130#5PC.AGDB     | A130#5QT.J#1AINFI  | A130#5V6.PAYR     | A130#5WJ.VBPA2     | A130#5W4.VEIAV    |
| A130#5Z8.VTBFHAPO | A130#58E.COER      | A130#6GT.CLOI#MOD | A130#6PV.CECP      | A130#69B.VWBPEI   |
| A130#7C6.MCTBC#HI | A130#7HJ.WTADAB    | A130#7HP.COMEP    | A130#7KZ.SOER      | A130#7YB.COOI     |
| A130#7Y1.QASH     | A130#70A.SADR8     | A130#701.VTBFHAZU | A130#72A.SOFA      | A130#724.CD0ENT2T |
| A130#78K.HRPM001  | A130#8B5.AUFG      | A130#8CO.FMUDBSEG | A130#8E0.HRAAHDR   | A130#8F7.P01CBT   |
| A130#8GR.AFIH     | A130#8PG.SOMG      | A130#8PU.VWBKEI   | A130#8ZF.SLGH      | A130#86B.COFV     |
| A130#88S.SLINCACH | A130#9AG.FMUDKBLP  | A130#9EJ.PTEX2010 | A130#9KZ.MOFF      | A130#9N0.BPEJ     |
| A130#9S4.MCHP     | A130#9Y2.BSIM      | A130#9ZR.MYMP1    | A130#9Z4.FMCFAB    | A130#936.BKPF     |
| A130#98R.AUVZ     | A132#000.#SAP      | A133#000.#SAP     | A140#ABJ.SWWORGTA  | A140#ALA.PTIMEOV2 |
| A140#APP.FILCT    | A140#AP6.QAMR      | A140#ARE.EDIDOCIN | A140#ARQ.S013BIW1  | A140#ATM.ANLQ     |

Table 15 (Page 14 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                    |                   |
|-------------------|-------------------|-------------------|--------------------|-------------------|
| A140#AU1.S227     | A140#AYX.KSSK     | A140#A10.S002BIW2 | A140#A3B.BFIT#A0   | A140#A5E.CKIS     |
| A140#A6H.ARIX#BSI | A140#A78.WBRF     | A140#A8E.GLFLEXT  | A140#BBW.CDHDR     | A140#BF8.STXL     |
| A140#BGD.VBPM     | A140#BH0.GLFUNCP  | A140#BH8.S128     | A140#BM1.DVM01     | A140#BN6.S408     |
| A140#BOH.VEKP     | A140#BO6.SER05    | A140#BS0.SAPWLT00 | A140#BTO.S162      |                   |
| A140#BTQ.DSYS#PHC | A140#BVQ.S273BIW1 | A140#BZL.DRAT     | A140#B11.TXW#S#EK  | A140#B6L.TEVEN    |
| A140#B8I.PROW     | A140#B8W.RPSQT    | A140#B9Z.VBSEC    | A140#B90.SCGENAPP  |                   |
| A140#CBT.SWW#CONT | A140#CCC.QAKL     | A140#CGW.S031     | A140#CHO.TEXTLOG   | A140#CIU.S263BIW1 |
| A140#CMN.BFOK#AB  | A140#CO7.DRZOP    | A140#CR8.S263BIW2 | A140#CSE.VBFA      | A140#CSJ.S104     |
| A140#CUS.COSS     | A140#CUX.S094     | A140#CVD.FMCFAA   | A140#CW1.PBED      | A140#CXI.COSPD    |
| A140#CXM.S140     | A140#C0D.TEVEN#MO | A140#C0X.CKBOB    | A140#C1D.JVPO1     |                   |
| A140#C7R.TXW#S#CO | A140#C8I.S023     | A140#C9Z.PLSR     | A140#DAE.TKETRPRO  |                   |
| A140#DBC.TXW#S#VB | A140#DHW.S172     | A140#DJT.VDBEPI   | A140#DKK.TXW#S#BK  | A140#DKW.VZZKOKO  |
| A140#DMS.WTADPN   | A140#DSE.TXW#S#VB | A140#DTY.CKML1    | A140#DYA.JVSO1     | A140#DYE.S018     |
| A140#DYP.FCABK    | A140#D0U.WBO2     | A140#D4Q.PYORDP   | A140#D5U.DRAO      | A140#D80.J#1BNFST |
| A140#EB2.AUAK     | A140#EB8.HRAAITM  | A140#EDN.WBRL     | A140#EFN.S406      | A140#EFQ.KLIT     |
| A140#EIV.COSSD    | A140#E15.QASR     | A140#EJO.GLPCT    | A140#EK8.S129      | A140#ENJ.COIX#DAT |
| A140#EY9.S003     | A140#EZF.MONI     | A140#E3K.VIMI39   | A140#E5E.QALT      | A140#FCR.S091BIW1 |
| A140#FDG.JCDS     | A140#FG0.FMCFBPAK | A140#FH0.VTBLII   | A140#FMA.JVVOO1    | A140#FMK.S006BIW2 |
| A140#FNO.S029     | A140#FQC.T52STH   | A140#FS0.BP2000   | A140#FTG.CF001     | A140#FTL.S077     |
| A140#FTQ.DSYS#PHC | A140#FUQ.S152     | A140#FU0.T5CPB    | A140#FU5.T52OCP4   | A140#FX2.RESB     |
| A140#FZV.MLCR     | A140#F00.FMIFIIT  | A140#F1X.JVTO2    | A140#F21.BFOD#A    | A140#F3R.S304     |
| A140#F4A.WBHK     | A140#F4K.S116     | A140#F5R.IBST     | A140#F5T.J#1BNFDO  | A140#F6I.S270BIW2 |
| A140#F8A.SCPARTIC | A140#F8T.S402     | A140#F9G.PPOIX    | A140#F9S.RPSCO     | A140#GB4.S300     |
| A140#GCH.ISTBED   | A140#GFE.PTDW#QUO | A140#GJ9.NAST     | A140#GLM.S200      | A140#GLW.COFF     |
| A140#GPK.MCKALKW  | A140#GQ3.S021     | A140#GQ8.ACCTHD   | A140#GRE.S019      | A140#GS5.S098     |
| A140#GUN.GREP     | A140#GVE.SDOKPHCB | A140#GVV.MDSM     | A140#GW3.QAES      | A140#GXP.QAMB     |
| A140#GY3.FMIOI    | A140#G0L.VZZPARO  | A140#G2B.S225     | A140#G26.QMIH      |                   |
| A140#G6C.CKMLMV00 | A140#G61.BFOK#A   | A140#G8P.GLFLEXA  | A140#HBN.S226      | A140#HI0.S107     |
| A140#HLS.VFKONV   | A140#HLX.IMCKF    | A140#HL8.MSEG     | A140#HM9.FCABP     | A140#HQH.JVVOO2   |
| A140#HRX.MLCRP    | A140#HS7.GLFLEXP  | A140#HUR.FILCA    | A140#HVB.HIKO      | A140#HXJ.J#1BNFRE |
| A140#HXP.WTADP    | A140#H1E.S002BIW1 | A140#H19.J#1BNFLI | A140#H67.TXW#S#MS  | A140#IDV.PLAS     |
| A140#IB.SWW#CONT  | A140#IIC.S103     | A140#IL7.S006     | A140#IMM.WTAD      | A140#IOR.MCAFPOV  |
| A140#IPB.COFVP    | A140#IQ3.S165     | A140#ITI.FMSU     | A140#IUI.BFIT#A    | A140#IVT.S262     |
| A140#IVV.S001BIW1 | A140#IXZ.GGREFT   | A140#IYH.WBHE     | A140#IZ8.S028      | A140#I1J.VTBLIS   |
| A140#I1M.RBVDMAT  | A140#I29.S012BIW1 | A140#I3K.S126     | A140#I3L.J#1AWITH  | A140#I9C.KANZ     |
| A140#JBG.WBHP     | A140#JBK.PTEXDIR  | A140#JB5.MDTC     | A140#JDI.TXW#S#CO  | A140#JDR.WTAKPN   |
| A140#JEG.S195BIW1 | A140#JEW.S170     | A140#JG5.VBREVE   | A140#JIK.TST03     | A140#JJW.ARIX#BSA |
| A140#JM8.S005BIW1 | A140#JNC.COIX#DAT | A140#JN9.SFDG     | A140#JOQ.VBOX      | A140#JSM.S074     |
| A140#JVH.AD01DLIE | A140#JWR.TXW#S#EK | A140#JW4.S022     | A140#J21.RESTO     | A140#J33.S105     |
| A140#J5S.FMIA     | A140#KBD.DSYAT    | A140#KB0.TXW#INDE | A140#KEV.AUSP      | A140#K18.GLREFA   |
| A140#KJC.S261     | A140#KJ0.PTRV#DOC | A140#KM4.PTRV#SCO | A140#KN7.ACCTIT    | A140#KO9.DSYAX    |
| A140#KQY.TXW#S#VB | A140#KQ9.PTRV#SRE | A140#KZE.S093     | A140#KZK.S123      | A140#K0P.VDBEPI#E |
| A140#K00.FMBE     | A140#K3T.GLREFV   | A140#K38.COEJ     | A140#LAU.T8APP#GL  | A140#LBL.MSTA     |
| A140#LB6.S160     | A140#LCT.CF050    | A140#LD5.S198BIW2 | A140#LE5.DSYS#PHC  | A140#LGS.IMCC     |
| A140#LHZ.IBINVALU | A140#LNB.S198BIW1 | A140#LO9.MLCRF    | A140#LP1.S171      | A140#LFX.VTBDLFG  |
| A140#LSE.MHNK     | A140#LUQ.TKEPTRP  | A140#LXI.ARIX#BKP | A140#L0E.BDCP      | A140#L1Q.GLFUNCV  |
| A140#L6O.MCDX     | A140#L6Z.S159     | A140#L8R.ALPERFDB | A140#L80.SCSTATUS  | A140#L83.S110     |
| A140#L9C.SWP#HEAD | A140#MAK.S164     | A140#MC6.QAVE     | A140#MDW.MSM#COMM  | A140#MDX.S404     |
| A140#ME9.KBKO     | A140#MHN.ARIX#BSA | A140#MHV.S303     | A140#MJ7.TZIN2     | A140#MOB.MLPPF    |
| A140#MPA.S125     | A140#MPC.SOFM     | A140#MPN.WRPT     | A140#MRH.VIRPS406  | A140#MSL.S197BIW2 |
| A140#MSV.ISEG     | A140#MTH.LWRKOBJ  | A140#MUL.ASSHR    | A140#MXD.VBKD      | A140#M1L.KWBS     |
| A140#M40.S270BIW1 | A140#M44.AULW     | A140#M5E.S080     | A140#M5K.SDOKCONT  | A140#M66.S082     |
| A140#M8H.PTRV#ROT | A140#M8N.S262BIW2 | A140#M9P.TXW#S#AN | A140#M92.QASE      | A140#ND9.CNDB     |
| A140#NE5.TXW#S#VB | A140#NF7.S005BIW2 | A140#NF8.MDTB     | A140#NH.F.SERPLIST | A140#NI0.JVCO1    |
| A140#NKX.MLPP     | A140#NL2.S405     | A140#NN4.S261BIW1 | A140#NO3.BCKVWBEP  | A140#NP2.VWBEP    |
| A140#NSM.AD01DLIS | A140#NST.SWWWIHEA | A140#NT2.FSLST    | A140#NUF.S004BIW1  |                   |
| A140#NV5.PTRV#DOC | A140#N4J.T77REFDO | A140#N8L.JVTO1    | A140#N9N.DRZOC     | A140#N9O.TLDPS#CO |
| A140#N94.S062     | A140#OBO.COSPR    | A140#OBV.CKMLMV00 | A140#OB2.S196BIW1  | A140#OFJ.AFVU     |
| A140#OLK.S127     | A140#OLY.GLPCP    | A140#OL5.QPRS     | A140#OMB.WBRP      |                   |
| A140#ON2.TXW#S#BS | A140#OOF.GGREFA   | A140#OOX.TXW#S#LI | A140#OQO.T77VP     | A140#OQX.AUFM     |
| A140#OSN.SDOKCONT | A140#OS0.EDID3    | A140#OVJ.WBO3     | A140#OV4.CKMI1     | A140#OZX.ASSOB    |
| A140#OZZ.STERM#TE | A140#O18.S001BIW2 | A140#O2Z.CE4S001# | A140#O3W.QAPP      | A140#O4C.IWB1CONT |
| A140#P31.MCVSRFK  | A140#P4A.LOANREF# | A140#P51.VBAP     | A140#P8S.SWWUSERW  | A140#P85.S161     |
| A140#0AS.PBID     | A140#0B7.COIX     | A140#0EA.JVSO2    | A140#0E4.S003BIW2  | A140#0H9.S015     |
| A140#015.WRPL     | A140#0NI.TZIN1    | A140#0NJ.S260BIW2 | A140#0NW.S091      | A140#0RB.S011BIW2 |
| A140#0RQ.PTQUODED | A140#0RR.GGREFP   | A140#0SW.BFOD#AB  | A140#0TH.FDW1      | A140#0UX.S097     |
| A140#0V5.VDKOKO#E | A140#0WZ.S301     | A140#00K.MCAFVGV  | A140#000.ACCTCR    | A140#01D.AFVV     |
| A140#021.VIRPS405 | A140#02L.S069     | A140#038.VDBEPP#E | A140#051.GLFUNCU   | A140#07A.ECMCT    |

Table 15 (Page 15 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A140#07G.SWWWIDEA | A140#076.MARI     | A140#1AQ.VRSD     | A140#1CX.BSAD     | A140#1ER.GLREFU   |
| A140#1E3.MCAFKOV  | A140#1E7.VIRPS407 | A140#1FG.MCSFIS   | A140#1F6.PTRV#SHD | A140#1G7.BDSEER   |
| A140#1MC.TXW#S#AN | A140#1MF.IWB2CONT | A140#1M1.WTAKP    | A140#1PY.S015BIW2 | A140#1PZ.ESLL     |
| A140#1R7.KBED     | A140#1UZ.S027     | A140#1WX.AFRU     | A140#1XQ.BSAS     | A140#1Y2.LWRKSUB  |
| A140#12V.S261BIW2 | A140#130.S068     | A140#14W.CATDE    | A140#15P.S090     | A140#16C.S091BIW2 |
| A140#177.VEPO     | A140#2AP.S273BIW2 | A140#2A3.SADLSTRE | A140#2EP.IWBKEYWR | A140#2E2.WBHI     |
| A140#2FV.PCTEXTS  | A140#2GA.S102     | A140#2HN.CATSHR   | A140#2I4.VDAUSZ   | A140#2I9.CATN     |
| A140#2J0.S033     | A140#2LA.S026     | A140#2OP.MDHS     | A140#2QN.S015BIW1 | A140#2S0.IBSTREF  |
| A140#2VB.VBEX     | A140#2W5.TXW#S#MK | A140#2YU.VBUK     | A140#20N.S076     | A140#23T.TZIN4    |
| A140#23Z.BSID     | A140#233.FMIP     | A140#24Q.CCMBJLS  | A140#26S.FMICOHD  | A140#26Y.S079     |
| A140#3EA.IWBKEYWR | A140#3EL.REGUPW   | A140#3F5.S017     | A140#3GJ.S163     | A140#3GU.DRAP     |
| A140#3HT.PTRV#SAD | A140#3JE.MKPF#ARI | A140#3LA.SAPWLT00 | A140#3LT.QALS     | A140#3MF.ANEA     |
| A140#3OD.PBIM     | A140#3P9.DSYAS    | A140#3QU.EKEH     | A140#3S3.VTBLIE   | A140#300.GLFUNCA  |
| A140#337.S075     | A140#37E.MHNKO    | A140#37L.S100     | A140#4FF.AFCV     | A140#4HI.PMPL     |
| A140#4IZ.FMEP     | A140#411.J#1BNFFT | A140#418.FMIT     | A140#4MU.S092     | A140#4OZ.SDOKOWN  |
| A140#4PJ.PTDW#TIM | A140#4VG.CVDPH    | A140#4WO.S085     | A140#42E.VBSEGK   |                   |
| A140#42T.CCMOJKE  | A140#425.EDIDC    | A140#43N.S407     | A140#439.TST01    | A140#44A.ARIX#BSA |
| A140#45R.TXW#S#VB | A140#5CR.FDT1     | A140#5F4.COEP     | A140#5G4.TXW#S#LI | A140#5HP.S012     |
| A140#5JF.WBFX     | A140#5KH.FMICOIT  | A140#5QD.S099     | A140#5RR.S271BIW2 | A140#5R2.QDQL     |
| A140#5SG.SCAPPT   | A140#5VO.MSM#COMM | A140#5YC.TZIN3    | A140#5YN.VBSEGD   | A140#5Y2.WBRK     |
| A140#50E.S150     | A140#54U.BSIS     | A140#55Z.RQIT     | A140#550.DRZOI    | A140#58Q.S271BIW1 |
| A140#6BC.FMSP     | A140#6BJ.SAPWLT00 | A140#6FX.S013BIW2 | A140#6F6.HIMA     | A140#6JK.RBDRSEG  |
| A140#6JV.S262BIW1 | A140#6JW.S039     | A140#6KO.GLREFT   | A140#6NC.AUSB     | A140#6PI.CATSDB   |
| A140#6P6.LWRKKEY  | A140#6QC.ANLP     | A140#6TU.S263     | A140#6TV.COIFT    | A140#6VQ.S260     |
| A140#6V1.S302     | A140#6WC.S272BIW2 | A140#6W3.CKMLCR   | A140#60R.CE4S001# | A140#63N.APQD     |
| A140#657.S173     | A140#658.RBVD     | A140#698.S070     | A140#7B1.S272BIW1 | A140#7EI.S011BIW1 |
| A140#7ID.CFNNN    | A140#7K0.TXW#S#CO | A140#7MP.SOOS     | A140#7MX.T5A1Q    | A140#7NC.TXW#S#AN |
| A140#7NJ.ECMCA    | A140#7NN.DSYAD    | A140#7SR.TRIX#DAT | A140#7XC.S166     | A140#7XW.COSP     |
| A140#7YR.SOC3     | A140#7ZK.INOB     | A140#7Z9.TOADL#OL | A140#704.LTAK     | A140#72Z.PTIMEOV1 |
| A140#751.PDSNR    | A140#753.BSE#CLR  | A140#772.OPIT     | A140#777.WITH#ITE | A140#78N.S195BIW2 |
| A140#8BX.PB4003   | A140#8CI.VDBEPP   | A140#8DH.VTBZV    | A140#8FM.SOES     | A140#8F0.VIBEPP   |
| A140#8II.S006BIW1 | A140#8IM.CCMLOG   | A140#8KH.GRRT     | A140#8L3.S260BIW1 | A140#8MC.QAMV     |
| A140#8N1.S124     | A140#8O9.VBUP     | A140#8PL.GLREFFP  | A140#8PW.S016     | A140#8QO.FSLSTA   |
| A140#8QU.S096     | A140#8SB.S004BIW2 | A140#8SN.S024     | A140#8U4.SWWLOGPA | A140#80J.S065     |
| A140#84F.FMIFIID  | A140#84V.REGUH    | A140#855.S025     | A140#87D.CCMLOGD  | A140#87I.GLPCA    |
| A140#87Z.S131     | A140#9B0.DVM02    | A140#9CE.WBHD     | A140#9ER.S003BIW1 | A140#9GA.PLAF     |
| A140#9GZ.WTAK     | A140#9H1.S012BIW2 | A140#9IM.S063     | A140#9M3.GLFUNCT  | A140#9M8.EDIDS    |
| A140#9PU.CODB     | A140#9Q6.VZFGD    | A140#9VN.TEXLGA   | A140#9VU.VBLB     |                   |
| A140#9WT.PTDW#PWS | A140#90V.S032     | A140#90Z.S196BIW2 | A140#94B.KEKO     | A140#969.T52ST    |
| A140#97F.AUFI     | A140#97L.LOANREF# | A140#98P.CKMPLP   | A140#98Q.VDBEKI   | A140#997.HIVG     |
| A141#000.#SAP     | A142#000.#SAP     | A143#000.#SAP     | A200#ABQ.T618ME   | A200#AB6.CICCCONF |
| A200#ACA.T77ZZ    | A200#AC7.BTXOVFR# | A200#ADO.TILG1    | A200#AFJ.T8J7E    | A200#AGH.SANO1    |
| A200#AH3.T001RWT  | A200#AJN.T5M5G    | A200#AKC.T5KTS    | A200#AK6.SCURX    | A200#ALP.TIV87    |
| A200#ANW.TZB22T   | A200#AOM.T706ESS1 | A200#APC.T007R    | A200#AQP.TKETRLGX |                   |
| A200#ARN.CMPPARAM | A200#ARQ.CCMCTIAD | A200#ARX.CACCEL   | A200#ASJ.TDIPR    | A200#ASK.TZKN2T   |
| A200#ATX.T5PPT    | A200#ATZ.TKENC6   | A200#AU7.CPRTYPET | A200#AVC.T599U    | A200#AVE.TMFA     |
| A200#AWM.MDRP#MEN | A200#AW9.DUEFL#TA | A200#AXL.CRVAR2   | A200#AYF.TWIC0200 | A200#AYR.TIV92    |
| A200#AYT.CD0BASUN | A200#A0P.T5ITNI   | A200#A0T.TSKTF    | A200#A1L.TRAN2    |                   |
| A200#A2N.MDRP#DAR | A200#A2X.J#1AINFT | A200#A30.T044D    | A200#A3U.T803H    | A200#A4T.TZ39     |
| A200#A4Y.J#1AINFT | A200#A49.EVMT#VS  | A200#A5A.SPTHB    | A200#A5D.T661K    | A200#A5M.T163X    |
| A200#A5T.LANG#MAN | A200#A5Z.AQXINTA  | A200#A50.T011T    | A200#A51.T811PC   | A200#A65.LDK03    |
| A200#A7B.TF003    | A200#A7C.TZ29     | A200#A8N.TKEVVR1  | A200#A9D.T801F    | A200#BA2.T8G30B   |
| A200#BCU.TCPFS2   | A200#BDH.T5M1A    | A200#BEE.TWPFIT   | A200#BEY.T5DC7T   | A200#BFE.EVFL#VS  |
| A200#BGK.TIVC1    | A200#BGZ.T556D    | A200#BHE.ANAT     | A200#BHP.T5J75    | A200#BHU.T5D0V    |
| A200#BH8.T8G21A   | A200#BIL.TIVKUE1  | A200#BJW.TMSCSYS  | A200#BLL.ROAPPLT  | A200#BMN.T7FRFFT  |
| A200#BMP.T7EHS00# | A200#BMU.TZB24    | A200#BM2.TKEBPSF  | A200#BPE.T51D5    | A200#BRB.TIV9H    |
| A200#BRD.T856Y    | A200#BRK.TWRF3    | A200#BSL.TONR     | A200#BTV.TKEZV    | A200#BUY.TKCVST   |
| A200#BU2.TIVROZ07 | A200#BV2.TXW#C#VO | A200#BWY.TKSR4H   | A200#BX6.CCMACTPR | A200#BYB.TKB9B    |
| A200#BY2.T689K    | A200#BZC.TIVC9T   | A200#BZH.T059OT   | A200#BZ2.MDRP#VIE | A200#B0X.T554R    |
| A200#B1X.TBD03    | A200#B11.ADMI#CRI | A200#B2J.T8J7D    | A200#B3T.RSMMETYP | A200#B5X.T5UGJ    |
| A200#B6F.TKFP     | A200#B65.HRWFPUSR | A200#B8M.PSJHIEDA | A200#B8R.MDRP#NOD | A200#B89.T8G30AT  |
| A200#B9C.TCEVERS  | A200#B9U.T048Y    | A200#CBT.DTINP    | A200#CB8.TZ35     | A200#CC2.TLDPS#PH |
| A200#CDD.TIV88    | A200#CDE.RODCHABA | A200#CDH.T5DWT    | A200#CDI.TABVAT   | A200#CDV.T811DS   |
| A200#CF2.TVDTX    | A200#CGO.ARCID#CU | A200#CGQ.USR07    | A200#CG7.TMC7K    | A200#CHI.T5M8I    |
| A200#CHK.USZBVLND | A200#CHS.EUAVHELP | A200#CID.T77CART  | A200#CIP.T5N5T    | A200#CIX.T059C    |
| A200#CI0.T445C    | A200#CI8.TRSE1    | A200#CJ9.TOAP2    | A200#CKW.THERK    | A200#CLB.T801S    |
| A200#CLM.T5DCI    | A200#CLQ.TVFBWAF  | A200#CL2.ROIDOCPR | A200#CME.WITH#CTN | A200#CMG.TCO47    |
| A200#CMJ.TKEPDARK | A200#CMM.SELARTDE | A200#CMR.T689     | A200#CMV.T77ALE#D |                   |

Table 15 (Page 16 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                    |                   |                   |
|-------------------|-------------------|--------------------|-------------------|-------------------|
| A200#CN8.CSRCCONS | A200#COF.TJ02V    | A200#COT.CKMLAB01  | A200#CO0.TDLO     | A200#CQJ.T5KIN    |
| A200#CQM.TWETT    | A200#CRV.TB210T   | A200#CSA.TVZ05BT   | A200#CSZ.AT05     | A200#CS9.T80DT    |
| A200#CUN.T093R    | A200#CUX.T5DWVT   | A200#CVJ.T5KTE     | A200#CV0.T5KYR    | A200#CYF.DBCKREPD |
| A200#CYO.J#1AOTDE | A200#CZG.T6WP2T   | A200#CZJ.QDPA      | A200#C0M.GST04SRV | A200#C0W.T044I    |
| A200#C1T.T162B    | A200#C2P.T082I    | A200#C3I.TMSPCONF  | A200#C3J.TMCE     | A200#C6F.TIV2C    |
| A200#C7D.T167C    | A200#C8T.CKMLMV01 | A200#C8U.TSKT3     | A200#C81.TIVAGT   | A200#C97.AQLSCAT  |
| A200#DAW.TIV48    | A200#DA3.TIVA9    | A200#DA5.TCARA     | A200#DA6.TF090    | A200#DCT.T8G21    |
| A200#DDF.TXW#C#V3 | A200#DD5.PKEN     | A200#DFB.VRSTABC   | A200#DFL.T059ZT   | A200#DG0.T706ESS2 |
| A200#DHB.CPNTYPET | A200#DHG.TIV9G    | A200#DHI.TIVAI     | A200#DKQ.T811D    | A200#DLZ.TCETARG  |
| A200#DOY.T5PP1    | A200#DPQ.TIVVA    | A200#DPS.TIVAG     | A200#DQJ.TDICO    | A200#DR0.TZB30T   |
| A200#DSB.TKCOR    | A200#DSU.T5KFT    | A200#DS8.QDPP      | A200#DTH.MDRP#CON | A200#DTP.TA20P11  |
| A200#DT1.T8A60    | A200#DUH.TIVROZ03 | A200#DUP.TIVROZ0I  | A200#DVE.TIVSA    | A200#DWM.TTTAB    |
| A200#DW5.SXDA0T   | A200#DXI.TCKMLBNK | A200#DX4.TIV68     | A200#DY0.T7EHS00# | A200#DZE.TIV86    |
| A200#DZQ.T80IT    | A200#DZ8.T445ZT   | A200#D0P.TWAT      | A200#D13.T7PM0    | A200#D24.MASSVARD |
| A200#D26.T77EOPT  | A200#D30.T258T    | A200#D35.TKEBPFL   | A200#D4D.SPH#SERV | A200#D4J.J#1AINFT |
| A200#D4L.CKMLMV00 | A200#D40.TZR96    | A200#D5E.ACT#ASPE  | A200#D5G.QIMTHT   | A200#D6Y.TKSR1H   |
| A200#D64.T005G    | A200#D7B.TIVAR1   | A200#D93.TZB2V     | A200#EAW.ROMSDIOB | A200#EA7.TCKMIT   |
| A200#EBU.SHDDC    | A200#EDD.TSAUM    | A200#EDJ.T5ITNR    | A200#EEO.J#1ASNRD | A200#EGO.TEMSG    |
| A200#EGT.T012D    | A200#EG7.TIV9B    | A200#EH2.TQ75T     | A200#EIH.T5J14    | A200#EIZ.TFCG     |
| A200#EKQ.T520CP2  | A200#EKW.T883S    | A200#EKZ.TRF1C     | A200#ELE.T5UF1    | A200#EMC.T811G    |
| A200#ENP.TT3X40   | A200#ENX.TLDPS#CO | A200#EO3.TIVROZ0G  | A200#EP4.TZB30    | A200#EP5.TCVPROF  |
| A200#EQK.TSP06T   | A200#EQX.TCUSTYPT | A200#ERR.CKMLMV00  | A200#EVV.CRVM#A   | A200#EWF.TZB22    |
| A200#EWG.KONX1    | A200#EX1.CKMLMV01 | A200#EYU.TC54T     | A200#EY1.VTBDPM   | A200#EZV.OIB01T   |
| A200#E0Q.FMFCF1   | A200#E1M.T5UF4    | A200#E17.TIVCD     | A200#E7E.CICCCONF | A200#E8S.T5J43    |
| A200#E8Z.TFAG     | A200#E83.VBWF12   | A200#E9I.TBE11     | A200#E9K.TSPG4    | A200#E9N.TF515    |
| A200#E94.TIVBA    | A200#E95.TSPP1    | A200#FAA.LANG#EXP  | A200#FAH.ATARCHIV | A200#FA6.TXW#C#SO |
| A200#FB1.TVKV     | A200#FCX.AT90     | A200#FC4.T165S     | A200#FDG.AIC#VBRK | A200#FDI.CCMCTIQU |
| A200#FDP.T5N2L    | A200#FDZ.EWUWAERT | A200#FE7.QDPKT     | A200#FGU.INDEXA   | A200#FGZ.VZWDVL   |
| A200#FHA.CICTOOLB | A200#FHJ.TCAPM    | A200#FHZ.TWSVT     | A200#FIQ.TMATY    | A200#FI2.TVFAW    |
| A200#FJA.TPMIM    | A200#FJS.KCDEKEY  | A200#FKH.TZB21T    | A200#FK2.TDIMCT   | A200#FK0.TKCONTRO |
| A200#FLG.TCREP    | A200#FLH.T801B    | A200#FLN.VZBAVF    | A200#FL0.TIVCA    | A200#FMG.T7HK04   |
| A200#FMH.TDKWG    | A200#FMN.T5UGK    | A200#FMX.T811P     | A200#FOC.T5ITNQ   | A200#FOR.DB2MON   |
| A200#FOZ.T879P    | A200#FO4.TWEK     | A200#FP0.TVDST     | A200#FQR.TIVROZ10 | A200#FRT.JBRBFART |
| A200#FSU.TIVA3    | A200#FS5.TWPTYT   | A200#FTA.PTEXLOG   | A200#FT5.DBCHECKO | A200#FUM.T703X    |
| A200#FVK.JBDMKAP  | A200#FZG.FMFCF2   | A200#F10.TMY01     | A200#F3A.TZKN8T   | A200#F4K.T514F    |
| A200#F47.TXW#C#V2 | A200#F5B.TIARS    | A200#F5I.T044J     | A200#F5L.T5D4S    | A200#F8N.JBDMKTS  |
| A200#F82.T684T    | A200#F9E.TJ01V    | A200#F9P.MDPUW     | A200#F9Z.TIVROZ09 | A200#GAD.TWEA     |
| A200#GAS.DSYS#XPR | A200#GBI.RODTIM   | A200#GC2.TTSTRT    | A200#GEP.T042EA   | A200#GER.TMSCTOK  |
| A200#GIA.VZBAV    | A200#GIL.T5UF2    | A200#GIO.CKMLMV00  | A200#GJQ.T52SES#C | A200#GKQ.T5KCC    |
| A200#GK2.T5J57    | A200#GLN.T162V    | A200#GMO.TZB5V     | A200#GMT.TKCCO    | A200#GMX.TA20NC1  |
| A200#GNR.T5KAM    | A200#GOY.T148Z    | A200#GO3.DBSYCHKD  | A200#GP1.TLDPS#CO | A200#GP4.TKSR3H   |
| A200#GQY.CICTOOLB | A200#GRL.TCNBT    | A200#GSD.ATO1      | A200#GSH.T77EP    | A200#GTQ.T51D3    |
| A200#GTT.TDUMY    | A200#GUT.EWUPRAEF | A200#GVP.TZS26     | A200#GWH.TIWOL    | A200#GWM.TA20P    |
| A200#GX7.RODIOBJ  | A200#GYO.MDRP#MAP | A200#GZL.LANG#AV   | A200#GZR.IACVERST | A200#GZ5.TWRF2    |
| A200#GZ9.REPPSCRN | A200#G1D.ATORT    | A200#G15.TF002     | A200#G2J.TA20PPI  | A200#G25.TOA02    |
| A200#G3H.T5PTT    | A200#G3S.T5N2H    | A200#G37.TDPZZ     | A200#G4V.TCNDB#PS | A200#G6F.TCN54    |
| A200#G6R.EWUCUKEY | A200#G7K.TAI03    | A200#G7S.SPHT      | A200#G78.T162G    | A200#G8J.TXPR1    |
| A200#G9I.LDK01    | A200#G9Z.TIVROZ0F | A200#HAQ.TIVB8     | A200#HA6.TQ85     | A200#HCY.TMCBIW   |
| A200#HC8.T028N    | A200#HEF.T242Y    | A200#HE4.TCSCRK    | A200#HFC.FMHVMTXT | A200#HFI.TWPUTT   |
| A200#HGO.SXDA2    | A200#HHC.T165U    | A200#HHX.CCMCLBC   | A200#HII.TMSCDES  | A200#HIU.TIV99    |
| A200#HK1.CSRCFCAL | A200#HLR.T77EHT   | A200#HNX.TIVC2     | A200#HOE.TZB28    | A200#HOH.TCPFS4T  |
| A200#HO8.LANG#OL  | A200#HPZ.T159A    | A200#HP3.TKETRND   | A200#HRQ.T097JP   | A200#HS3.AUFLAY1  |
| A200#HTK.TCERS    | A200#HTU.OICQTT   | A200#HUO.TMATT     | A200#HVA.MCLIV    | A200#HVK.T7PHSC   |
| A200#HV5.T059U    | A200#HWV.TWEAT    | A200#HW2.CKMLMV00  | A200#HX2.T703S    | A200#HYX.TDIM     |
| A200#HZJ.T5ITNY   | A200#HZ0.T811R    | A200#HZ1.T260S     | A200#HZ3.TKETD1   | A200#H1A.RPGRI    |
| A200#H10.TCAPT    | A200#H17.TTCDS    | A200#H2A.WRFT2     | A200#H2S.TZB3V    | A200#H3S.TCJO3    |
| A200#H30.TIV9F    | A200#H41.TKSR2H   | A200#H5I.T005F     | A200#H6J.IACSERVI | A200#H7F.T5W1V    |
| A200#H7T.LANG#PEX | A200#H7X.T5A1R    | A200#H76.UTSEGDAT  | A200#H8P.TRSE2    |                   |
| A200#H8Q.CKMLAB02 | A200#H86.SWUTYP2A | A200#H98.TLSY8     | A200#IBC.CCMCCONT | A200#ICF.CCMCBQUE |
| A200#IEC.T7EHS00# | A200#IFG.ATLPG    | A200#IHT.T165M     | A200#IH7.TCEDELI  | A200#IIW.TA20NH1  |
| A200#IK0.TIV18    | A200#IK1.CCMCTIBK | A200#IK2.T5P1R     | A200#IK7.SXDA2T   | A200#INA.CCPROFSR |
| A200#INW.TIANP    | A200#IN8.SNCSYSAC | A200#ION.T5S3H     | A200#IO6.TCATSA   | A200#IPA.T702K    |
| A200#IPM.TCO48    | A200#IPW.T7FRFF   | A200#IQS.TRACOLCU  | A200#ISM.AT09T    | A200#ISP.T042OFI  |
| A200#ISU.AT03T    | A200#ITG.TA20NRF  | A200#IT7.T5DW0     | A200#IUN.HRS1220  | A200#IVK.USCOMPAN |
| A200#IVL.T811S    | A200#IVT.TCB03    | A200#IWT.HCCMCTIBK | A200#IW9.TKEQUOT  | A200#IXR.T165E    |
| A200#IX6.TKFPAT   | A200#IYT.EBACONTX | A200#IZP.TMCWWT    | A200#IZ5.TKETD1T  | A200#I1A.RSMVTDET |
| A200#I16.TPARU    | A200#I2W.SHDTTCI  | A200#I34.TZS27     | A200#I4K.TZB26    | A200#I5C.T042OFIT |
| A200#I5Z.EWUCUDEL | A200#I50.ET002    | A200#I57.TIVA6     | A200#I6A.T7PMT1   | A200#I6B.TRK1T    |

Table 15 (Page 17 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                    |                   |                    |
|-------------------|-------------------|--------------------|-------------------|--------------------|
| A200#I6C.VTBDFC   | A200#I63.TZRPT    | A200#I65.TKENC4    | A200#I66.TKEPSZKT | A200#I8E.TIV100    |
| A200#I86.TIVC5    | A200#I9B.TKENC1   | A200#I96.T5M1B     | A200#JAC.MASSVARS | A200#JAH.T5J76     |
| A200#JAI.RODKYF   | A200#JBQ.TCUPOSN  | A200#JC1.T5ITN9    | A200#JC3.TMSCNFS  | A200#JD4.T7PMP     |
| A200#JD5.THSTC    | A200#JEK.T803F    | A200#JE3.T618MET   | A200#JGN.JBD1T    | A200#JIO.TCKMHD    |
| A200#JJJ.TIV05    | A200#JJN.TKSR1    | A200#JL6.TVFBWA    | A200#JMM.TVSGT    | A200#JMQ.T258Z     |
| A200#JND.T5KMX    | A200#JN1.CICPROFI | A200#JN5.TCN53     | A200#JQ9.T811DA   | A200#JRK.TA20PSH   |
| A200#JR0.TVTRT    | A200#JTW.TRNSPACE | A200#JUS.TA20PSF   | A200#JVI.T514X    | A200#JWA.T167V     |
| A200#JW7.AUFLAY0  | A200#JXP.TKEQUS1  | A200#JYD.TKCVS     | A200#JYV.TZ02B    | A200#JZQ.TKETD2    |
| A200#J02.TTZDT    | A200#J04.TZBPV    | A200#J1J.GODIRLOC  | A200#J2C.JBDMKTA  | A200#J2G.T5CB0     |
| A200#J2I.TZSZ1    | A200#J2L.TCERT    | A200#J2W.ESHDG     | A200#J4Z.MDSEQ    | A200#J47.TIV67     |
| A200#J50.VCLSTRUC | A200#J6P.RODCHA   | A200#J61.TVFBWG    | A200#J7O.PA0415   | A200#J8C.TKRSTR    |
| A200#KAH.TKA3G    | A200#KAN.TIVROZ02 | A200#KA2.T7EHS00#  | A200#KCQ.WMPRT    | A200#KC3.TKEPLEXI  |
| A200#KDL.TDICO#T  | A200#KEX.CCMCCPRO | A200#KE1.TF517     | A200#KE6.TWEKT    | A200#KFT.T7HK5N    |
| A200#KKG.TLDPS#TA | A200#KG9.OICQCT   | A200#KH7.RKOCLMIG  | A200#KIA.ALE#DWM# | A200#KJX.T7PHSM    |
| A200#KK9.T811F    | A200#KMA.QISTPT   | A200#KMX.AQLTS     | A200#KM8.T7EHS00# | A200#KN8.TZSZ5     |
| A200#KOO.TIVROZ0B | A200#KQO.T5J42    | A200#KQV.TKE1PP51  | A200#KQ1.TCERELE  | A200#KRH.TKCOTR    |
| A200#KR5.TKEHA    | A200#KSW.TA20NRHS | A200#KS1.TMCBIWU   | A200#KTS.TWIC0100 | A200#KT0.TFRC2     |
| A200#KU7.TPVAR2   | A200#KVH.TCVPROFD | A200#KWD.TKACPS    | A200#KWK.CCMCLBC# | A200#KX9.TOASM     |
| A200#KYR.T8J7G    | A200#KZE.T618EM   | A200#KZ9.MASSTAB   | A200#K0W.TXW#C#V4 | A200#K1G.TLDPS#LA  |
| A200#K1H.TSPOE    | A200#K1W.TMSMCONF | A200#K2A.TIVBH     | A200#K29.CSRCCONT | A200#K3P.VLB#DFDE  |
| A200#K48.TVFAP    | A200#K6G.TCESYST  | A200#K6J.TPVAR1    | A200#K7A.TZB7V    | A200#K72.ATXVO     |
| A200#K78.T048X    | A200#K8I.T5DWPT   | A200#K8U.T5UF0     | A200#K8W.TA20NRC  | A200#K85.TZB21     |
| A200#K9V.CRV5#A   | A200#LA5.CKMLMV00 | A200#LCG.TXW#C#GL  | A200#LCI.AT72     | A200#LCJ.TKEPSZK   |
| A200#LCN.VDORDER  | A200#LCW.VCLSTRUD | A200#LC5.SXDA1     | A200#LC7.RSTMETYP | A200#LDI.MDRP#NOD  |
| A200#LDM.EWUWAERT | A200#LD4.PATN     | A200#LET.TMFS      | A200#LFE.FMFCF0   | A200#LGA.T7FRFAT   |
| A200#LHG.AUFLAY2  | A200#LIH.SDPROTCA | A200#LII.TZ28      | A200#LIK.T5N20    | A200#LIN.T5KOT     |
| A200#LIR.T77CRT   | A200#LJK.MASSAENA | A200#LJV.EWULC     | A200#LXX.TZUSA    | A200#LLL.TIV42     |
| A200#LMR.TIV6F    | A200#LNA.REPPAPPL | A200#LNW.T5ITNW    | A200#LOQ.DF63S    | A200#LOR.TKEQUS3   |
| A200#LO8.TDUMMY   | A200#LPM.J#1ASNRT | A200#LPZ.T7036     | A200#LRJ.EDPPV    | A200#LRK.TEDS2     |
| A200#LSN.T811C    | A200#LTG.TIVBG    | A200#LT8.GRIX#SRC  | A200#LU2.KCVART   | A200#LVR.T883      |
| A200#LXH.T5W4B    | A200#LXO.TKEPPLSZ | A200#LXR.T5M5F     | A200#LXT.VZBAVV   | A200#LX8.TSPP0T    |
| A200#LYN.TIV98    | A200#LYQ.ADMI#APP | A200#LYX.T445NK    | A200#LY2.T52SM    | A200#LZN.HRSPUSR   |
| A200#L1Z.INDEXZ   | A200#L14.ROIIST   | A200#L4G.T5LER     | A200#L4T.T260     | A200#L6I.T8G22     |
| A200#L60.TIV75    | A200#L64.IACKEYCO | A200#L8B.T5F6M     | A200#L8M.LDK04    | A200#L9H.T881W     |
| A200#L92.LANGTR2  | A200#L93.NRIV#RES | A200#L96.AQGS CAT  | A200#MAJ.AQGTB    | A200#MAK.CICCONF   |
| A200#MAW.JBRBFART | A200#MBM.CCMCBQPR | A200#MBU.T689T     | A200#MBZ.AT72T    | A200#MB1.SELARTDE  |
| A200#MB3.T7AR65   | A200#MCP.TWPPK    | A200#MCY.T883T     | A200#MDG.T059REXT | A200#MDM.LDK00     |
| A200#MDN.TIVS1    | A200#MDR.TMFAT    | A200#MD1.BFUSER#T  | A200#MD8.EBACONTX | A200#MEN.TA20PI    |
| A200#MEU.TMSPVERS | A200#MEV.T5F6L    | A200#ME0.T165F     | A200#MFN.COPARAM  | A200#MGT.TWSST     |
| A200#MIO.T084     | A200#MJ0.TIV83    | A200#MJ8.TQ42      | A200#MK2.TIVROZ0H |                    |
| A200#MK4.CCMSCRVA | A200#MLX.CICPROFM | A200#MMV.THLPX     | A200#MMY.MERGECLI |                    |
| A200#MNX.CCMCSEAR | A200#MN4.J#1AINFT | A200#MO8.DBCHECKD  | A200#MQM.EDMMS    | A200#MQ0.KCDEFI LE |
| A200#MRC.CPNTYPE  | A200#MRK.J#1AAT08 | A200#MRR.T165A     | A200#MRV.AUTHUPD  | A200#MTU.PA0172    |
| A200#MT4.T022T    | A200#MUQ.TIVB7    | A200#MUU.TKEBPFM   | A200#MVC.TIV66    | A200#MWK.ATV02     |
| A200#MWR.TXW#C#V2 | A200#MXB.LISCOPAK | A200#MXF.TXW#C#V0  | A200#MXV.PA0270   | A200#MYP.TQ41      |
| A200#MZ3.T371E    | A200#M0E.RODIOBJC | A200#M0R.T005H     | A200#M0X.EWUCUKTX | A200#M13.KONDD     |
| A200#M2X.TZB29    | A200#M3F.TZB27    | A200#M3L.T167B     | A200#M3R.T888T    | A200#M3W.TZ39B     |
| A200#M35.TCKMLBNK | A200#M4L.TDL3     | A200#M56.ROIISGEN  | A200#M6Y.SQLT#IND | A200#M84.LOGIC#DE  |
| A200#M9Q.CKMLMV01 | A200#NAP.TSWST    | A200#NBP.VBWF11    | A200#NCV.T661T    | A200#NDH.TIVC6     |
| A200#NDN.TZS03    | A200#ND6.TKEPPI   | A200#NEH.CCMCBQPR  | A200#NEN.T5DWN    | A200#NE1.WITH#CTN  |
| A200#NF3.SMLG     | A200#NGH.T811DH   | A200#NGI.RSTVTDET  | A200#NIZ.T044G    | A200#NJD.T5M19     |
| A200#NJ9.TDP0     | A200#NKC.TCOBA    | A200#NLT.TVFBWGT   | A200#NMO.AQXINTT  | A200#NNV.TIVROZ04  |
| A200#NN0.AUFLAY3  | A200#NPB.BRACNTL  | A200#NPX.RSCONREL  | A200#NQ0.TDICT#T  | A200#NRH.T5BVH     |
| A200#NR1.TZ27     | A200#NSA.TKETRLX  | A200#NSR.T8G30A    | A200#NTE.SXDAO    | A200#NTH.TCP0D     |
| A200#NTW.T77EZOPT | A200#NVF.TPVAR1T  | A200#NVY.TFIN200   | A200#NV8.TOASB    |                    |
| A200#NW9.CCMCBQUE | A200#NXT.T5K0S    | A200#NY2.T5D80     | A200#NZL.T004M    | A200#N0U.T059V     |
| A200#N15.TFIN201  | A200#N19.T5M17    | A200#N4H.TPFO2     | A200#N6B.ARCH#REP | A200#N6G.TKES      |
| A200#N6U.SWUFORMT | A200#N74.TF516    | A200#N9R.T060L     | A200#OBK.RSMREPLE | A200#ODW.T801Q     |
| A200#OEJ.T630T    | A200#OFY.TA20NF   | A200#OGG.CKMLAB01  | A200#OHM.TQREO    | A200#OIM.TWPPKT    |
| A200#OIR.TZ36T    | A200#OKB.BTXPURGE | A200#OK0.TIVCG     | A200#OLQ.ARCH#SER | A200#OLV.BTXOVFR   |
| A200#OMD.TIVKUE2  | A200#OMQ.MERGEDIR | A200#ONC.ROIIS     | A200#ONR.TKETD21  | A200#ON5.TZB24T    |
| A200#OPL.TIV82    | A200#OTG.TXW#C#VO | A200#OT7.CICFH CAS | A200#OUE.KONX     | A200#OUU.VVBAG     |
| A200#OUY.T048W    | A200#OV5.T5KTT    | A200#OWU.TMFST     | A200#OW5.TDIEX    | A200#OXK.T5N2I     |
| A200#OYU.T3620    | A200#OZE.TMKV     | A200#OZT.T148ZT    | A200#O0P.TCN52    | A200#O03.TCB06     |
| A200#O1C.TIV40    | A200#O1L.T77ALE#I | A200#O1Q.TKEQUO    | A200#O18.T5KTR    |                    |
| A200#O24.MDRP#MEN | A200#O36.T5KMT    | A200#O4H.VTBLMCID  | A200#O6F.LISAKTTX | A200#O6M.T311A     |
| A200#O6W.TIV69    | A200#O7S.T5KSP    | A200#O9B.FMHVMTXT  | A200#O9Y.T5P3L    | A200#P0A.RODUNI    |
| A200#P0Z.T059FB   | A200#P3F.TCVPROFT | A200#P3R.TIVBC     | A200#P4T.TKEDRS   | A200#P44.T5M8R     |

Table 15 (Page 18 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A200#P48.R2AUFNR  | A200#P5H.TVARH    | A200#P51.TFAGT    | A200#P6H.CKMLMV01 | A200#P6R.WRFT1    |
| A200#P9L.TA20NRH  | A200#P9S.TZB23    | A200#P9Z.TRVOR    | A200#0AB.TCNB     | A200#0BO.TPNNR    |
| A200#0BV.T77KT    | A200#0B9.T042C    | A200#0EF.INFCFGDB | A200#0E2.TZDG3    | A200#0E8.LCONVT   |
| A200#0FI.T811L    | A200#0FL.TIV1R    | A200#0F2.T007I    | A200#0F4.J#1AINFT | A200#0G4.TCETRAL  |
| A200#0HR.TLHIZU   | A200#0H3.CMP#EXCE | A200#0IX.CRV#B    | A200#0I2.TSPG3    | A200#0KB.TIVB5    |
| A200#0K4.MASSNAME | A200#0NY.TIVBI    | A200#0OQ.TA20PS   | A200#0OS.T5N5S    | A200#0OT.TDICT    |
| A200#0PI.VITXT    | A200#0PJ.T028O    | A200#0PT.TILGA    | A200#0P2.TWRF3T   | A200#0P3.SHDTT    |
| A200#0QO.TA20NHS  | A200#0QV.TWEZT    | A200#0SF.RSTREPLE | A200#0SY.TCBP#SOP | A200#0S7.FRUN     |
| A200#0TC.TIVKUE3  | A200#0TW.T5E60    | A200#0T3.T390#OT  | A200#0T4.TB210    | A200#0UO.T7EHS00# |
| A200#0UO.T52SES   | A200#0VC.VTBDFFT  | A200#0VZ.TKMPLEXI | A200#0V6.PFFCT    |                   |
| A200#0WB.CCMAUTHP | A200#0WJ.T549P    | A200#0WR.TKETD11  | A200#0W8.J#1AAA2T | A200#0XL.KCSLV    |
| A200#0X2.TBP2B    | A200#0YA.J#1AINFT | A200#0YF.T5DWET   | A200#0Y4.TIVC7    | A200#0ZC.T5PTV    |
| A200#0ZF.SXDA1T   | A200#0ZN.TCURW    | A200#0ZY.AQXINT   | A200#0Z3.T5PFN    | A200#00Y.VZBAVZ   |
| A200#000.ACDIAGSH | A200#01F.LISCOPAZ | A200#02C.TZ28T    | A200#024.T630     | A200#03Y.T5M16    |
| A200#04R.TFIO2T   | A200#04V.DBMSGDB6 | A200#05I.BUFCHCK  | A200#05Q.T77EH    | A200#06C.CPRTYPE  |
| A200#07A.T7AR46   | A200#07V.T7AR55   | A200#089.TCPFS5   | A200#09C.TCPFS1   | A200#09P.TRBRG    |
| A200#090.AT85     | A200#096.T5N2K    | A200#1AS.TKENC5   | A200#1BJ.T022F    | A200#1B0.CCMSCRPR |
| A200#1B1.VTBLMCID | A200#1CN.FM01E    | A200#1CQ.CCMCSEAR | A200#1CX.EVCE     | A200#1DD.T167F    |
| A200#1D4.SWU5#DYN | A200#1EI.FMCF5B   | A200#1ET.TKZUTR   | A200#1EZ.TZB29T   | A200#1E7.LDA01    |
| A200#1GP.T7PMY2   | A200#1G7.TTZX     | A200#1HV.TIVROZ0E | A200#1IQ.IWBENTRY | A200#1I6.TIVC8    |
| A200#1I8.T5DW1T   | A200#1JM.T802D    | A200#1KY.T559S    | A200#1K6.T5W1X    | A200#1LN.TWEZ     |
| A200#1MD.T8G01T   | A200#1MG.SCURR    | A200#1MQ.CRVD#A   | A200#1M8.VTPRST   | A200#1N5.VBUST    |
| A200#1QM.LANG#TEX | A200#1QQ.TZIETEST | A200#1QX.T410     | A200#1RC.TIVM2    | A200#1RD.J#1AGICD |
| A200#1RF.CRV#B    | A200#1RV.INFCFGTH | A200#1TC.T5KET    | A200#1TO.T569U    | A200#1U1.T5D8N    |
| A200#1VQ.TTXB     | A200#1XD.T7EHS00# | A200#1XV.EVMTT#VS | A200#1ZT.TZ37     | A200#10L.CKMLAB01 |
| A200#11U.CVCHS    | A200#12G.TIVROZ08 | A200#12M.TZB6V    | A200#12N.RSMDELDT | A200#13E.SHDDF    |
| A200#13L.ARCH#RPR | A200#14A.CKMLMV00 | A200#14L.OICQC    | A200#14M.T011     | A200#146.AT09     |
| A200#157.VTBPROD  | A200#16H.T7EHS00# | A200#17Q.T71GST   | A200#173.TRNSPACE | A200#175.T77EJ    |
| A200#19V.T241Y    | A200#2D7.TCECLILY | A200#2EW.CICFSCAS | A200#2F0.ATMA     | A200#2GY.T5DWI    |
| A200#2I0.VDPNNR   | A200#2JU.J#1AAA2  | A200#2JZ.CCMCTIQU | A200#2JU.LDK02    | A200#2KI.T059W    |
| A200#2K4.EVFD#VS  | A200#2K9.T059D    | A200#2LE.TF370    | A200#2LR.TXW#C#V0 | A200#2L1.SWF#WFPT |
| A200#2M6.T5ITNT   | A200#2PG.TA20P1   | A200#2P9.TIVB3    | A200#2QV.COMAP    |                   |
| A200#2QX.FMWF#MDR | A200#2SA.TKENC2   | A200#2SX.TZ34T    | A200#2SY.T7EHS00# | A200#2TO.EWUEXCLK |
| A200#2TP.T165     | A200#2TQ.TXW#C#ST | A200#2WK.TWATT    | A200#2W5.S008     | A200#2XX.TIV85    |
| A200#2YK.T599V    | A200#2YT.TSP0C    | A200#206.TZ39T    | A200#21F.ADMI#EXA | A200#22Y.EVFLT#VS |
| A200#23W.T5EMUPRO | A200#235.J#1AAA5  | A200#24L.CD9NTTYP | A200#241.T5M18    | A200#250.ADMI#SBO |
| A200#26N.T811PT   | A200#28E.REPPINDX | A200#28M.FMR01    | A200#28S.TMSCDOM  | A200#287.TWRVT    |
| A200#3BM.T082J    | A200#3B5.TZB4V    | A200#3CG.TDIEV    | A200#3CZ.CRVAR1T  | A200#3DL.FMFD     |
| A200#3DT.TMPPFT   | A200#3EJ.TIVCF    | A200#3EN.DBMSGDB2 | A200#3FR.CDESTBDC | A200#3F1.TMC73    |
| A200#3HA.T51TNZ   | A200#3KS.CRV#B    | A200#3KV.T5M5D    | A200#3K7.TIVB1    | A200#3LA.T5KTO    |
| A200#3LY.T77BU    | A200#3NC.TCSVL    | A200#3NE.TVARS    | A200#3P9.T7AR87   | A200#3Q5.ANKL     |
| A200#3RN.TKPSR    | A200#3SR.QDPK     | A200#3SZ.CRVAR1   | A200#3TB.SHDDFDO  | A200#3T3.T5W4A    |
| A200#3T4.DBMSGORA | A200#3T6.CCMCSCON | A200#3VE.SCPFLAG  | A200#3VW.TABVA    | A200#3WG.TZB25    |
| A200#3XC.TVGM0    | A200#3XX.T800M    | A200#3XZ.TF390    | A200#3X4.TDV08    | A200#3YX.T158G    |
| A200#3Y3.TFAGS    | A200#3ZU.TDIM#T   | A200#31U.TRBRGT   | A200#32H.TCESYSTT | A200#33B.HRSPUSR# |
| A200#34B.T8G02T   | A200#340.TCATSDLI | A200#35B.ATCVO    | A200#350.TMPPF    | A200#36R.T52OCP1  |
| A200#361.CICCCONF | A200#37Z.T5KAT    | A200#374.TCSUB    | A200#38S.TIVCB    | A200#382.TSPG1    |
| A200#39N.TIVC4    | A200#39V.TKETD2T  | A200#4AF.CCMDNIS  | A200#4A6.TIVROZ0D | A200#4BU.T7AR45   |
| A200#4CD.T51TNN   | A200#4D3.TWSP     | A200#4EM.TVKVT    | A200#4E8.TWIC0250 | A200#4GR.TKECMA   |
| A200#4GZ.ATARCHIV | A200#4H4.TA20PSC  | A200#4IW.DBMSGOR  | A200#4JE.TZANGVOR | A200#4K3.T007D    |
| A200#4L4.TIVBD    | A200#4NN.T5J44    | A200#4NY.CCOPTT   | A200#4PV.T5M8Q    | A200#4RR.T569V    |
| A200#4SD.T77FB    | A200#4T1.FIWF#MDR | A200#4VS.T022FT   | A200#4V8.TZB0V    | A200#4WK.T7PMA    |
| A200#4W8.TIV8C    | A200#4XN.T5M5E    | A200#4XT.T751C    | A200#4YO.TFRC3    | A200#4ZP.T048Z    |
| A200#40E.TWRF11T  | A200#40L.TSAVX    | A200#41T.T77QA    | A200#41U.BTXPURG  | A200#415.T041CT   |
| A200#418.T5KCF    | A200#42S.TWEPT    | A200#42Z.TIVC3    | A200#43Q.TCART    | A200#43R.TKEDRSF  |
| A200#44T.T5J41    | A200#44V.EWJOBSC  | A200#45B.TRK00    | A200#45G.TCATSAT  | A200#46D.T71GS    |
| A200#46R.TVZ05B   | A200#46T.T8G03T   | A200#464.TXW#C#V1 | A200#48M.CKMLMV00 | A200#48W.T77EIT   |
| A200#48Z.OICQST   | A200#5BU.T445Z1   | A200#5BV.DBCON    | A200#5CO.TZ25     | A200#5DG.TCOBN    |
| A200#5D8.TIVA4    | A200#5EH.TCPFS4   | A200#5EW.T7BRC1   | A200#5GE.T811IA   | A200#5GI.T5KTV    |
| A200#5G3.CCMCCONT | A200#5HS.TF625    | A200#5HT.TIV97    | A200#5IP.CICPROFI | A200#5IT.TIV2B    |
| A200#5IW.T807R    | A200#5JK.TIVSB    | A200#5J0.T6WP1T   | A200#5J2.DPSTRUC  | A200#5J3.SHDDCDO  |
| A200#5J6.T77EZOPT | A200#5KA.WITH#CTN | A200#5K1.KCDER#H  | A200#5K2.TIV2J    | A200#5K8.TIV8Z    |
| A200#5LU.T059P    | A200#5N1.TTXPI    | A200#5OH.T5KVT    | A200#5ON.SHDDCDE  | A200#5O7.Q1STP    |
| A200#5PG.T5D4R    | A200#5PO.T410T    | A200#5QJ.TBP2A    | A200#5R7.TIV96    | A200#5S2.T5DWL    |
| A200#5TS.T5UF3    | A200#5U1.TWPIF    | A200#5U7.T060K    | A200#5VH.TKEQUS2  | A200#5VK.T800DOM  |
| A200#5V9.TKETRLG  | A200#5YR.T5ITNK   | A200#52J.T8G20    | A200#52R.TZ34     | A200#52Z.TKENC3   |
| A200#530.TCGRP    | A200#539.T5ITNP   | A200#54I.TMSCDOL  | A200#541.TBD00T   | A200#55B.TRNSPACE |
| A200#56H.T059O    | A200#57E.WITH#CTN | A200#57P.CD0BASUN | A200#578.TCATS#IT | A200#580.T5PFT    |



Table 15 (Page 19 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| A200#589.TKEDRST  | A200#59P.T190OT   | A200#6AJ.TPIK2    | A200#6AX.CCMSCRPR | A200#6BW.TWEP     |
| A200#6CD.T8J7F    | A200#6CF.TIVROZ01 | A200#6CH.STWB#SET | A200#6C3.T6WST    | A200#6D3.APP#FCTR |
| A200#6EO.T831A    | A200#6FD.TKEAS    | A200#6FF.TIVROZ06 | A200#6FW.TIVB4    | A200#6F4.VDVORTR  |
| A200#6GE.RSAUPROF | A200#6G1.LDK06    | A200#6H4.J#1AAA2M | A200#6JI.CIMAP    | A200#6J4.TLSYT    |
| A200#6KL.TSPG2    | A200#6KX.VIEA01   | A200#6K5.TSPG0T   | A200#6MN.ROISIOBJ | A200#6OI.BRANT    |
| A200#6OS.T165R    | A200#6O2.T059FBH  | A200#6PO.HRS1221  | A200#6PR.T8J7H    | A200#6QK.T7EHS00# |
| A200#6QT.SPH#TELU | A200#6RA.OIFSPBLT | A200#6RM.T7EHS00# | A200#6SB.CCPROFT  | A200#6SX.T190ST   |
| A200#6TY.TVFAPT   | A200#6UJ.CCMAC    | A200#6UT.T823D    | A200#6VE.SDPROTCA | A200#6XY.T5DWP    |
| A200#6YW.MDRP#VIE | A200#6YZ.INFCFGAL | A200#6ZH.ROAPPL   | A200#6ZS.TIV4B    | A200#60C.TWPPT    |
| A200#617.CDESTPID | A200#618.MERGENEG | A200#624.TSPG0    | A200#637.ANGB     | A200#65R.T823C    |
| A200#67O.T5UF5    | A200#7AC.T169HT   | A200#7AG.FMCF1R   | A200#7AV.EVVST    | A200#7AZ.K003     |
| A200#7CW.PRDKZ    | A200#7C7.EUARHELP | A200#7C9.T005E    | A200#7DW.SMG      | A200#7D7.TIVCC    |
| A200#7FS.CVCSN    | A200#7FX.SPH#ATIC | A200#7GC.T831D    | A200#7GP.TZB26T   | A200#7GS.TKEABC   |
| A200#7G6.TIV46    | A200#7G8.TIVAB    | A200#716.T7FRFA   | A200#7JW.CUATEXTS | A200#7J1.RFCGO    |
| A200#7KB.TCOBC    | A200#7KQ.TNETMONI | A200#7K1.LANG#SOU | A200#7K4.TIV47    | A200#7K8.TIVROZ0C |
| A200#7L2.TIVROZ1A | A200#7L3.TCETARGT | A200#7L7.TEPSCUS  | A200#7MG.TDO11T   | A200#7MH.TKCCC    |
| A200#7MY.TTXFORMA | A200#7M2.T5KV2    | A200#7N0.TQ75K    | A200#7N5.T5KIT    | A200#7O9.T5M8O    |
| A200#7QF.TKCUM    | A200#7QY.IWBENTRY | A200#7RI.EWUADMUS | A200#7T7.T313G    | A200#7UM.T5V3D    |
| A200#7U5.T445C1   | A200#7VY.SWLCREMA | A200#7WJ.TA20NH   | A200#7W1.TZS22    |                   |
| A200#7XM.DBCHECKD | A200#7ZC.CCC#CHEC | A200#701.AT185    | A200#70Z.TZ35T    | A200#705.AT06     |
| A200#71N.T5KTM    | A200#71P.BRAN     | A200#71Z.T77ALE#I | A200#72J.T5KAW    | A200#729.SXDA3    |
| A200#73G.T311     | A200#73T.TZB1V    | A200#740.USZBVLND | A200#75J.T5DC5T   | A200#75Z.CCMCTIQU |
| A200#77Z.TLOCKLOC | A200#8AC.J#1AINFT | A200#8AV.OIFSBLCD | A200#8BS.T165T    | A200#8B8.TIVROZ0A |
| A200#8DT.MERGEMAP | A200#8D0.TLHIOZ   | A200#8EU.T884F    | A200#8G5.T5DCVT   | A200#8HI.TZS02    |
| A200#8HK.EVSK     | A200#8H5.T77CAR   | A200#8IX.T16SC    | A200#8I4.T048A    | A200#8J5.VDDARL   |
| A200#8KD.VTBPRODT | A200#8K2.TMCSF    | A200#8LB.ATMAT    | A200#8L7.T702L    | A200#8MM.TCETRALT |
| A200#8NM.T5J77    | A200#8NN.TKEPFIEL | A200#8NP.T618MS   | A200#8O0.LTCONV   | A200#8P6.TDB08    |
| A200#8QF.CCMADKEY | A200#8SM.CCMAC#T  | A200#8SZ.T007X    | A200#8S1.TQ40T    | A200#8UG.TKEVAA   |
| A200#8U1.MASSFUNC | A200#8VI.EWUCUCHK | A200#8WD.J#1AAA1  | A200#8WF.T8J7I    | A200#8WL.LDK05    |
| A200#8WQ.TZ24     | A200#8XG.T5DCGT   | A200#8X2.TIVC9    | A200#8YO.PRDKZT   | A200#8YU.CD0BASUN |
| A200#8Z3.TXW#C#VO | A200#807.CICCCONF | A200#811.TMKVT    | A200#821.T804J    | A200#826.CCMCTIPR |
| A200#827.KCVAR    | A200#87X.TKEQUS1T | A200#88C.T048V    | A200#88Q.T801L    | A200#89I.TIV84    |
| A200#9AC.TA20NC   | A200#9AO.NRIV#LOK | A200#9B2.TC048T   | A200#9CM.DIV01    | A200#9FP.TCETARGH |
| A200#9FT.T77EI    | A200#9GF.TCUSPXRE | A200#9G5.CEST4    | A200#9HY.TVIER    | A200#9IY.T5F6K    |
| A200#910.J#1AAA2M | A200#918.TA20NF1  | A200#9KP.CICPROFM | A200#9KX.TDCREDIT | A200#9L3.RODCHABG |
| A200#9ME.TWSGT    | A200#9MN.BTXSUPB  | A200#9MQ.CCMADKEY | A200#9M0.LISCOPAM | A200#9OA.TQ85#T   |
| A200#9OK.TA20PST  | A200#9PP.TZB32    | A200#9QP.TZB31    | A200#9SK.TIVROZ05 | A200#9SW.TIVT5    |
| A200#9S0.T77CR    | A200#9UD.T77KE    | A200#9UP.TIVB9    | A200#9VH.TZANGVOR | A200#9VL.T311L    |
| A200#9WZ.AT70     | A200#9XX.J#1AINFT | A200#9YC.T5KRT    | A200#9YE.TZB28T   | A200#92S.PFFCTT   |
| A200#922.SHDDFDE  | A200#93D.T007J    | A200#94U.ATLPGT   | A200#95L.VTBDFCX  | A200#98G.TMSTCRI  |
| A200#98W.T706F1   | A200#989.TTXPT    | A201#BJM.#SAP     | A201#BTM.#SAP     | A201#CGY.#SAP     |
| A201#COR.#SAP     | A201#CZ6.#SAP     | A201#DW1.#SAP     | A201#D3V.#SAP     | A201#EBU.#SAP     |
| A201#GA2.#SAP     | A201#IAR.#SAP     | A201#IW0.#SAP     | A201#JV1.#SAP     | A201#J7C.#SAP     |
| A201#KY1.#SAP     | A201#LUR.#SAP     | A201#P04.#SAP     | A201#P2E.#SAP     | A201#P4M.#SAP     |
| A201#P7G.#SAP     | A201#000.#SAP     | A201#1AF.#SAP     | A201#1BW.#SAP     | A201#1DF.#SAP     |
| A201#1GQ.#SAP     | A201#1GS.#SAP     | A201#1N0.#SAP     | A201#397.#SAP     | A201#4EY.#SAP     |
| A201#5AV.#SAP     | A201#6XQ.TFI02    | A201#7AE.#SAP     | A201#7HI.#SAP     | A201#7KK.#SAP     |
| A201#7ZS.#SAP     | A202#BFS.#SAP     | A202#DAJ.#SAP     | A202#DZJ.#SAP     | A202#D55.#SAP     |
| A202#D6V.#SAP     | A202#FAG.#SAP     | A202#FNR.#SAP     | A202#FT4.#SAP     | A202#HFB.#SAP     |
| A202#HQJ.#SAP     | A202#L6F.#SAP     | A202#MDT.#SAP     | A202#MM2.#SAP     | A202#P3Z.#SAP     |
| A202#000.#SAP     | A202#22C.#SAP     | A202#3WF.#SAP     | A202#3XB.#SAP     | A202#4GP.#SAP     |
| A202#5HR.#SAP     | A202#5M3.#SAP     | A202#60S.#SAP     | A202#61B.T001W    | A202#7IM.#SAP     |
| A202#70U.#SAP     | A202#9AV.#SAP     | A202#9HP.#SAP     | A203#GVE.#SAP     | A203#JZO.#SAP     |
| A203#000.#SAP     | A203#6DG.#SAP     | A203#6RL.#SAP     | A210#ABJ.USZBVSYS | A210#AIZ.TMC2W    |
| A210#AKA.TWGV     | A210#AN1.SHDFVCI  | A210#AQC.TST06    | A210#BNB.WWWPARAM | A210#BOR.RTXTH    |
| A210#B28.TQ42T    | A210#B4O.TIVA2    | A210#CBM.CSDLGSCR | A210#CB2.CMPWLE   | A210#CCE.THEXC    |
| A210#CF9.IACHTRCT | A210#CMR.T558A    | A210#CQC.W3TREES  | A210#CTF.CMPWLEC  | A210#CUG.T823P    |
| A210#DHB.TCUSINFU | A210#DO7.T801M    | A210#DRX.TBICU    | A210#DU7.KCSLU    | A210#DYD.TWMLT    |
| A210#D52.VTIRATE  | A210#EEI.T823K    | A210#EKZ.CSOBJECT | A210#E29.TZS01    | A210#E3A.TMC4UC   |
| A210#E43.T7EHS00# | A210#E45.BTXCUTX# | A210#FS4.CSDIALOG | A210#F6K.CSDLGSCR |                   |
| A210#F8R.SWF#WFPD | A210#GFD.USZBVSYS | A210#GYB.T801G    | A210#G1S.GB922B   |                   |
| A210#G2M.CSDLGSCR | A210#G4U.CSDIALOG | A210#HHQ.EWUCUPAK | A210#HLB.TQ41T    | A210#HY7.TTPLA    |
| A210#H01.T007K    | A210#H2K.NRIV     | A210#H24.TWGLV    | A210#H63.REPPARMS | A210#H66.TIVA1    |
| A210#IN2.BTXEGRP  | A210#I03.TWGV     | A210#I68.MCSLISEF | A210#JME.MYHLP    | A210#JNF.TFIND2   |
| A210#JOD.T5KWR    | A210#J31.TFIND    | A210#J96.RLIB#COM | A210#KT8.T77KD    | A210#K1K.TVARIND  |
| A210#LJI.MODWRD   | A210#LTK.IACHTRCL | A210#LTT.T803G    | A210#LV4.IACHTRCP | A210#MAQ.TWRF1    |
| A210#MCC.TKBBA    | A210#M4S.T444P    | A210#M6K.T7EHS00# | A210#NPM.AQXTXQ   | A210#OIX.PCEC     |
| A210#ONB.TWGF     | A210#OXA.LFEI     | A210#OYU.TKEV1    | A210#OYW.THEXS    | A210#P4X.USRCOBJ  |

Table 15 (Page 20 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                    |                   |                   |
|-------------------|-------------------|--------------------|-------------------|-------------------|
| A210#P5F.T823Z    | A210#0GY.T801E    | A210#0KW.T5J40     | A210#0Y2.T8JX     | A210#000.AQXTBBS  |
| A210#08I.SWF#WFPR | A210#1BU.TKBBAT   | A210#1ET.IACSERVP  | A210#1HG.CSOBJECT | A210#1JK.TLSY7    |
| A210#1OU.TABS#SB  | A210#1QV.SHDFV    | A210#1VM.SHDGVDO   | A210#1WW.RLIB#TEX | A210#2CP.SHDGVDE  |
| A210#2PR.IBCO     | A210#2UM.IFLOUSR  | A210#20M.TIV00     | A210#3FU.CSDIALOG | A210#3MP.IACSERVT |
| A210#3V4.T5D2B    | A210#32B.T5J39    | A210#320.SREPOATH  | A210#4OB.WWWDATA  | A210#4TS.DFCF     |
| A210#439.BTXCUTX  | A210#5KM.WWWLANGR | A210#5U8.CSDLGITM  | A210#510.T007L    | A210#6HM.BRALOG   |
| A210#6IG.T042FSL  | A210#6MT.OAPRE    | A210#6PH.TTXBR     | A210#62F.LSWOR    | A210#66K.CUSAMEN  |
| A210#7HK.T007V    | A210#7IF.BTXRCPT  | A210#7JT.SCPRPRL   | A210#7TQ.TOAOS    | A210#7ZO.CSDLGITM |
| A210#8J2.TBICUT   | A210#8ON.CSDLGITM | A210#8OV.SCPRATTR  | A210#8OY.MERGEH   | A210#8QM.VORINDX  |
| A210#8Q3.T801D    | A210#8WI.IACHTRC  | A210#8YB.TKEV2     | A210#86M.KCSLO    | A210#9FL.UXCLIST  |
| A210#9X3.CSOBJECT | A210#91Y.CSKSTPL  | A210#94E.BTXEGRP#  | A211#HSM.#SAP     | A211#H6F.RZLLITAB |
| A211#000.#SAP     | A212#NLA.#SAP     | A212#000.#SAP      | A212#27T.#SAP     | A213#000.#SAP     |
| A220#B67.RTXTT    | A220#CFJ.T7EHS00# | A220#E6E.FILTERTE  | A220#FAP.CUSAMENT | A220#FST.IACMIMEL |
| A220#G4K.TBD22    | A220#H4U.BTXRATE  | A220#IF3.BXTAXC    | A220#KJM.BTXRATE# |                   |
| A220#M9B.BTXOVER# | A220#NX1.KZAZU    | A220#OF5.TST21     | A220#O63.GTADIRA  | A220#O7Q.T558D    |
| A220#000.ATZVO    | A220#081.T7EHS00# | A220#1T6.CMP#RUNS  | A220#2P1.LKLAH    | A220#23H.TCSCR    |
| A220#3GD.T7EHS00# | A220#3KE.TSL5D    | A220#373.IACHTMLL  | A220#4JJ.T7EHS00# | A220#4VE.SCPRTEXT |
| A220#5GS.T7EHS00# | A220#5HH.LKSML    | A220#6OT.TTXU      | A220#6W7.T7EHS00# | A220#7GK.IACMIME  |
| A220#7GR.BTXBGRP  | A220#7KM.TCSCRT   | A220#7KY.IACHTML   | A220#89N.BTXOVER  | A220#99B.T5BTM    |
| A221#000.#SAP     | A222#N59.T800S    | A222#000.#SAP      | A223#000.#SAP     |                   |
| A230#A2O.SCPADATA | A230#CMA.MCWPS    | A230#DE6.T558B     | A230#G60.TKEDRX   | A230#JAC.CMPWLIMP |
| A230#JT3.LTDX     | A230#LBO.CHVW     | A230#L5X.FTWRCONT  | A230#MAG.VARI     | A230#MGX.ATXKO    |
| A230#M56.DSYS#PHH | A230#NNX.SCPADATA | A230#NQG.TTSTRCOM  | A230#NW9.MCSIDIR  | A230#N5Q.LCABN    |
| A230#OFG.LWRKSTAT | A230#OM0.CD0ENT3T | A230#0KC.CEALE01   | A230#000.AQGTS    | A230#2TZ.LKSSK    |
| A230#3XG.ARCH#IDX | A230#4N6.RTXTF    | A230#49Y.LCABNT    | A230#5LS.CMPWLH   | A230#5ML.VIAROBJ  |
| A230#6JE.FILTERDE | A230#8OE.T7EHS00# | A231#000.#SAP      | A232#000.#SAP     | A233#000.#SAP     |
| A240#B22.SCPRECA  | A240#C7T.T558C    | A240#C8O.T5K8E     | A240#DAZ.SCPRVALS | A240#D01.MCSI     |
| A240#FAX.CMPOBJ   | A240#FX8.ARC#IDX# | A240#FZ3.T5U8C     | A240#F2A.BRATEXT  | A240#JJ3.ARC#IDX# |
| A240#MES.CMPWL    | A240#NMA.GTADIR   | A240#OV7.TCGC2     | A240#000.ARCH#IDX | A240#09P.GTODIR   |
| A240#2JX.MERGETA  | A240#45P.T5K8C    | A240#55W.CMPWLK    | A240#52C.TCGC0    | A240#591.VIAROBJ  |
| A240#64W.ARC#IPC# | A240#646.FINI     | A240#82T.RTXTL     | A241#000.#SAP     | A242#000.#SAP     |
| A243#GLD.#SAP     | A243#000.#SAP     | CL10#000.TESCL     | CL30#AE8.DSYO1    | CL30#AFP.DSYO3    |
| CL30#AS7.EPIDXB   | CL30#CH9.YCMUS    | CL30#FTH.REGUC     | CL30#F11.CVER4    | CL30#GAH.RFMHN    |
| CL30#GVS.CVER3    | CL30#HXP.EDI30C   | CL30#IMU.PCDCLS    | CL30#IN6.EPIDXC   | CL30#IQP.VTEST10  |
| CL30#J2U.SFHOA    | CL30#LN9.VERCLUST | CL30#LXN.CVEP2     | CL30#NIQ.DSYO2    | CL30#N0U.VER#CLUS |
| CL30#PA5.KOCLU    | CL30#P5F.DOKCL    | CL30#0AV.CLU4      | CL30#0JX.SFHYT    | CL30#000.AABLG    |
| CL30#1GQ.EDIDOC   | CL30#1U7.VBLOG    | CL30#185.VBFLC     | CL30#2CJ.CVER2    | CL30#2RR.RFBLG    |
| CL30#3XD.GLS2CLUS | CL30#4PU.CVEP1    | CL30#5E8.CVER1     | CL30#5PH.VBCLU    | CL30#6ZN.RKEPI    |
| CL40#HSY.EDI40    | CL40#000.CDCLS    | DI00#AN6.TRJOB     | DI00#ARG.DTELRENA | DI00#AXG.DD15L    |
| DI00#AZK.TIV9D    | DI00#A3P.INSTVERS | DI00#A7P.LANG#FTT  | DI00#A8F.DD02DB6  | DI00#BA4.F4TMP    |
| DI00#BI0.TSPIN    | DI00#BNV.TNMAP    | DI00#DD3.DD02INF   | DI00#DMN.VERI#BT# | DI00#DWV.DDPART   |
| DI00#D5I.CD0MC3   | DI00#EEN.DDPATH   | DI00#EHL.LANG#FTO  | DI00#ERY.TIV94    | DI00#E9X.RSTODIRD |
| DI00#FJ.S.DF52L   | DI00#FR6.TFM14    | DI00#FTZ.DF60D     | DI00#FZ5.DDBUF    | DI00#F8V.DDCSTA   |
| DI00#GWD.TICNV    | DI00#GX6.TTYPT    | DI00#GFC.TIV9E     | DI00#HBG.USRFLDGR | DI00#HIS.CD0T000  |
| DI00#HVL.DD12SYB  | DI00#ICB.DD02DB2  | DI00#I1N.TFLOATCO  | DI00#IQS.USRFLD   | DI00#IW2.CD0T120T |
| DI00#I29.DDALIAS  | DI00#I3A.CD2HV2FT | DI00#JKF.DD10L     | DI00#KBR.PAT01    | DI00#KCW.DD12ORA  |
| DI00#KEC.CD0T140T | DI00#KID.DD15T    | DI00#LDB.DF14A     | DI00#LHJ.CCDBCHEC | DI00#LKK.DDCDIM   |
| DI00#LTL.USRFLDT  | DI00#L48.DF52T    | DI00#L65.LCCONV    | DI00#MAZ.TIV91    | DI00#MB4.TCNV     |
| DI00#MGH.TAREF    | DI00#M9T.CHKDC    | DI00#NBU.DDLOADH   | DI00#NGA.TADB2    | DI00#NIW.DD12MSS  |
| DI00#NWK.SE63#UMS | DI00#NWX.DDVE1    | DI00#NY2.PAT02     | DI00#OBG.DDCNVEXI | DI00#OKX.NPUT     |
| DI00#OSE.TBATG    | DI00#OZQ.DD02MSS  | DI00#O16.CD0MC2    | DI00#O9W.VERPF2   | DI00#0AY.DD12INF  |
| DI00#0OZ.DDDTRENU | DI00#0S1.USRFLDVA | DI00#0XW.CHKAC     | DI00#000.APSRV    | DI00#1DE.DSIDB6   |
| DI00#1NF.IGMSS    | DI00#1QC.DDCPRO   | DI00#12W.CD0T500T  | DI00#2A8.DSTDB6   | DI00#249.PAT00    |
| DI00#3AU.CD0MC1   | DI00#3NA.DDCNVUSR | DI00#3NO.ASGRP     | DI00#3Q4.TZDVA    | DI00#3SL.DD14S    |
| DI00#3VV.DCERRLIS | DI00#3V4.CVIMPDD  | DI00#4EB.TGMSS     | DI00#4OM.DB6EDLCK | DI00#46F.RLIB#DOC |
| DI00#5MJ.DDCNVTAB | DI00#5WB.VERPF    | DI00#52O.CD2HV1PT  | DI00#59K.CD0T130T | DI00#6U2.DD12DB6  |
| DI00#6W0.RELEASEM | DI00#654.TIV9A    | DI00#7FQ.TIV9C     | DI00#7X7.TAMSS    | DI00#803.TIV95    |
| DI00#9IW.DDVEPR   | DI00#9N1.TIV93    | DI00#9O1.CD2APP0   | DI00#9TG.TEPSNUM  | DI00#9UE.DD12DB2  |
| DI00#9U3.PAT06    | DI01#000.#SAP     | DI02#000.#SAP      | DI10#AIQ.DDCPROT  | DI10#B58.TBDB2    |
| DI10#B8U.F4UHLP   | DI10#C45.DF17L    | DI10#C6U.SEGSYB    | DI10#DSU.DDNTT    | DI10#BSW.DB6TREOR |
| DI10#EBV.DDYTF    | DI10#E0J.GCTAB    | DI10#F07.DB2TRES\$ | DI10#GOU.DDNTT#HI | DI10#GZ2.DB6TSTAT |
| DI10#I4I.VTRUM    | DI10#JUI.DF32S    | DI10#JW8.DTELDOKI  | DI10#K69.VERI#IND | DI10#K77.DDOTT    |
| DI10#N5B.DDICNVLS | DI10#OJN.TDI01    | DI10#OT2.TFM04     | DI10#0ZG.DDYTT    | DI10#000.D4NTF    |
| DI10#1LO.DF31S    | DI10#3BG.D8NTT    | DI10#30F.PUTTB     | DI10#4XU.DD02ORA  | DI10#4Z2.DB6IREOR |
| DI10#5WL.DDSTORAG | DI10#77P.DF17T    | DI10#8B2.TFM18     | DI10#835.DB2IREOR | DI11#000.#SAP     |
| DI12#000.#SAP     | DI20#B32.DDLOADD  | DI20#CMN.DF55L     | DI20#DXO.DDCPROTA | DI20#D00.DF55T    |
| DI20#FHT.DDNTF    | DI20#H2Y.DF53S    | DI20#I95.DF35S     | DI20#J58.DDOTF    | DI20#J7M.DDNTF#HI |
| DI20#L4C.DSCDB6   | DI20#MY8.DF62S    | DI20#O3X.DF36S     | DI20#000.D4NTF    | DI20#082.DF52A    |

Table 15 (Page 21 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| DI20#1GW.D8NTF    | DI20#5VC.DD02SYB  | DI20#6H6.DDPRH    | DI20#6MJ.DTELPROT | DI20#70Y.DD02ALL  |
| DI20#9E6.DF33S    | DI20#9SW.DD42S    | DI21#000.#SAP     | DI30#D35.DTELLINK | DI30#000.DB6SNP   |
| DI30#4ZR.TBDIR    | DI33#000.#SAP     | DI40#C8O.TODIR    | DI40#H2F.VRSX     | DI40#1LP.VRSMODIS |
| DI40#IOS.DF61S    | DI40#N4N.DF54S    | DI40#000.DDCNVSTA | DI40#3TC.DDPRS    | DI40#7PK.VRSX2    |
| DO00#AIZ.TUCHK3   | DO00#DDT.FILENAME | DO00#E0O.ARCH#GEN | DO00#EQJ.FILETEXT |                   |
| DO00#ET2.PARAMVAL | DO00#FHM.TCDRS    | DO00#F2R.VERI#JOI | DO00#G31.CLASS#IN | DO00#HJQ.FILEPATH |
| DO00#H4T.SXPGCOTA | DO00#IHS.ARCH#USR | DO00#M2F.ARCH#ENQ | DO00#M5Y.SVALT    |                   |
| DO00#OES.OPSYSTEM | DO00#OKL.ADMI#FID | DO00#P5M.PATHTEXT | DO00#000.ADMI#FID | DO00#006.TNDIR    |
| DO00#2DJ.ARCH#EVE | DO00#2FD.SXPGCOST | DO00#2LG.FILETEXT | DO00#2QB.TUCHK    | DO00#264.TUCHK2   |
| DO00#4LG.ARCH#ETX | DO00#4N3.TLSY3    | DO00#4AR.FSYSTXT  | DO00#4SG.VERI#CLN |                   |
| DO00#4XE.CLASS#DE | DO00#448.ADMI#FIL | DO00#46U.TPFYPROP | DO00#5SR.CLASS#DE | DO00#8UQ.OPTEXT   |
| DO00#8ZW.FILENAME | DO00#863.PATH     | DO00#9GQ.FILESYS  | DO00#91Q.ADMI#RUN | DO00#931.ARCH#DEF |
| DO00#94C.ARCH#OCL | DO01#000.#SAP     | DO02#000.#SAP     | DO03#000.#SAP     | DO10#BWF.THLPG    |
| DO10#FTQ.TERM8    | DO10#LWT.TLSY5    | DO10#L1U.SBM105   | DO10#NQ1.TCHLP    | DO10#NT6.STM132   |
| DO10#0VV.RFCCMC   | DO10#0VY.SFSYSP   | DO10#000.IODIR    | DO10#2XA.THLPG    | DO10#4VV.TPFYDOC  |
| DO11#000.#SAP     | DO12#000.#SAP     | DO20#GUF.TSOS     | DO20#HIA.SBM80    | DO20#L0P.PCDHDR   |
| DO20#L4P.GODIR    | DO20#P5L.TRM255   | DO20#0KE.CATG     | DO20#000.CATA     | DO20#4RX.SFREIM   |
| DO20#4XD.SFRECOU  | DO20#590.HLPREFEX | DO20#7ET.TUREP    | DO20#9LS.SBM20    | DO23#000.#SAP     |
| DO30#G05.SBM60    | DO30#HVR.TRMABB   | DO30#H6K.HLPREF   | DO30#J91.TRM040   | DO30#0VV.TRM060   |
| DO30#000.HLPINDX  | DO30#2J5.TRM080   | DO32#000.#SAP     | DO33#000.#SAP     | DO40#F1W.SBM132   |
| DO40#GFD.TRMINT   | DO40#KJY.TTODIR   | DO40#0LE.TRM020   | DO40#000.LTODIR   | DO42#000.#SAP     |
| LD10#000.D021LINF | LD40#D54.D021L    | LD40#IN1.D020LINF | LD40#MHT.D010Y    | LD40#ODP.D010LINF |
| LD40#0A1.D020L    | LD40#000.D010L    | LD40#7T4.D010Q    | LO01#000.#SAP     | LO10#ZZZ.MLICHECK |
| LO11#000.#SAP     | LO41#000.#SAP     | LX10#000.D344L    | LX30#000.D342L    | LX30#8LH.D346T    |
| LX42#000.#SAP     | PO20#AJ9.MEOR     | PO20#ANA.VTEST11  | PO20#AOD.SFWPL    | PO20#BT3.M#WDEP   |
| PO20#BUZ.M#IRLM   | PO20#BY1.M#MLIK   | PO20#BY9.M#MCEA   | PO20#B69.M#TVEN   | PO20#CD8.M#MCBM   |
| PO20#CHJ.SFCPL    | PO20#CJ1.CRVP     | PO20#DI1.M#VMCR   | PO20#DQM.VPOOL    | PO20#D3F.KAPOL    |
| PO20#D64.YMUS     | PO20#EFT.MBAN     | PO20#EMX.M#MTVO   | PO20#EQU.M#REVN   | PO20#E4T.VLIM     |
| PO20#E4U.FINPL    | PO20#FAC.DVPOOL   | PO20#FNN.MBMP     | PO20#FRF.PVER2    | PO20#FR2.SAKO     |
| PO20#F2H.M#MEBE   | PO20#F71.M#MCA2   | PO20#GAN.M#MREA   | PO20#GBJ.VIND     | PO20#GJS.AANL     |
| PO20#G4X.MAT1     | PO20#HB9.UTAB     | PO20#HEB.M#MSAK   | PO20#HVW.SMPOOL   | PO20#IGJ.KALK     |
| PO20#IS3.M#PRPR   | PO20#I7M.VMCV     | PO20#JE4.M#VMVM   | PO20#JTC.MCLIB    | PO20#JTK.M#VTBA   |
| PO20#KDN.KRED     | PO20#KHH.M#VMVL   | PO20#LDY.PLOM     | PO20#LL3.M#VLIM   | PO20#LOH.ORDE     |
| PO20#LRA.M#VMVA   | PO20#LTM.M#MCA1   | PO20#LVF.KCPOL    | PO20#LVJ.PTEST1   | PO20#LXD.M#T001   |
| PO20#L83.KDPOL    | PO20#MBB.M#VMPV   | PO20#MET.M#PAVW   | PO20#MHC.M#MTVN   | PO20#MTM.M#VMVG   |
| PO20#MUT.ATAB     | PO20#MW0.M#UPRO   | PO20#MYD.PVER1    | PO20#M71.M#MVER   | PO20#NAY.DEBI     |
| PO20#NMN.M#WPAN   | PO20#NM4.MSAK     | PO20#NNL.M#J1BA   | PO20#N9G.M#MPTX   | PO20#OE7.M#DGMI   |
| PO20#OMZ.KEPOOL   | PO20#OPH.TESPO    | PO20#OUG.QDPT     | PO20#O4D.KGPOL    | PO20#OZS.M#CKKA   |
| PO20#000.AANK     | PO20#1ZH.M#VMVK   | PO20#17Z.CFIS     | PO20#2AA.MEKK     | PO20#2HH.M#VMPA   |
| PO20#2N5.M#WORD   | PO20#2WP.M#KKEB   | PO20#2W4.M#CV01   | PO20#2YA.REBL     | PO20#26X.VBMC     |
| PO20#264.KBPOL    | PO20#3KE.M#IFLM   | PO20#3MW.LDAN     | PO20#3M4.M#DARL   | PO20#3VG.M#VTIO   |
| PO20#4M1.BPHIER   | PO20#4TD.GLTP     | PO20#41Y.LDKO     | PO20#5K6.M#MCGU   | PO20#5L2.M#HORD   |
| PO20#5W8.M#MEBZ   | PO20#559.M#VMCF   | PO20#57P.MEIN     | PO20#6IW.M#MCFL   | PO20#6UG.M#WABI   |
| PO20#7CT.LISA     | PO20#7EA.M#REBL   | PO20#7E1.MBRK     | PO20#7IG.M#MEOR   | PO20#7TC.M#IBEW   |
| PO20#7W9.M#AKTE   | PO20#705.M#UNTR   | PO20#74E.M#MBIK   | PO20#9AZ.M#MTVM   | PO20#9DY.GLSP     |
| PO20#9TB.DVPOOLTE | PO20#9YZ.M#MCAB   | PO20#9Y3.M#MCGB   | PO20#93J.MSPOOL   | PR00#ADY.DDICNVDI |
| PR00#AY2.DDICNVCT | PR00#CH6.TSP0H    | PR00#CRI.LANG#CON | PR00#EFD.TSP0I    | PR00#GVQ.SDBAC    |
| PR00#HPK.LCOLHDR  | PR00#I1X.CCCEXITC | PR00#J7F.LCOLRST  | PR00#KU2.TUCHK1   | PR00#LM6.TPSTAT   |
| PR00#LX5.TSPDEVCF | PR00#MCS.TRACOLSY | PR00#NFM.TSP0K    | PR00#N13.CCOPTION | PR00#N4H.TSP03L   |
| PR00#N7B.TRACOLT  | PR00#OZG.CCCEXITC | PR00#000.ADAA     | PR00#2MC.TVEP7    | PR00#2ZP.TRBATC   |
| PR00#3ZA.TFO12    | PR00#367.TSPRMGCF | PR00#5V0.TRACOLR  | PR00#63N.TMSALOG  | PR00#64N.LANG#AVS |
| PR00#661.TLSY6    | PR00#7XS.LANG#AVT | PR00#73F.TSP02F   | PR00#751.TVEP6    | PR00#8D8.LANG#AVA |
| PR01#000.#SAP     | PR03#000.#SAP     | PR10#C71.TFO11    | PR10#DME.DBAFID   | PR10#D4W.LWRKIID  |
| PR10#HRK.TSP8T    | PR10#I4E.CCOBJS   | PR10#P9H.AMSK     | PR10#0T2.AMSP     | PR10#000.AMDT     |
| PR10#3RE.WPTST    | PR10#3X5.DBSTATC  | PR10#7EN.TPLOG    | PR10#80V.TSP03D   | PR10#95F.CCCFLOW  |
| PR11#000.#SAP     | PR11#5EA.TSP03C   | PR12#000.#SAP     | PR13#000.#SAP     |                   |
| PR20#AMX.DBSTATTD | PR20#B47.DBSTATTD | PR20#DAP.DBSTATIA | PR20#FHQ.BAL#INDX | PR20#GN3.TSP0L    |
| PR20#GOB.DBSTATIO | PR20#HA7.DBSTATHD | PR20#IME.DBSTATID | PR20#I5D.DBSTATHA | PR20#I5R.F4COLS   |
| PR20#K2D.DBSTAIHO | PR20#MXP.DBSTATHD | PR20#NE5.DBSTATTA | PR20#OF3.DBSTATTO | PR20#000.AMDS     |
| PR20#1ZR.DDCSTAT  | PR20#2M7.TSP03A   | PR20#3L7.TSP02L   | PR20#3VR.DBSTATID |                   |
| PR20#4A7.DBSTATHO | PR20#462.VBWRK    | PR20#6IX.DBSTAIHD | PR20#6OR.DBSTAIHA | PR20#9HB.TSP06    |
| PR21#GC2.BTCDELAY | PR21#000.#SAP     | PR23#000.#SAP     | PR30#EQU.VBHDR    | PR30#GEW.VBDATA\$ |
| PR30#HI7.VBMOD    | PR30#HYI.TSPEVJOB | PR30#ZZZ.DDLOG    | PR30#000.TSP02    | PR30#5KK.TSPEVDEV |
| PR31#000.#SAP     | PR40#MXS.DBTABPRT | PR40#O0Y.MSSDEADL | PR40#000.DBTABLOG | PR40#21C.TSP01    |
| SD00#AI6.DD20T    | SD00#FFW.DD16S    | SD00#0EN.DD21S    | SD00#000.DD12L    | SD00#2EZ.DD12T    |
| SD00#3JJ.DD17S    | SD00#8QI.DD24S    | SD00#9RB.DD29T    | SD02#000.#SAP     | SD10#OU3.DD25T    |
| SD10#000.D020SINF | SD20#000.DD08L    | SD30#AU2.DD08T    | SD30#HJN.D022S    | SD30#I9N.DD05S    |
| SD30#JT9.D021S    | SD30#000.D010T    | SD40#KWI.D010TINF | SD40#000.D010S    | SD40#4MK.DD03L    |

Table 15 (Page 22 of 22). Databases and Tablespace in SAP R/3 4.5A, Format: Database.Tablespace

|                   |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| SO00#BBF.ICO#P    | SO00#ERD.CCCINFO  | SO00#F7R.TBVIEWER | SO00#GCL.SXS#TABL | SO00#JM2.CUS#CPSF |
| SO00#JRJ.CCSTAT   | SO00#JYK.CUS#ATTR | SO00#KJW.DVSEQDIR | SO00#KZT.CUS#ATTR | SO00#LQ2.SXS#ATTR |
| SO00#MAZ.SXS#ATTR | SO00#MQ9.RSMPCHEC | SO00#MXZ.GUIDIR   | SO00#N7R.SYSBUPLA | SO00#OCD.TABNA    |
| SO00#000.APTREE   | SO00#22V.RLIB#CON | SO00#39D.SXS#SCRN | SO00#610.TBPROGRE | SO00#654.CCCEXIT  |
| SO00#7PO.CUS#COMP | SO00#8I5.SXS#FCOD | SO01#000.#SAP     | SO02#000.#SAP     | SO03#000.#SAP     |
| SO10#D6U.TRCLT    | SO10#FSK.EUIMPORT | SO10#JWK.RLIB#TRE | SO10#KV5.SREPALOG | SO10#000.DIRTREE  |
| SO10#348.FUSEQDIR | SO10#4J3.EUDIAL   | SO10#4RQ.GUIDIRT  | SO10#93J.TREELOG  | SO13#000.#SAP     |
| SO20#H12.RSEUTAB  | SO20#J7C.SMODILOG | SO20#000.RSEUINC  | SO23#000.#SAP     | SO30#C5N.DWTREE   |
| SO30#FKM.EUFUNC   | SO30#GF2.EUINFO   | SO30#000.CROSS    | SO30#039.TCP11    | SO30#59F.SMODISRC |
| SO30#6M2.TCP17    | SO30#9EI.TCP13    | SO31#000.#SAP     | SO33#000.#SAP     | SO40#JXE.EUINFOLI |
| SO40#000.EUF4VALU | SX00#DDX.DDTYPET  | SX00#DTJ.IAMSS    | SX00#EBI.DF07T    | SX00#EHC.DF12T    |
| SX00#E29.DF10T    | SX00#F18.TGDB2    | SX00#F4H.DF16L    | SX00#G5H.DF12L    | SX00#IPH.LDBB     |
| SX00#JF7.RODIR    | SX00#JPD.NOTRA    | SX00#KWO.DF08T    | SX00#K9T.DD06T    | SX00#MF9.DD20L    |
| SX00#M0B.DF13L    | SX00#O7H.DF11T    | SX00#000.DD06L    | SX00#1XG.DF06L    | SX00#19N.DF11L    |
| SX00#2CO.DD28S    | SX00#24R.DF10L    | SX00#3C5.IADB2    | SX00#3DN.IGDB2    | SX00#3Z8.DF06T    |
| SX00#4BA.DF15L    | SX00#5O1.DF16T    | SX00#6YZ.DD29L    | SX00#62C.DF07L    | SX00#7BH.DF08L    |
| SX00#72G.DF15T    | SX00#750.DF14L    | SX00#8LZ.DD25L    | SX00#9FD.TRBAT    | SX00#91Q.MCUSREXI |
| SX00#97U.DF13T    | SX01#000.#SAP     | SX03#000.#SAP     | SX10#AJW.DIAPAR   | SX10#A2T.DD01L    |
| SX10#A9O.DM45L    | SX10#CIC.DM02S    | SX10#CJQ.DM40T    | SX10#C5K.DF40D    | SX10#H37.DF04L    |
| SX10#J4Q.DF03T    | SX10#J9W.D4XTT    | SX10#LAR.TFM18X   | SX10#LBC.TERM2    | SX10#MYU.DBMAPS   |
| SX10#M4J.DSYST    | SX10#OH0.D020T    | SX10#O2D.DF03L    | SX10#0N8.DM45T    | SX10#000.D020S    |
| SX10#5OI.DM40L    | SX10#5UA.IADB6    | SX10#6MJ.DF04T    | SX10#6UI.DDXTT    | SX10#673.DD40L    |
| SX10#73Q.MACOB    | SX10#9HP.DD26S    | SX10#9ZI.MACID    | SX10#994.DM46S    | SX11#000.#SAP     |
| SX12#KWN.DD07L    | SX12#000.#SAP     | SX13#000.#SAP     | SX20#BJV.DD02L    | SX20#CCK.DF34S    |
| SX20#CNJ.TRMMSG   | SX20#EJF.DM25L    | SX20#FX6.DM42S    | SX20#G8Y.DD02T    | SX20#HVR.DM02T    |
| SX20#M3F.EUGUITEX | SX20#0QJ.DDTYPES  | SX20#000.DD01T    | SX20#2NH.DM02L    | SX20#38X.DD09L    |
| SX20#4QN.DD27S    | SX20#4TJ.DD33S    | SX20#4WO.DD04L    | SX20#49W.DD40T    | SX20#61S.DM26L    |
| SX20#697.DM41S    | SX20#7GG.DM42T    | SX20#844.DM03S    | SX20#89O.DM43T    | SX21#000.#SAP     |
| SX22#DS7.DD07T    | SX22#000.#SAP     | SX23#P95.TITLE    | SX23#000.#SAP     | SX30#AGG.D4XTF    |
| SX30#B4N.DOKHL    | SX30#C0B.DF43S    | SX30#DG6.EUDB     | SX30#DLJ.TERM4    | SX30#HAG.DF42S    |
| SX30#HC7.DDXTF    | SX30#H7A.DF30S    | SX30#I3A.TERM6    | SX30#KRS.D345T    | SX30#NDS.TERM3    |
| SX30#000.D010INC  | SX30#06R.DF41S    | SX30#214.D010TAB  | SX30#49O.DD03T    | SX30#51D.TERM     |
| SX30#7JQ.TERM7    | SX32#M94.FUNCT    | SX32#000.#SAP     | SX33#M46.DOKIL    | SX33#000.#SAP     |
| SX40#AUO.FUPARARE | SX40#FK8.TERCL3   | SX40#K9L.D301T    | SX40#ONS.D021T    | SX40#000.D010SINF |
| SX40#2R8.DOKCLU   | SX40#3X6.TERCL    | SX40#590.DD04T    | SX40#7ZU.T512CLU  | SX40#9D2.TERCL2   |
| SX42#000.#SAP     | SX43#AN9.TFDIR    | SX43#000.#SAP     |                   |                   |

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## Appendix G. Special Notices

This redbook is directed at customers who need to install and do the implementation of SAP R/3 on the System/390 platform. The redbook presents practical examples to demonstrate the database setup and typical database administration activities performed in an SAP R/3 on System/390 installation. The redbook helps database administrators, SAP basis consultants, and system programmers understand the database activities necessary for implementing SAP R/3 on System/390. The information in this publication is not intended as the specification of any programming interfaces that are provided by any of the products mentioned in this document. See the PUBLICATIONS section of the appropriate IBM Programming Announcement for the products mentioned in this document for more information about what publications are considered to be product documentation.

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| DFSMSHsm                      | DRDA                       |
| Enterprise Systems Connection | ESCON                      |
| Architecture                  |                            |
| IBM                           | IMS                        |
| Language Environment          | MVS/ESA                    |
| NetView                       | OPC                        |
| OpenEdition                   | OS/2                       |
| OS/390                        | Parallel Sysplex           |
| POWERparallel                 | PROFS                      |
| PSF                           | QMF                        |
| RACF                          | RAMAC                      |
| Resource Measurement Facility | RETAIN                     |
| RMF                           | RS/6000                    |
| S/390                         | SAA                        |
| SP                            | SP2                        |
| System/390                    | VTAM                       |
| 3090                          |                            |

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## Appendix H. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

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### H.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see "How to Get ITSO Redbooks" on page 263.

- *Implementing SAP R/3 in an OS/390 Environment*, SG24-4945
- *High Availability Considerations: SAP R/3 on DB2 for OS/390*, SG24-2003
- *Implementing SnapShot*, SG24-2241
- *Implementing DFSMSdss SnapShot and Virtual Concurrent Copy*, SG24-5268

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### H.2 Redbooks on CD-ROMs

Redbooks are also available on the following CD-ROMs:

| 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 Redbook    | SK2T-8038             |
| Lotus Redbooks Collection                             | SK2T-8039             |
| Tivoli Redbooks Collection                            | SK2T-8044             |
| AS/400 Redbooks Collection                            | SK2T-2849             |
| RS/6000 Redbooks Collection (HTML, BkMgr)             | SK2T-8040             |
| RS/6000 Redbooks Collection (PostScript)              | SK2T-8041             |
| RS/6000 Redbooks Collection (PDF Format)              | SK2T-8043             |
| Application Development Redbooks Collection           | SK2T-8037             |

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### H.3 SAP References

The SAP references in the following list can be obtained via:

- FAX: +49(6227)34-4779
- Telephone: +49(6227)34-4784

| Document Title                                                        | SAP Document Material Number |
|-----------------------------------------------------------------------|------------------------------|
| <i>BC SAP Database Administration Guide: DB2 for OS/390</i>           | 51003810                     |
| <i>R/3 Installation on UNIX: DB2 for OS/390</i>                       | 51003808                     |
| <i>R/3 Installation on Windows NT: DB2 for OS/390</i>                 | 51002660                     |
| <i>SAP R/3 on DB2 for OS/390: Planning Guide SAP R/3 Release 4.5A</i> | 51003811                     |
| <i>BC SAP High Availability</i>                                       | 50020596                     |

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## H.4 Other Publications

These publications are also relevant as further information sources:

- *SAP R/3 on DB2 for OS/390: Connectivity Guide*, SC33-7965
- *DB2 for OS/390 V5 Utility Guide and Reference*, SC26-8967
- *DB2 for OS/390 V5 SQL Reference*, SC26-8966
- *DB2 Admin Tool User's Guide Ver. 1 Rel. 2*, SC26-8428
- *DB2AUG Reference Guide*, SC23-0591
- *DB2 PM for OS/390 V5 Online Monitor User's Guide*, SC26-8990
- *ISMF User's Guide*, SC26-4508
- *DFSMS/MVS V1R3 General Information*, GC26-4900
- *DFSMS/MVS V1R4 Access Method Services for the Integrated Catalog Facility*, SC26-4906
- *DB2 for OS/390 V5 Administration Guide, Volumes I and II*, SC26-8957
- *OS/390 V2R6.0 RMF User's Guide*, SC28-1949
- *OS/390 V2R6.0 RMF Report Analysis*, SC28-1950
- *DB2 for OS/390 V5 Application Programming and SQL Guide*, SC26-8958
- *DFSMS/MVS V1R3 Utilities*, SC26-4926
- *DFSMS/MVS V1R2 DFSMSHsm Storage Administration Guide*, SH21-1076
- *DB2 for OS/390 V5 Installation Guide*, GC26-8970
- *OS/390 MVS System Messages, Volume 5*, GC28-1788
- *OS/390 JES2 Messages*, GC28-1796
- *OS/390 MVS System Messages, Volume 4*, GC28-1787
- *OS/390 MVS System Codes*, GC28-1780
- *DB2 Performance Monitor for OS/390 V5 Batch User's Guide*, SC26-8991
- *DB2 for MVS/ESA V4 Utility Guide and Reference*, SC26-3395
- *QMF User's Guide and Reference (Current Release)*, SC26-4096



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## How to Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, redpieces, and CD-ROMs. A form for ordering books and CD-ROMs by fax or e-mail is also provided.

- **Redbooks Web Site** <http://www.redbooks.ibm.com/>

Search for, view, download or order hardcopy/CD-ROMs redbooks from the redbooks Web site. Also read redpieces and download additional materials (code samples or diskette/CD-ROM images) from this redbooks site.

Redpieces are redbooks in progress; not all redbooks become redpieces and sometimes just a few chapters will be published this way. The intent is to get the information out much quicker than the formal publishing process allows.

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- **Telephone Orders**

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Fax phone number is in the "How to Order" section at this site:  
<http://www.elink.ibm.link.ibm.com/pbl/pbl/>

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## Glossary

**Explanation of Cross-Reference:** The following cross-references are used in this glossary:

**Contrast with.** This refers to a term that has an opposed or substantively different meaning.

**See.** This refers the reader to multiple-word terms in which this term appears.

**See also.** This refers the reader to terms that have a related, but not synonymous meaning.

### A

**ABAP/4 Query.** Facility that allows users without knowledge of the ABAP/4 programming language or table or field names to define and execute their own reports. There are three types of report formats available:

- Basic lists
- Statistics
- Ranked lists

**acceptance test.** Delivery system test performed on various platforms before delivery.

**access network.** The part of the network connecting the application hosts to the front-end clients.

**activation administrator.** An activation administrator activates authorization profiles and authorizations, and makes them effective in the system. An activation administrator can only change profiles and authorizations specified in his or her own authorization profile. An activation administrator can also delete active versions of profiles and authorizations.

**active.** Editing status of an R/3 online document. It tells the system that the document has been edited and can now be translated.

When a document is activated, the current contents of the document are permanently linked to the current version number. When an active document is maintained, the editing status is changed to "raw version" or "final version," and the version number is incremented.

**active version.** In the authorization system, authorizations and authorization profiles that have been activated. Activated profiles and authorizations are available in the system.

**ADK archive.** The new archiving process that is offered by SAP starting with release 2.2F or 3.0A; it offers a redo option.

**Advanced Program-to-Program Communication.**

Protocol developed by IBM as part of its Systems Network Architecture (SNA). The protocol is designed to enable application programs running on different computers to communicate with each other and exchange data.

**alternative session.** The SAP System is capable of simulating several working sessions simultaneously on one display terminal. The entire scope of functionality of the SAP System is available in each alternative session. You can therefore process various transactions simultaneously on one computer.

**application host.** A physical machine on which an application runs.

An application host may support one or more application services (dialog, update, enqueue, batch, message, gateway, or spool). The term "application server" is often used to describe the host machine, but the preferred term is "application host," since this is clearly distinct from the related term, "application service."

**application server.** A term used for both application host and application service.

**application service.** A logical component of the SAP R/3 system that provides a clearly defined service to clients requesting it.

The application services are the dialog, update, enqueue, batch, message, gateway, and spool services.

**Archive Development Kit.** The Archive Development Kit (ADK) contains the following components:

- Definition of commercially related data as a logical archiving entity (see also **archiving object**)
- Methods for passing the data to be archived to the archive file in the form of function modules
- Example programs
- Documentation
- Archive management for executing programs
- Network graphic to illustrate the dependencies between archiveable data.

The ADK controls the data transfer between the archiving programs and the archive files at run-time.

**archive handle.** Identification number assigned to an archive file when it is opened during a program run. When assigning the ID, the system specifies for each archive handle whether read or write access to the archive file is required. This identification is necessary because a program can process archive

files for several business objects (see also **archiving object**).

**authorization.** Authority to perform a particular action in the R/3 System. An authorization is identified by the name of an authorization object and the name of the authorization created for the object. An authorization specifies one or more permissible values for each authorization field listed in an authorization object. There are simple authorizations and composite authorizations. A simple authorization specifies sets of values for authorization fields. A composite authorization lists simple authorizations. You can use a composite authorization to associate several alternative authorizations with an authorization object in an authorization profile. Authorizations are entered in a user's master record.

**authorization administrator.** User responsible for maintaining authorizations and authorization profiles. For security reasons, this user should not be authorized to activate authorizations and profiles or to maintain user master records. With such authorizations, the user could single-handedly define, activate, and assign system access authorizations.

**authorization check.** Check performed to ascertain whether a user is authorized to execute a particular function. Processes, functions, and data accesses in the R/3 System can only be performed when user authorizations have been checked in the respective system and application programs.

**authorization field.** In authorization objects, authorization fields represent values for individual system elements that are supposed to undergo authorization checking to verify a user's authorization.

**authorization object.** Element of the authorization concept. Authorization objects allow you to define complex authorizations. An authorization object groups together up to ten authorization fields in an AND relationship in order to check whether a user is allowed to perform a certain action. To pass an authorization test for an object, the user must satisfy the authorization check for each field in the object.

**authorization profile.** Element of the authorization system. An authorization profile gives users access to the system. A profile contains authorizations which are identified by the authorization object and the authorization name. If a profile is specified in a user master record, the user has all the authorizations defined in this profile.

Changes in profiles or authorizations in the profile take effect immediately for all users who have this profile. Individual changes in user master records are not required.

There are single and composite authorizations. A single profile contains authorizations. A composite profile lists single profiles. Composite profiles can be

used as reference users, that is, may contain profiles that constitute a standard set of authorizations.

To assign standard authorizations to users, the name of the composite profile must be entered in his or her user master record. Changes in a reference profile take effect immediately for all users who have the profile.

**authorization trace.** Transaction to record all required authorization objects within a processing step.

## B

**background processing.** Processing that does not take place on the screen. Data can be processed in the background while other functions are being performed in parallel on the screen.

**basic conversation.** Conversation in a prescribed format. Basic conversation is the recommended conversation type for low-level programs.

**basic key figure.** A value that can be displayed in a report and that is stored in a numerical value field of a database table. It can also be used in formulas or rules for computing other values in a report.

**batch input.** Interface that facilitates the transfer of large amounts of data to an SAP system. You can use batch input to transfer both legacy data and external data to the SAP system.

**batch input command.** Command used to control the processing of batch input sessions. There is a batch input command for each of the following functions:

- Terminate processing a session
- Delete a transaction from a session
- Skip a transaction in a session
- Change the processing mode during processing

**batch input message.** Data from an external system in a form that the SAP system can process. Created by a batch input program, a batch input message consists of data and a specific SAP record format.

**batch input session.** A sequence of transactions supplied with application data by a batch input program. The system stores these transactions in a batch input session until you decide to process the session. You can later process the session in the online system. The system updates the database when the session is processed. With this technique, you can transfer large amounts of data to the SAP system in a short time.

**BDC option.** Batch Data Communication option. BDC options define the processing mode for a batch input session. Examples of modes used for processing sessions are:

- Display all records

- Display for error dialogs only
- Process session in the background
- Process session on the screen

**binary mode.** Mode (or format) in which a file can be processed.

**bridge.** Computer that links two LANs with each other.

## C

**CCMS.** See **Computing Center Management System**.

**central instance.** An SAP R/3 administrative unit in which, at minimum, message and enqueue services reside.

A central instance can have dialog, update, enqueue, batch, message, gateway, spool, and database services all on one host. This setup is often used in small installations, but you must ensure that the host is sufficiently powerful to support all services.

For SAP R/3 on DB2 for OS/390, SAP R/3 creates a central instance without a database; that is, the database (DB2 for OS/390) runs on another machine.

**central system.** See **central instance**.

**CLAW.** See **Common Link Access to Workstation (CLAW)**.

**client.** In commercial, organizational, and technical terms, a self-contained unit in an R/3 System with separate master records and its own set of tables.

**command file.** List of development environment objects in correction and transport requests. Command files are created in one of three different ways:

- Automatically when an object is edited
- By entering the objects with the editor
- Through the environment analyzer

**Common Communications Support.** IBM standard for standardized communication support. CCS provides protocols for network communication and data interchange for application programs integrated in an SAA environment.

**Common Link Access to Workstation (CLAW).** An architecture that defines the channel commands used between the host and the channel attachment adapter.

**communication call.** CPI-C calls under ABAP/4. The ABAP/4 CPI-C interface is implemented through CPI-C calls.

**communication profile.** Definitions for controlling how sessions in an SNA network are set up, kept open, and closed. In VTAM, a complete record of

communication profiles is defined in a "logmode table."

**communications interface.** An interface through which data is exchanged between programs in accordance with set protocols.

**communications manager.** The communications manager is responsible for communications between computers and programs. It is part of the OS/2 operating system (extended edition), and it supervises the data flow between OS/2 workstations and other systems and/or programs. It provides different terminal emulations and allows the use of different communication protocols.

**communications server.** Program for the management of computer and program links. It provides different types of communication and monitors the data flow between computers or programs. The communications server is suited for a client server configuration. It is a product of the companies DCA and Microsoft.

**communications workstation.** The communications server manages communications between computers and programs. It provides several communication types and supervises the data flow between computers and/or programs. It is a product of the companies DCA and Microsoft.

**component.** Data for a part of an application.

**Computing Center Management System.** Tool for monitoring, controlling, and configuring the R/3 System. The Computing Center Management System (CCMS) supports round-the-clock system administration functions from the R/3 System. You can analyze and distribute the system load, and monitor the resource consumption of the different system components.

**controller.** Control unit for communication between the logical units within an SNA network.

**conversation.** Data exchange between transaction programs. Prerequisite for such a data exchange is an existing session.

**conversation ID.** Parameter from the CPI-C interface; it identifies the conversation.

**CPI.** Common Programming Interface. An IBM standard that defines a standardized interface for program development. CPI provides languages, commands, and calls for developing applications within an SAA environment.

**CPI-C.** Common Programming Interface-Communication. The part of CPI that provides definitions for inter-program communication. These definitions can be divided into four areas:

- Session setup

- Session control
- Communication
- End of session

**current status.** The current status of a system with regard to its contents and structure.

## D

**daemon.** A task, process, or thread that intermittently awakens to perform some chores and then goes back to sleep (software).

**data acquisition.** Initial transfer of data to the SAP system. This process can be performed automatically or manually.

**data backup.** Term used for all measures and automatic facilities that are used to safeguard data or data media against loss or damage.

**data dictionary.** A central catalog that contains the descriptions of an organization's data and provides information about the relationships between the data and its use in programs and screens. The data descriptions in a data dictionary are also called metadata, that is, data that describes other data.

**Database Interface.** In SAP R/3, a program that resides on the application server and is responsible for interacting with the database.

**database reconnect.** The automatic reconnect of an SAP work process to a database instance when the existing connection has been closed unexpectedly.

**database host.** A machine on which the SAP R/3 database is stored and which contains the support necessary to access that database from an instance.

**database server.** A term that is used for both database host and database service.

**database service.** A service that stores and retrieves business data in an SAP R/3 system.

**DATEX-L.** Public communications service mainly for duplex operation. Duplex operation means that data is transferred on one line in both directions. With DATEX-L, the exchange partners are selected directly. DATEX-L is especially suited for short connections such as the use of information system or posting transactions in banking.

**DATEX-P.** Public communications service for packets (a packet consists of 128 bytes). With DATEX-P, duplex operation is not possible. The post office determines through which lines the packets are transferred. DATEX-P is especially suited for the transfer of great amounts of data.

**DBIF.** See **Database Interface.**

**DDIC.** See **data dictionary.**

**dialog interface.** Interface for operating the SAP system from a terminal using a keyboard.

**dispatcher.** A job under the SAP R/3 system that manages workload. Each instance has a single dispatcher that manages the workload for that instance. Presentation services interact with the dispatcher. End user requests and units of work are assigned by the dispatcher to the work processes of the instance for completion.

## E

**EarlyWatch.** A service provided by SAP to help customers keep their systems in a well-tuned state.

**enqueue service.** A special work process that is responsible for handling the special locking requirements of SAP R/3. The enqueue service handles logical locks (for example, locks that may need to be held across an entire SAP R/3 system, instead of only within the database). There is only one enqueue service for an entire SAP R/3 system and it runs under the central instance, by default.

**Enhanced ESCON support.** Support that provides high-performance communications between an OS/390 system and an AIX system that is attached through the ESCON channel interface.

**Enterprise Systems Connection Architecture (ESCON).** An architecture for an I/O interface that provides an optical-fiber communication link between channels and control units.

**ESCON.** See **Enterprise Systems Connection Architecture (ESCON).**

## F

**fibre.** The transmission medium for the serial-I/O interface. A link is a point-to-point pair of conductors (optical fibres) that physically interconnects a control unit and a channel, a channel and a dynamic switch, a control unit and a dynamic switch, or, in some cases, a dynamic switch and another dynamic switch. The two conductors of a link provide a simultaneous two-way communication path. One conductor is for transmitting information and the other is for receiving information. A link is attached to a channel or control unit by means of the link interface of that channel or control unit and to a dynamic switch by means of a dynamic-switch port.

**format specification.** Layout specification for an output list. In an ABAP/4 report, you specify the format of an output list with the WRITE statement.

**formatting option.** Presentation alternative for data in an output list. In ABAP/4 reports, you can use the

formatting options offered by the WRITE statement to output data. Examples of formatting options include alignment of text, rounding of figures, and special formats for date fields. The available options depend on the data type.

**functional area.** ABAP/4 Query allows users to define reports without programming knowledge. When creating a query, the user must choose a functional area. The functional area determines which tables and fields a query can reference.

**functional group.** Functional groups are used in ABAP/4 Query. A functional group is a set of several fields that forms a meaningful unit. It presents the user with a preselected set of fields and thus avoids the need to look at all fields in a logical database.

## G

**gateway.** Intelligent interface that connects dissimilar networks by converting one protocol to another. For example, a gateway converts the protocol for a token ring network to the protocol for SNA. The special computers responsible for converting the different protocols, transfer speeds, codes, and so on are also usually considered gateways.

**GOPHER.** A menu-based search scheme, used to find information on the Internet. Originally developed at the University of Minnesota, it lets you reach a destination on the Internet by selecting items from a series of text menus.

**graphical user interface.** Display format that enables you to choose commands, start programs, display files, and perform other functions by selecting menu options, pressing function keys or pushbuttons, or pointing to icons with the mouse. In the R/3 System, the user interface consists of the following main elements:

- GUI title
- GUI status

**GUI.** See **graphical user interface.**

## H

**Help function.** A function that delivers information on SAP System use. To request an explanation for an object, position the cursor on the object and press F1. Object-specific explanations (for example, for fields, menu options, messages, and so on) can be requested in the entire SAP system.

**hot-site backup.** The use of an identical copy of the production database on a standby database host.

## I

**ICLI.** See **Integrated Call Level Interface.**

**import test.** Transport procedure. As you transport development environment objects, a check of the target system is made already in the export phase to find out whether all objects of the transport request can be transported to the target system. Import is blocked if the database of the target system contains a protected object that would be affected by the transport.

**inactive flag.** Flag that prevents a test procedure or test module from being executed.

**individual execution.** Execution of one test procedure on its own.

**individual test.** Test which makes the alpha test easier.

**instance.** An administrative unit that groups together components of an R/3 system that provide one or more services. These services are started and stopped at the same time. All components belonging to an instance are specified as parameters in a common instance profile. A central R/3 system consists of a single instance that includes all the necessary SAP services.

**Integrated Call Level Interface.** A component used by the SAP R/3 DBIF interface. It consists of a client and server component and allows AIX application servers to access an OS/390 data base server remotely across a network. The DBIF uses only a subset of data base functions and the ICLI delivers exactly that subset.

## J

**job.** Continuous chain of programs, controlled one after the other in time by particular control commands.

## L

**landscape.** A set of SAP R/3 systems, including production, test, quality and assurance, and "sandbox" systems.

**link.** The transmission medium for the serial-I/O interface. A link is a point-to-point pair of conductors (optical fibres) that physically interconnects a control unit and a channel, a channel and a dynamic switch, a control unit and a dynamic switch, or, in some cases, a dynamic switch and another dynamic switch. The two conductors of a link provide a simultaneous two-way communication path. One conductor is for transmitting information and the other is for receiving information. A link is attached to a channel or control

unit by means of the link interface of that channel or control unit and to a dynamic switch by means of a dynamic-switch port.

**list header.** First line on the screen in an output list. The list header is often the same as the program title, but you can also define it separately from the program.

## M

**main memory size.** Size of the main memory (in kilobytes).

**mapping.** The way that logical services (the various SAP R/3 system services—dialog, update, enqueue, batch, message, gateway, spool, database, and network services) are assigned to physical host machines.

**message.** Message in the R/3 system. There are several different types of messages. Examples are:

- Online messages from various application areas (information messages, warning messages, error messages)
- System messages
- Messages from background jobs

**message service.** A special job within the central system (instance) that is responsible for facilitating communications between instances within the same SAP R/3 system and for identifying services in the SAP R/3 system to jobs outside the SAP system. There is only one message service for an entire SAP R/3 system and it runs under the central instance, by default.

## P

**presentation service.** Part of the SAP R/3 system that interacts with the end user. It provides the graphical user interface on the PC and is sometimes referred to as SAPGUI. The presentation services of SAP R/3 interact with an instance of SAP R/3 to carry out end-user requests.

**printer writer.** A job that writes spooled files to an output device independently of the program that produced the output.

**productive session.** A batch input session that is recorded and processed at a later time. Changes to the database are only made when the session is processed. A productive session can only be processed once.

**profile.** Summary of system parameters with defined values. The parameters define, for example, the size of buffer areas, the maximum number of system users, and so on. The system parameters can be

grouped together in a profile. When activating the system, a certain profile can be called up.

## Q

**query.** ABAP/4 Query allows users to define reports without programming knowledge. When creating a query, you enter only individual texts such as the title and select fields and options that determine the report structure.

## R

**reconnect.** There is a database reconnect in the event that a work process receives an error return code of a particular class.

**RFC.** Remote Function Call. RFCs allow you to call and process predefined procedures (functions) in a remote SAP system. RFCs manage communication control, parameter transfer, and error handling.

**router.** An intelligent network component that holds information about the configuration of a network and controls data flows accordingly.

## S

**SAP R/3 system.** An SAP R/3 database and a collection of SAP R/3 instances (application servers) that provide services to the users. The collection of instances consist of one central instance and, optionally, one or more secondary instances. Each system has a system identifier called SAPSID.

**SAPGUI.** See **presentation service**.

**secondary instance.** An instance that does not have a message service or enqueue service. A secondary instance is connected to the central system (instance) and uses the message service and enqueue service under that central instance to perform its work. It does not depend on the central instance to be fully operational. A secondary instance does not have complete knowledge of all the resources of an SAP R/3 system nor the status of those resources. It depends upon the central instance for that knowledge.

**session log.** Record of a batch input session run. A session log is created for each session run. The log is contained in an external file on the operating system level. A session log contains messages generated by the batch input system and by the transactions processed in a session. It also contains overall statistics.

**session overview.** List of batch input sessions. The session overview contains the session name, date and time of creation, the session status and the name of the person who created the session, among others. You can select a session from the session overview



and run it, provided the session does not have the status “locked” or “processed.”

**SNA.** Systems Network Architecture. A widely used communications framework developed by IBM to define network functions and establish standards for enabling its different models of computers to exchange and process data. SNA is essentially a design philosophy that separates network communications into five layers.

**spool request.** A record that is created when information is sent to a printer or an output device. A spool request contains details about the request and a copy of the information.

**syntax group.** A syntax group contains the names of all operating systems that use the same syntax for assigning file names.

**system architecture.** Setup and basic structure of an electronic data processing (EDP) system. This term can also be used to cover software, its setup and development. Examples are:

- The way data and programs are stored
- The method of system control
- The type of interfaces possible
- The structure of the operating system, and how it works

**system log.** Recorded log of errors and events in the R/3 System. The system log contains information about program and transaction terminations, database errors, and so on.

**system services.** The logical set of functions needed to support the SAP R/3 system. These comprise dialog, update, enqueue, batch, message, gateway, spool, and database.

## T

**TCP/IP.** Transmission Control Protocol/Internet Protocol. A software protocol developed for communications between computers.

**text element.** Text that appears on the selection screen or the output screen of an ABAP/4 report. Text elements are used to store texts that are displayed on the selection screens or output screens of ABAP/4 reports, but are not hard-coded in programs. The different types of text elements include:

- Report or program titles
- List headings
- Column headings
- Selection texts
- Text symbols

**text mode.** Mode (or format) in which a file can be processed.

**text symbol.** Text constant specified and maintained outside a program. Text symbols are used instead of text literals in programs because the programs are then independent of any particular language and remain easy to maintain. Each text symbol must have a three-character ID.

**trailer.** Value field (6-9) associated with the context attribute field of a test procedure, for determining the order of execution.

**training session.** Batch input session, in which a processing model was recorded for training purposes. Training sessions can be called as often as required, and they can be edited. Database changes take place when training sessions are recorded and processed.

**transport layer.** The network layer that maintains end-to-end connections between communicating computers.

**transport log.** Record of the transfer of development environment objects from a source system to a target system. A transport log contains the following elements:

- Summary of activity
- Logging of the export of objects from a source system
- Logging of the import test carried out in the target system
- Logging of the import of objects into a target system

## U

**unit of measurement.** Quantity of measurement for a physical quantity (see the following dimensions below). Units of measurement are displayed on the screen and are used for internal conversions. There are standardized names (ISO codes) for all units of measurement. Examples are:

- Dimension: Length Units of measurement: Meter, centimeter, inch, and so on
- Dimension: Time Units of measurement: Second, minute, hour, and so on

In the R/3 System, quantity units with no dimensions (for example, crate, cardboard box, and so on) are handled in the same way as units of measurement and are maintained at the same place (although conversion factors cannot be specified).

**use.** Selection among application test, platform test, and individual test, which can be assigned to a test procedure.

**user administrator.** A user administrator is authorized to create and edit users by entering authorizations and values for other user parameters. User master records can be assigned to user groups. A user administrator can be authorized to create or modify only user master records that belong to a

particular user group or set of groups, or users that have not been assigned to any user group. For security reasons, the administrator should not be authorized to maintain or activate authorization profiles and authorizations. With these authorizations, the user could single-handedly define, activate, and assign system access authorizations.

**user buffer.** Buffer from which the data of a user master record is loaded when a user logs on.

**user group.** A group of users as defined in the component ABAP/4 Query. In the teams or departments within a company, the problem areas to be covered by ABAP/4 Query should be similar, or even identical, and concern the same functional areas. In ABAP/4 Query, users are therefore assigned to one (or more) user groups.

## W

**work process.** A job in the SAP R/3 system that actually does the work. Each work process is assigned a primary role by the dispatcher, which controls, to a certain degree, what type of work is to be performed by that work process. The number of work processes and the types that can exist for an

instance is controlled by the instance profile and within the SAP R/3 system by the Central Computer Management System.

## Numerics

**3088.** 3088 Multisystem Channel Communication Unit (MCCU), a channel-to-channel adapter (CTCA). An input/output device that is normally used by a program in one system to communicate with a program in another system. The adapter provides the data path and synchronization for a data transfer between two channels. When the adapter is used to connect two channels that are associated with different systems, a loosely coupled multiprocessing system is established. The adapter, as viewed by either of the channels it connects, has the appearance of an unshared input/output device.

## List of Abbreviations

|               |                                                             |                 |                                                                                                                                                                                                                            |
|---------------|-------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ABEND</b>  | abnormal end                                                | <b>EDM</b>      | environmental descriptor manager (DB2)                                                                                                                                                                                     |
| <b>ACS</b>    | access control system (HACS)                                | <b>EDP</b>      | electronic data processing                                                                                                                                                                                                 |
| <b>ADSM</b>   | ADSTAR data storage management                              | <b>ERP</b>      | Enterprise Resource Planning (new paradigm going one step past MRP and MES)                                                                                                                                                |
| <b>AFP</b>    | Advanced Function Printing                                  | <b>ESCON</b>    | enterprise systems connection (architecture, IBM System/390)                                                                                                                                                               |
| <b>AG</b>     | Aktiengesellschaft (German for Joint-Stock Company)         | <b>FDDI</b>     | fiber distributed data interface (100 Mbit/s fiber optic LAN)                                                                                                                                                              |
| <b>AIX</b>    | Advanced Interactive Executive (IBM's flavor of UNIX)       | <b>FI</b>       | finance                                                                                                                                                                                                                    |
| <b>APAR</b>   | authorized program analysis report                          | <b>FUNCT</b>    | function/functional                                                                                                                                                                                                        |
| <b>APPC</b>   | advanced program-to-program communication                   | <b>G/L</b>      | general ledger                                                                                                                                                                                                             |
| <b>ASC</b>    | address space control (MVS)                                 | <b>GB</b>       | gigabyte (10 <sup>9</sup> bytes or 1,000,000,000 bytes) case should be Gb                                                                                                                                                  |
| <b>ASCH</b>   | APPC/MVS scheduler                                          | <b>GDG</b>      | generation data group                                                                                                                                                                                                      |
| <b>ASCII</b>  | American National Standard Code for Information Interchange | <b>GOPHER</b>   | A menu-based search scheme, used to find information on the Internet. Originally developed at the University of Minnesota, it lets you reach a destination on the Internet by selecting items from a series of text menus. |
| <b>BSDS</b>   | bootstrap dataset (DB2)                                     | <b>GUI</b>      | graphical user interface                                                                                                                                                                                                   |
| <b>CCSID</b>  | coded character set identifier                              | <b>HSM</b>      | Hierarchical Storage Manager (IBM program product, now part of DFSMS)                                                                                                                                                      |
| <b>CD-ROM</b> | (optically read) compact disk - read only memory            | <b>I/O</b>      | input/output                                                                                                                                                                                                               |
| <b>CLAW</b>   | Common Link Access to Workstation protocol                  | <b>IBM</b>      | International Business Machines Corporation                                                                                                                                                                                |
| <b>CMOS</b>   | complementary metal oxide semiconductor                     | <b>ID</b>       | identification/identifier                                                                                                                                                                                                  |
| <b>CPI-C</b>  | Common Programming Interface for Communications (SAA)       | <b>IDCAMS</b>   | The program name for access method services (OP SYS)                                                                                                                                                                       |
| <b>CPU</b>    | central processing unit                                     | <b>INEWS</b>    | information news facility (IBM)                                                                                                                                                                                            |
| <b>DASD</b>   | direct access storage device                                | <b>INTERNET</b> | A worldwide network of TCP/IP-based networks                                                                                                                                                                               |
| <b>DB</b>     | database                                                    | <b>IRLM</b>     | integrated resource lock manager                                                                                                                                                                                           |
| <b>DBA</b>    | data bank administrator                                     | <b>ISMF</b>     | Interactive Storage Management Facility (IBM software product)                                                                                                                                                             |
| <b>DCE</b>    | Distributed Computing Environment (OSF)                     | <b>ISO</b>      | International Organization for Standardization                                                                                                                                                                             |
| <b>DD</b>     | data definition                                             |                 |                                                                                                                                                                                                                            |
| <b>DDL</b>    | data definition language                                    |                 |                                                                                                                                                                                                                            |
| <b>DFSMS</b>  | Data Facility Storage Management Subsystem (MVS and VM)     |                 |                                                                                                                                                                                                                            |
| <b>DSN</b>    | data set name                                               |                 |                                                                                                                                                                                                                            |
| <b>EBCDIC</b> | extended binary coded decimal interchange code              |                 |                                                                                                                                                                                                                            |

|              |                                                                      |              |                                                                                                                                          |
|--------------|----------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ITSO</b>  | International Technical Support Organization                         | <b>SD</b>    | storage director (DASD controller)                                                                                                       |
| <b>JCL</b>   | job control language (MVS and VSE)                                   | <b>SIS</b>   | sales information system                                                                                                                 |
| <b>JES</b>   | job entry subsystem (MVS counterpart to VM's RSCS)                   | <b>SMIT</b>  | System Management Interface Tool (see also DSMIT)                                                                                        |
| <b>KB</b>    | kilobyte, 1000 bytes (1024 bytes memory) case should be Kb           | <b>SMS</b>   | system managed storage (MVS and VM)                                                                                                      |
| <b>LUW</b>   | logical units of work                                                | <b>SNA</b>   | Systems Network Architecture (IBM)                                                                                                       |
| <b>MVS</b>   | multiple virtual storage (IBM System 370 & 390)                      | <b>SPUFI</b> | SQL processor using file input                                                                                                           |
| <b>NFSS</b>  | network file system server (DFP MVS)                                 | <b>SQL</b>   | structured query language                                                                                                                |
| <b>ODM</b>   | object data manager (AIX)                                            | <b>SYSIN</b> | system input stream                                                                                                                      |
| <b>PC</b>    | personal computer                                                    | <b>TB</b>    | terabyte (10**12 bytes or 1,000,000,000,000 bytes) case should be Tb                                                                     |
| <b>PCT</b>   | percent                                                              | <b>TCPIP</b> | transmission control protocol internet protocol                                                                                          |
| <b>PM</b>    | product marketing                                                    | <b>TRLE</b>  | transport resource list entry (VTAM)                                                                                                     |
| <b>PPR</b>   | prior point in time recovery (DB2)                                   | <b>TSO</b>   | time sharing option                                                                                                                      |
| <b>PROJ</b>  | project                                                              | <b>UDP</b>   | user datagram protocol (TCPIP)                                                                                                           |
| <b>PSF</b>   | print spool facility                                                 | <b>UNIX</b>  | An operating system developed at Bell Laboratories (trademark of UNIX System Laboratories, licensed exclusively by X/Open Company, Ltd.) |
| <b>PTF</b>   | program temporary fix                                                | <b>URL</b>   | Universal Resource Locator                                                                                                               |
| <b>QM</b>    | quality management                                                   | <b>VSAM</b>  | Virtual Storage Access Method (IBM)                                                                                                      |
| <b>QMF</b>   | Query Management Facility (IBM program product)                      | <b>VTAM</b>  | Virtual Telecommunications Access Method (IBM) (runs under MVS, VM, & DOS/VSE)                                                           |
| <b>RAMAC</b> | Raid Architecture with Multi-Level Adaptive Cache                    | <b>VTOC</b>  | volume table of contents                                                                                                                 |
| <b>RBA</b>   | relative byte address                                                | <b>WM</b>    | work measurement                                                                                                                         |
| <b>REQ</b>   | request                                                              |              |                                                                                                                                          |
| <b>RID</b>   | Record Identifier (DB2) (5/96)                                       |              |                                                                                                                                          |
| <b>SAA</b>   | Systems Application Architecture                                     |              |                                                                                                                                          |
| <b>SAP</b>   | Systems, Applications, Products in Data Processing (software vendor) |              |                                                                                                                                          |

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# Index

## A

- abbreviations 273
- acronyms 273
- ACS routines 29
- activity time 84
- ADSM 20
- AF\_UEINT physical file system 10
- AIX application server 6
- alert monitor 21
- ALTER STOGROUP command 186
- ALTER TABLESPACE command
  - example 180
  - usage 179
  - user impact 182
- APAR 47, 139
- application programs 1
- application server
  - middleware 1
  - process 80
  - workload 112
- application services 1, 2, 4, 6
- archive log 20
- ARCHIVE LOG command 133
- ASCII tables 18
- automation 24

## B

- BACKINT interface 20
- backup
  - alternatives 129
  - point of currency 129
  - point-in-time 129
  - scheduling 56
  - status 55
  - tablespace listing 57
  - tablespace timing 146
- backup and recovery
  - application servers 127
  - architectural differences: AIX and DB2 for OS/390 125
  - archiving 19
  - automation 24
  - backup and restore 125
  - central instance 127
  - DB2 for OS/390 catalog and directory 127
  - installation differences: AIX and DB2 for OS/390 126
  - new tablespaces 127
  - operation availability 137
  - order of magnitude 135
  - overview 19
  - planning 133
  - point-in-time 20, 135

- backup and recovery (*continued*)
  - prior point-in-time 125
  - protocols 20
  - referential integrity 135
  - SAP R/3 supporting software and files 127
  - transport and correction system 127
- basis layer 1
- bibliography 261
- BKPF table 189
- bootstrap data set 134
- buffer monitoring 46
- buffer pool
  - activity 62, 70
  - considered in example 189
  - detail 71
- buffered tables 17

## C

- catalog
  - DB2 136, 146, 207
  - DB2 (STOSPACE update) 171, 173
  - display 22
- central instance 2, 136
- CHECK INDEX utility 128
- client/server
  - of SAP R/3 2
  - products 1
  - server 4
- clustering index 157
- command
  - ALTER STOGROUP 186
  - ALTER TABLES 180
  - ALTER TABLESPACE 179, 180, 182
  - ARCHIVE LOG 133
  - list 86
  - LISTCAT 163, 164
  - STOP DB2 133
- COMMIT WORK 12
- compression 5
- conditional restart (DB2) 140, 143
- COPY utility
  - CHANGELIMIT 129
  - general 128
  - REPORTONLY 129
  - SHRLEVEL CHANGE 20, 130
  - SHRLEVEL REFERENCE 20, 125, 131
- cost of ownership 5
- CTS 47

## D

- data checking 24
- data class
  - APPLx 18

- data class (*continued*)
  - associated storage groups 18
  - definition 178
  - USERx 18
  - values 178
- data integrity 5, 10
- data set monitoring 24
- data sharing 5
- database
  - administration 5
  - catalog 21
  - checking 92, 100
  - DSNDB01 18
  - DSNDB06 18
  - large, support for 5
  - layout 17
  - locking 10, 61
  - performance 91
  - restart assistance 24
  - server 4
  - service 1
  - services 3
  - starting and stopping 19
- DATABASE 2 for OS/390
  - See DB2 for OS/390
- Database Interface (DBIF) of SAP R/3 6
- DB2
  - commands 22
  - comparison with Oracle 15
  - for AIX 17
  - overview 15
  - rollback 12
  - utilities 22, 24
- DB2 Administration Tool
  - option 12 (12X) 173
  - option 13 173
  - options 173
  - RUNSTATS usage 173
  - STOSPACE usage 173
- DB2 for OS/390
  - activity time 84
  - additional features 5
  - analysis 59
  - catalog 136, 146, 207
  - commands 86
  - commit 72
  - conditional restart 140, 143
  - data integrity 5, 10
  - data sharing 5
  - directory 136, 146, 207
  - dynamic statement cache 75
  - EDM pool 74
  - features 5
  - index analysis 98, 103
  - Installation Panel 142
  - installation parameters 85
  - locking 69, 72
  - log 142

- DB2 for OS/390 (*continued*)
  - logging 73
  - Online Monitor 26
  - open/close activity 76
  - performance 60
  - release 52
  - RID list activity 79
  - SQL activity 78
  - statement cache statistics 83
  - storage group 30
  - subsystem services 77
  - table analysis 98, 99
  - table call statistics 122, 123, 124
  - table index analysis 103
  - tablespace analysis 96
  - tablespace history 95
  - thread activity 80
  - thread report 86
  - thread SQL activity 82
  - user SAPR3 18
  - very large database support 5
    - with SAP R/3 3
  - workload 58
- DB2ADM
  - See DB2 Administration Tool
- DB2AUG
  - function 173
  - scheduling 173
- DBA planning calendar 53
- DBxx Transactions 15
- dialog step workload 113
- directory (DB2) 136, 146, 207
- documentation 1, 261
- DSNDB01 18
- DSNDB06 18
- DSNTIPS 142
- dynamic SQL 137
- dynamic statement cache 75

## E

- EBCDIC tables 18
- EDM pool 74
- Enhanced ESCON 4
- ESCON channels
  - network 7
  - physical connection 8
  - protocol 8
- ethernet LAN physical connection 8
- event determination 27
- exception determination 27
- exporting and importing functions 47

## F

- FDDI LAN
  - application server connection 9
  - physical connection 8

free space 93, 157, 158, 160

## H

hot spot tables 176

HSM 25

## I

ICLI

See integrated call-level interface (ICLI)

index

analysis 98, 103

changing in example 189

checking 24

clustering 157

finding in example 189

missing 100

missing unique indexes 31

monitoring 40

partitioning 189

rebuild timing 153, 233

recovery 142

reorganization 160

space 40

status 40

storage during REORG 160

usefulness 117

installation

central instance 2

parameter history 100

installation (DB2) 142

installation parameters 85

integrated call-level interface (ICLI)

DBIF 6

general 4, 6

High Speed UDP 4

server 7

trace control 88

## J

JCL

ALTER STOGROUP 186

ALTER TABLESPACE 180

automated generation 24

COPY 152, 201

COPY example 146, 147

COPY TABLESPACE 145

display 107

DSN1COPY 145, 149

DSN1COPY example 149

examples 201

LISTCAT 164

management 105

RECOVER INDEX 145

RECOVER INDEX ALL example 153

RECOVER TABLESPACE 145

RECOVER TABLESPACE example 150, 151

JCL (*continued*)

reload 200

REORG 181

RUNSTATS utility 167

STOSPACE utility 171

submission 53

utility examples 145

JES 54

job scheduler 25

job status 54

job submission 53

## L

large database support 5

LISTCAT command

ENTRIES parameter 163

function 163

JCL example 164

LEVEL parameter 164

output 165

recommendation 163

TSO example 164

load and unload functions 47

locking 10, 61, 69, 72

log

activity 73

archive 20

OS/390 system 87

recovery 158, 159

log (DB2) 142

logical unit of work (LUW) 10

## M

management disciplines 138

MERGECOPY utility 128

monitoring

buffers 46

data sets 24, 42

database 32, 33

extents 90

Oracle 21

overview 21

tablespaces 34

volumes 42

MSEG table in example 187

## N

Netview DB2PM interface 27

non-transparent tables 19

## O

object

authorization 22

display 22

dynamic definition 24

- offline backup 126
- offline reorganization 158
- Online Monitor 26
- online reorganization 158
- open/close activity 76
- Oracle
  - comparison with DB2 15
  - for AIX 17
  - monitoring 21
  - reorganization 47
  - SAPDBA transaction 15, 47
- OS/390 system log 87

## P

- Parallel Sysplex 5
- partitioned tablespace 163
- performance
  - determination 26
  - extent recommendation 165
  - monitoring 26
  - queries 22, 23
- planning calendar 53
- point-in-time
  - DSN1COPY 20
  - recommendations 143
  - recovery 21, 125, 137, 138
  - recovery (with DSS) 132
  - recovery example 151
  - recovery techniques 138
- presentation services 1
- PTF 235

## Q

- quiesce point
  - point of consistency 133
  - user access 135
- QUIESCE utility 128, 134, 146

## R

- R/3
  - See SAP R/3
- RAMAC Virtual Array 144
- RDMS 51
- RECOVER INDEX utility 20, 128
- RECOVER TABLESPACE utility 128
- recovery
  - alternatives 132
  - automation 24
  - index 142
  - levels 133
  - point of currency 132
  - point-in-time 133
  - quiesce point 133
  - tablespace timing 151
- redbook 5, 261

- referential integrity 20
- REORG utility
  - altered tablespace 180
  - example 181
  - JCL 181
  - timeout errors 183
- reorganization
  - access type consideration 157
  - automation 24, 25
  - criteria 24
  - index 160
  - justifications 157
  - offline 158
  - overview 46
  - recommendations 160
  - share-level change 160
  - tablespaces 157
  - user impact 158, 159
- REUSE parameter 139, 142, 153, 235
- RID list activity 79
- RS/6000 SP2 gateway nodes 9
- RUNSTATS utility
  - checking tablespace growth 169
  - DB2ADM usage 173
  - example 167
  - frequency 167
  - function 166
  - new tablespace 173
  - NPAGES setting 168, 170
  - options 167
  - recommended 181
  - SAMPLE parameter 167
  - SHRLEVEL 166
  - used in example 188, 190, 200

## S

- SAP R/3
  - alert monitor 21
  - architecture 1, 2, 6
  - BACKINT interface 20
  - backup tablespace 57
  - basis layer 1
  - buffered tables 17
  - buffered tablespace 126
  - database performance 91
  - integration 1
  - locking 10
  - logical unit of work 10
  - non-transparent tables 19
  - R3INST 126
  - release 52
  - services 2
  - structure 1
  - system status 52
  - table call statistics 122, 123, 124
  - transparent tables 18
  - tuning profile parameters 109
  - tuning summary 108



- SAP R/3 (continued)
  - unbuffered tables 17
  - unbuffered tablespace 126
  - utilities 3
- SAP R/3 transaction
  - DB02 15, 16, 31, 89, 168
  - DB03 17, 100
  - DB04 132
  - DB05 101
  - DB12 17, 20
  - DB13 15, 17
  - DB2C 104
  - DB2J 105, 169
  - DBxx 15
  - general 21, 51
  - SAPDBA 15, 16
  - SE11 16, 18, 37, 49, 222
  - SE14 32, 188, 191
  - SM13 143
  - ST02 108
  - ST03 16, 110
  - ST04 16, 33, 46, 160
  - ST05 117, 118
  - ST07 120
  - ST10 121, 160, 174
  - STxx 108
- SAPGUI 52, 53
- scalability 4
- scratch table
  - definition 179
  - examples 179
- scripts 215
- segmented tablespace 34
- SHRLEVEL CHANGE 128
- SHRLEVEL REFERENCE 128
- single-tier system 2
- size category
  - definition 177
  - exhibiting 177
  - table 225
- SMS 30
- SnapShot 140, 144
- software services 1
- space
  - allocation 24, 35
  - queries 22
- SQL
  - activity 78, 83
  - dynamic 22, 137
  - error -904 182, 183
  - error -911 182
  - EXPLAIN 22, 117
  - setting SQLID for SAP R/3 187, 189
  - SQLID 22
  - thread activity 82
  - trace 175
- SQLID 187, 189
- starting and stopping the database 19
- statement cache statistics 83
- storage group 18, 30
- storage groups 18
- STOSPACE utility
  - catalog update 173
  - DB2ADM usage 173
  - function 171
  - growth comparison 173
  - show allocated space 172
- subsystem services 77
- SYSIBM 18
- system status 52
- System/390
  - benefits 4
  - structure 6
- systems management capabilities 4

## T

- table
  - analysis 98, 99
  - backup timing 146
  - call statistics 122, 123, 124
  - COPY 201
  - data class 19
  - high insert 176
  - index analysis 103
  - monitoring 37
  - partitioned 163
  - recovery timing 151
  - reorganization 157
  - segmented 34
  - sequence for COPY 149
  - shipped in SAP R/3 4.5A 237
  - synchronization 159
  - transparent 19
  - unbuffered 161
  - unit of recovery 133
- tablespace
  - analysis 96
  - backup and recovery 20
  - buffered 126
  - creation 127
  - growth 95
  - monitoring 34
  - starting and stopping 19
  - unbuffered 126
- TCP/IP
  - communication between application and presentation servers 4
  - multi-tier configurations 3
- thread activity 80
- thread report 86
- thread SQL activity 82
- threshold determination 27
- tiers 2
- tools
  - DB2 Administration Tool 22

tools (*continued*)  
  DB2AUG 24  
  DB2PM 26  
  DFSMS 29  
transaction  
  See SAP R/3 transaction  
transparent tables 18  
TRLE 9  
troubleshooting performance problems 26  
tuning  
  requirements 26  
  utility run time comparisons 146  
two-tier system 2

## U

UDP 9  
unbuffered tables 17  
user SAPR3 18  
utilities  
  CHANGE LOG INVENTORY 142  
  CHECK INDEX 128  
  checking 24  
  COPY 19, 24, 125, 128, 130, 139, 147, 149, 152  
  COPY CONCURRENT 130  
  COPY example 146, 147  
  COPY TABLESPACE 145  
  DFSMS 42  
  DSN1CHKR 25  
  DSN1COPY 25, 126, 131, 145  
  DSN1COPY example 149  
  DSN1PRNT 25  
  JCL examples 145  
  MERGECOPY 24, 128, 130  
  QUIESCE 21, 25, 128, 134, 141, 146  
  RECOVER 20, 24, 139, 141  
  RECOVER INDEX 20, 128, 145, 147  
  RECOVER INDEX ALL example 153  
  RECOVER TABLESPACE 128, 145, 147  
  RECOVER TABLESPACE example 150, 151  
  REORG 25, 158, 159  
  REPAIR 25  
  REPORT 25  
  RUNSTATS 22, 23, 25, 33, 34, 37, 160, 163, 166  
  STOSPACE 22, 25, 33, 34, 163, 171  
  use in point-in-time recovery 139  
  utility run time comparisons 146

## V

VB tables 12  
VBDATA 12  
VBHDR 12  
VBMOD 12  
volume  
  analysis 31  
  contents 24  
  extents 89  
  free space 93

volume (*continued*)  
  label 31  
  monitoring 24, 42  
  storage group 18  
  table of contents 93  
VSAM 21, 40, 163  
VSAM extent limit 157, 179, 184  
VTAM TRLE 9

## W

Windows NT application server 4, 6, 9  
workload 112  
workload analysis 58  
workload statistics records 116

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