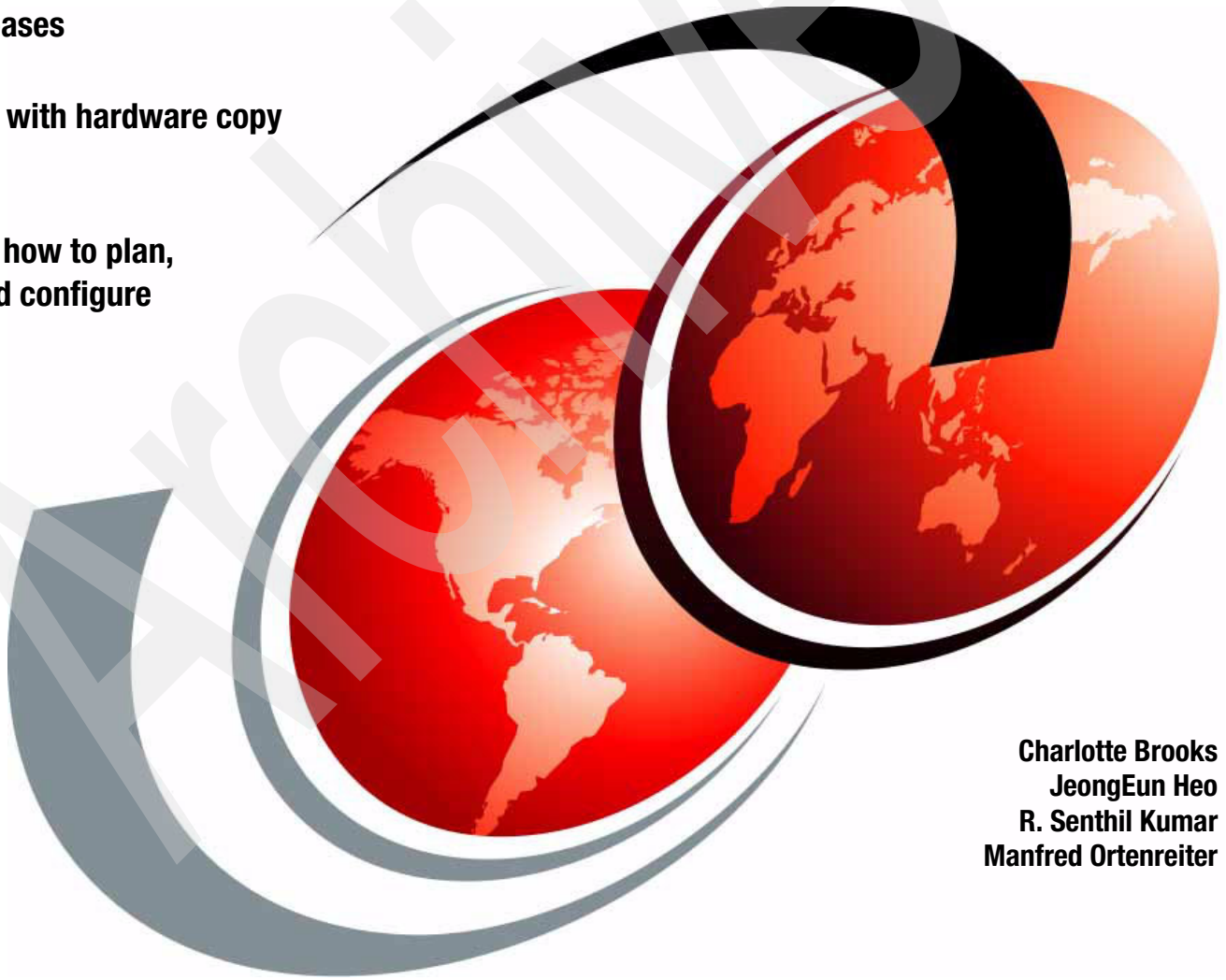
Tivoli software

IBM

IBM Tivoli Storage Manager for Advanced Copy Services

- Near instant backup and recovery of SAP databases
- Integrates with hardware copy services
- Describes how to plan, install, and configure



Charlotte Brooks
JeongEun Heo
R. Senthil Kumar
Manfred Ortenreiter

Redbooks

ibm.com/redbooks

International Technical Support Organization

IBM Tivoli Storage Manager for Advanced Copy Services

December 2006

SG24-7474-00

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

First Edition (December 2006)

This edition applies to 5608-ACS IBM Tivoli Storage Manager for Advanced Copy Services.

Contents

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

Trademarks

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

AIX®	FlashCopy®	Redbooks™
DB2®	HACMP™	Redbooks (logo) ™
DB2 Universal Database™	IBM®	System p™
DS6000™	ibm.com®	System Storage™
DS8000™	POWER5™	Tivoli®
Enterprise Storage Server®	pSeries®	TotalStorage®

The following terms are trademarks of other companies:

SAP NetWeaver, mySAP, SAP R/3, SAP, and SAP logos are trademarks or registered trademarks of SAP AG in Germany and in several other countries.

Snapshot, and the Network Appliance logo are trademarks or registered trademarks of Network Appliance, Inc. in the U.S. and other countries.

Java, JRE, JVM, and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.

Preface

Backing up SAP® software environments is increasingly challenging in today's 24x7 enterprises. Even more challenging is restoring these environments. Applications and databases grow ever larger, putting increasing strain on the management infrastructure. Using hardware-assisted copy mechanisms to perform fast backups and restores is one way to address these issues.

Tivoli® Storage Manager, along with associated products, allows you to leverage FlashCopy® to perform fast backups, almost "instant" restores, as well as database cloning for testing and other purposes. These applications are fully integrated with SAP software in DB2® UDB and Oracle environments, providing reliable, intelligent techniques for data protection.

This IBM® Redbook will help you plan, configure, and run IBM Tivoli Storage Manager for Advanced Copy Services and associated applications in your SAP software environments.

The team that wrote this redbook

Charlotte, Manfred, Senthil, JeongEun

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

Charlotte Brooks is an IBM Certified IT Specialist and Project Leader for Storage Solutions at the International Technical Support Organization, San Jose Center. She has 15 years of experience with IBM in storage hardware and software support, deployment, and management. She has written many IBM Redbooks™, and has developed and taught IBM classes in all areas of storage and storage management. Before joining the ITSO in 2000, she was the Technical Support Manager for Tivoli Storage Manager in the Asia Pacific Region.

JeongEun Heo is an IBM Senior IT Specialist in Technical Sales/Support in IBM Korea. She has 10 years of experience with IBM and before joining IBM, she majored in Computer Science. She has over 8 years of experience in Tivoli Storage Manager. Her other areas of expertise include Windows®, AIX®, PSSP, and HACMP™. She is now with the IBM Software Group, performing pre-sales support for clients and business partners for Tivoli Storage Manager and TotalStorage® Productivity Center. She has taught many technical classes including Tivoli Storage Manager. She is an IBM Certified Advanced Deployment Professional — Tivoli Storage Management Solutions.

R. Senthil Kumar is an IT specialist working for IBM Global Services in India since 1997. He has 16 years of experience in IT. Before joining IBM he worked for HCL Hewlett-Packard Limited. He has worked with Tivoli Storage Manager since 2001 and his expertise includes implementing pSeries® servers, storage, and HACMP. He is an IBM certified professional on Tivoli Storage Manager and pSeries system administration. He holds a Degree in Information Systems from Birla Institute of Technology & Science, Pilani, and a Diploma in Electrical & Electronics from V.Ramakrishna Polytechnic, Tiruvottiyur.

Manfred Ortenreiter is a software Support Specialist working for ITS Central Region Tivoli Front End in Germany. He has worked at IBM for 21 years and has 15 years of experience in software support. He holds a degree in power engineering from the UAS in Bochum. His areas of expertise include all subjects of IBM Tivoli storage products on host and distributed platforms.

Thanks to the following people for their contributions to this project:

Deanna Polm, Sangam Racherla, Yvonne Lyon
International Technical Support Organization, San Jose Center

Arnold Erbsloeh, Christian Kaiser, Ralf Lichtenstein, John Marshall, Hans-Joachim Renger, Ernesto Puig Rodriguez, Andreas Uhl
IBM Boeblingen

Tom Chang and Staff
Garden Inn, Los Gatos

Become a published author

Join us for a two- to six-week residency program! Help write an IBM Redbook dealing with specific products or solutions, while getting hands-on experience with leading-edge technologies. You'll have the opportunity to team with IBM technical professionals, Business Partners, and Clients.

Your efforts will help increase product acceptance and customer satisfaction. As a bonus, you'll develop a network of contacts in IBM development labs, and increase your productivity and marketability.

Find out more about the residency program, browse the residency index, and apply online at:

ibm.com/redbooks/residencies.html

Comments welcome

Your comments are important to us!

We want our Redbooks to be as helpful as possible. Send us your comments about this or other Redbooks in one of the following ways:

- Use the online **Contact us** review redbook form found at:

  ibm.com/redbooks

- Send your comments in an email to:

  redbooks@us.ibm.com

- Mail your comments to:

  IBM Corporation, International Technical Support Organization
  Dept. HYTD Mail Station P099
  2455 South Road
  Poughkeepsie, NY 12601-5400

1

Introduction

In this chapter we provide an introduction to Tivoli Storage Manager for Advanced Copy Services and the various components that it uses. We also supply information about the prerequisites for all modules of Tivoli Storage Manager for Advanced Copy Services available at the time of writing this book.

1.1 Tivoli Storage Manager for Advanced Copy Services

Tivoli Storage Manager for Advanced Copy Services software provides online backup and restore of data stored in SAP software on DB2 and Oracle databases by leveraging the copy services functionality of the underlying storage hardware. Using hardware-based copy mechanisms rather than traditional file-based backups can significantly reduce the backup/restore window on the production server. Backups are performed through an additional server called the *backup server,* which performs the actual backup. Because the backup operation is offloaded to the backup server, the production server is free from nearly all the performance impact. The production server's processor time is dedicated for the actual application tasks, so application users' performance is not affected during backup.

Tivoli Storage Manager for Advanced Copy Services is used in conjunction with some other products to interact with the applications and perform the backup from the backup server to Tivoli Storage Manager. The products with which it interfaces are Tivoli Storage Manager for Enterprise Resource Planning (Data Protection for mySAP), Tivoli Storage Manager for Databases (Data Protection for Oracle), and the inbuilt Tivoli Storage Manager interfaces for DB2 UDB.

Tivoli Storage Manager for Advanced Copy Services has these modules currently available:

- Data Protection for IBM Disk Storage and SAN Volume Controller for mySAP™ with DB2 UDB — FlashCopy integration for mySAP with DB2 on SVC, DS6000, DS8000™
- Data Protection for IBM Disk Storage and SAN Volume Controller for mySAP with Oracle — FlashCopy integration for mySAP with Oracle on SVC, DS6000, DS8000
- Data Protection for IBM Disk Storage and SAN Volume Controller for Oracle — FlashCopy integration for Oracle on SVC, DS6000, DS8000
- DB2 UDB Integration Module and Hardware Devices Snapshot Integration Module — FlashCopy integration for DB2 on ESS, SVC, DS6000, DS8000
- Data Protection for ESS for Oracle — FlashCopy integration for Oracle on ESS
- Data Protection for ESS for mySAP — FlashCopy integration for mySAP with DB2 or Oracle on ESS

In this book we use the abbreviated term Data Protection for FlashCopy as a generic term for all these products, specifying either SAP Oracle, SAP DB2, DB2, or Oracle where we have to be more specific.

Tivoli Storage Manager for Advanced Copy Services was previously known as Tivoli Storage Manager for Hardware which was supported on the IBM Enterprise Storage System (ESS) only. It had the following modules:

- Data Protection for IBM ESS for mySAP with DB2
- Data Protection for IBM ESS for mySAP with Oracle
- Data Protection for IBM ESS for DB2
- Data Protection for IBM ESS for Oracle

Certification: Tivoli Storage Manager for Advanced Copy Services is certified by SAP for Split Mirror Disk Backup, BC-BRS. For more information on this certification, see:

https://www.sdn.sap.com/irj/sdn/docs?rid=/webcontent/uuid/adcd8c1a-0901-0010-f59e-865ae151acaf

Note: Tivoli Storage Manager for Hardware was withdrawn from marketing on June 16, 2006. It is replaced by Tivoli Storage Manager for Advanced Copy Services.

1.1.1 Why Tivoli Storage Manager for Advanced Copy Services?

In today's IT environments, database sizes are large and growing larger. Most of the servers operate 24x7 with very high uptime requirements. With large database sizes, the traditional direct to tape backup can last for hours, with significant impact on the production server's application performance due to the high I/O activity caused by backup. Faster tape technology cannot necessarily keep up with the shrinking backup windows. Restore time is also critical -— restoring a very large database from tape can take too long — meaning too high an outage.

Many storage disk systems provide a snapshot function for a point-in-time copy. However, if this function is used (in isolation) when the applications are running or online, the copied data will not be in a consistent state for restore. To create a useful, restorable backup, you should have proper application knowledge to interact with the application, and put it in a proper state before performing the snapshot. Scripting is one way to achieve this; however, the scripting task is complex, requiring detailed application knowledge, and testing and maintenance effort. A package solution, such as Tivoli Storage Manager for Advanced Copy Services, alleviates this.

In this redbook, we will use the term FlashCopy, which is an IBM implementation of point-in-time snapshot, because at this time, only IBM disk systems are supported as the underlying hardware.

Major challenges faced in today's environments

Here are some of the major challenges encountered:

- Application databases take a long time to back up.
- Application performance is impacted during the entire backup window.
- More archive logs get created during the large backup window, thus causing difficulty in managing them. Also, in the event of recovery, it takes time because more archive logs have to be applied.
- Large recovery times are experienced (that is, a restore takes more time).
- Application knowledge is required to implement FlashCopy.
- Scripting is required to automate FlashCopy.

Tivoli Storage Manager for Advanced Copy Services overcomes these challenges, and provides the following benefits:

- It reduces backup time dramatically to a few seconds on the production server using FlashCopy services of the storage hardware.
- Application performance on the production server is not impacted, because the actual backup is done from the backup server.
- Because the backup window is much smaller, fewer archive logs are generated. This means that during recovery, fewer files have to be applied.
- Database restore can take a few seconds if done using the Flashback restore services of the storage hardware.
- It is "application-aware", so consistent, restorable backups can be made.
- No scripting is required to do the FlashCopy, validate, and do backup. These functions are all integrated within the product.

Tivoli Storage Manager for Advanced Copy Services:

- Minimizes the impact on the database servers while allowing automated database backups to the Tivoli Storage Manager server.
- Employs a backup server that offloads the backup data transfer from the FlashCopy volumes to the Tivoli Storage Manager server.
- Provides options to implement high efficiency backup and recovery of business critical databases while virtually eliminating backup related downtime, user disruption, and backup load on the production server.

The Data Protection for FlashCopy FlashBack restore functionality provides a fully automated tool for a fast restore of business critical databases.

1.1.2 Supported platforms

Tivoli Storage Manager for Advanced Copy Services (all components), supports AIX 5.2, AIX 5.3 in both 32 bit and 64 bit mode.

1.1.3 Supported storage environment

Tivoli Storage Manager for Advanced Copy Services supports the following IBM System Storage™ disk systems with its various modules.

- Enterprise Storage Server® (ESS) Model 800
- DS6000 disk storage system
- DS8000 disk storage system
- SAN Volume Controller (SVC)

Note: Tivoli Storage Manager for Advanced Copy Services can use only one type of disk system in each configuration. However, if you have multiple disk systems from IBM or other vendors, they can all be used together when the SAN Volume Controller is used as a virtualization layer. For more information about SVC, see:

http://www.ibm.com/servers/storage/software/virtualization/svc/index.html

1.2 Data Protection for mySAP (DB2 UDB)

Tivoli Storage Manager for Advanced Copy Services Data Protection for FlashCopy for mySAP (DB2 UDB) performs integrated FlashCopy backup of SAP software installed on the DB2 UDB database. It is well integrated with the DB2 administration utilities and the copy services of the underlying storage system.

1.2.1 Operating environment

Data Protection for FlashCopy for mySAP (DB2 UDB) requires a production server running SAP software on a DB2 database on AIX, with one of the supported disk systems. The backup server must be another AIX server with access to the same disk system. The backup server will back up the FlashCopy'd data copied from the production server to the Tivoli Storage Manager server. The Tivoli Storage Manager can be installed on the backup server, or on another server with connectivity to the production and backup servers. If a separate server is used for the Tivoli Storage Manager server, this can be on any supported operating system platform.

Data Protection for FlashCopy for mySAP (DB2 UDB) has a prerequisite of Tivoli Storage Manager for ERP - Data Protection for mySAP (DB2 UDB) to do the actual backup and restore. The DB2 client is also required on the backup server.

1.2.2 Prerequisites

Next we discuss the requirements for Data Protection for FlashCopy for mySAP (DB2).

Hardware requirements

The following hardware is required:

- IBM System p™ server for production and backup server (and optional take-over production server if HACMP is used).
- One of these disk systems:
  - DS6000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.0.600.16. Data Protection for FlashCopy currently does not work with 6.0.600.20 microcode level.
  - DS8000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.1.0.38.
  - SVC storage system with V2.1 storage engine or higher.
  - ESS 800 with FlashCopy license feature (FC 1830-1835). Microcode V2 is required.
- Production and backup servers require SCSI or Fibre Channel adapter for connecting to the storage system.
- Production and backup servers require 100 MB of free disk space for installing Data Protection for FlashCopy on each.
- Production and backup servers require 256 MB of memory for Data Protection for FlashCopy only. This does not include other components' memory requirements.
- LAN connection is required between:
  - Production and backup servers to the server running DS open API CIM agent in ESS, DS6000, or DS8000 environment. CIM agent, in turn, requires communication with the ESS, DS6000, or DS8000.
  - Production and backup servers to the SVC Master Console in SVC environment. The SVC Master Console, in turn, requires communication with the SVC.
  - Production and backup servers to Tivoli Storage Manager server for doing backup / restore.
  - Production and backup servers for rexec, NFS communication.
- The FlashCopy source volumes (where the DB2 SAP database is located) should be accessible only from the production server. Similarly, the FlashCopy target volumes should be accessible only from the backup server. The source and target volumes should be of matching size and should be contained within the same disk system.
- In an HACMP environment, there are two production servers in the HACMP cluster. In this case, a separate backup server is required, making a total of three servers required. The backup server *cannot* be part of the HACMP production server cluster. If a clustered production server is used, then the takeover server has identical requirements as the production server.

Software requirements

The following software is required:

- AIX 5.2 with ML05 or AIX 5.3 with ML01. Refer to the readme file for the latest fix requirements.
- Subsystem device driver (SDD) V1.6.0.2. For ESS 800, DS6000, or DS8000, either SDD or SDDPCM can be used.
- Subsystem device driver path control module (SDDPCM) V2.1.0.1. This is not supported for SVC f — only SDD is supported here.
- Locale en_US.ISO8859-1, which can be checked using the AIX command, **`locale -a`**.
- The **`rexecd`** daemon must run on the production server. The backup server will execute commands on the production server using **`rexec`**.
- The **`rshd`** daemon must be running on the production server. The backup server will use **`rsh`** during installation and configuration.
- The database must reside on journaled file system (JFS or JFS2) using separate log devices. JFS2 inline logs are not supported. The DB2 database cannot reside on raw devices.
- NFS is required between production and backup servers.
- Tivoli Storage Manager server V5.2 or higher, and Tivoli Storage Manager backup-archive client V5.3 or higher.
- Tivoli Storage Manager API V5.3.0 or higher. Check the Data Protection for mySAP readme file for the Tivoli Storage Manager API requirements.
- Tivoli Storage Manager for Databases Data Protection for mySAP (DB2) V5.3.1 or higher.
- If using ESS for storage, the ESS CLI V2.4.1.50 is required. The version must correspond to the microcode level installed in the ESS clusters.
- DS Open API CIM agent V5.1.0.47 for ESS, DS6000, and DS8000 environment. The CIM agent can be installed on any server accessible from the production and backup server. Only non-SSL mode is supported. In the SVC environment, the Master Console console has the required CIM software pre-installed.
- CIM server runtime (Pegasus) V2.3.2.2. Only the client libraries are used by Data Protection for FlashCopy. This is available as part of the AIX expansion pack.
- CIM server base providers for AIX (Pegasus) V1.2.4.2. This is available as part of the AIX expansion pack.
- OpenSSL. Available on the “AIX toolbox for Linux applications for POWER” CD-ROM.
- SAP R/3® 4.6B to 4.6D or mySAP ERP solution.
- SAP software administration tools 6.20 patch15 or higher. Not required if DB2 V8.2 log file management is used.
- DB2 8.1 Fixpak 3 or 8.2.

1.2.3 Functions

Data Protection for FlashCopy for mySAP (DB2) has two major components: **`tdphdwdb2`** and **`splitint`**. Data Protection for FlashCopy for mySAP (DB2) provides some active functions for interacting with DB2 and Data Protection for mySAP, and some passive functions.

The active functions include:

- Highly available DB2 database backup using FlashCopy

- Highly available DB2 database restore using FlashCopy
- Integrating with DB2 functions to support running copy services functions, including FlashCopy and withdraw
- Keeping the progress of the Data Protection for FlashCopy functions in a housekeeping file to monitor the proper sequential usage of the functions
- Sending information to the Data Protection for mySAP administration assistant while Data Protection for FlashCopy is running.

The passive functions include:

- Monitoring a running FlashCopy process when the FlashCopy is invoked with COPY, INCR options
- Seamless augmentation of the functions of Data Protection for mySAP
- Centrally administered and scheduled backup operations

1.3 Data Protection for FlashCopy for mySAP with Oracle

Tivoli Storage Manager for Advanced Copy Services Data Protection for FlashCopy for mySAP (Oracle) performs integrated FlashCopy backup of SAP software environments installed on Oracle databases. It is well integrated with the SAP software DBA tools package BR*Tools and the copy services of the underlying storage system.

1.3.1 Operating environment

Data Protection for FlashCopy for mySAP (Oracle) requires a production server running SAP software with an Oracle database on AIX, with one of the supported disk systems. The backup server must be another AIX server with access to the same disk system. The backup server will back up the FlashCopy'd data copied from the production server to the Tivoli Storage Manager server. The Tivoli Storage Manager can be installed on the backup server, or on another server with connectivity to the production and backup servers. If a separate server is used for the Tivoli Storage Manager server, this can be on any supported operating system platform. The entire backup is accomplished through the BR*Tools component **brbackup**, Data Protection for FlashCopy (**splitint**), and Data Protection for mySAP (**backint/prole**) working together.

Data Protection for FlashCopy for mySAP (Oracle) has a prerequisite of Tivoli Storage Manager for ERP - Data Protection for mySAP (Oracle) to do the actual backup and restore. The Oracle client and BR*Tools are required on the backup server.

1.3.2 Prerequisites

Here we describe the requirements for Data Protection for FlashCopy for mySAP (Oracle).

Hardware requirements

The following hardware is required:

- IBM System p server for production and backup server (and optional take-over production server if HACMP is used)

- One of these disk systems:
  - DS6000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.0.600.16. Data Protection for FlashCopy currently does not work with 6.0.600.20 microcode level.
  - DS8000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.1.0.38.
  - SVC storage system with V2.1 storage engine or higher.
  - ESS 800 with FlashCopy license feature (FC 1830-1835). Microcode V2 is required.
- Production and backup servers require SCSI or Fibre Channel adapter for connecting to the storage system.
- Production and backup servers require 100 MB of free disk space for installing Data Protection for FlashCopy on each.
- Production and backup servers require 256 MB of memory for Data Protection for FlashCopy only. This does not include other components' memory requirements.
- LAN connection is required between:
  - Production and backup servers to the server running DS open API CIM agent in ESS, DS6000, or DS8000 environment. CIM agent, in turn, requires communication with the ESS, DS6000, or DS8000.
  - Production and backup servers to the SVC Master Console in SVC environment. The SVC Master Console, in turn, requires communication with the SVC.
  - Production and backup servers to Tivoli Storage Manager server for doing backup / restore.
  - Production and backup servers for rexec, NFS communication.
- The FlashCopy source volumes (where the Oracle database is located) should be accessible only from the production server. Similarly, the FlashCopy target volumes should be accessible only from the backup server. The source and target volumes should be of matching size and should be contained within the same disk system.
- In an HACMP environment, there are two production servers in the HACMP cluster. In this case, a separate backup server is required, making a total of three servers required. The backup server *cannot* be part of the HACMP production server cluster. If a clustered production server is used, then the takeover server has identical requirements as the production server.

Software requirements

The following software is required:

- AIX 5.2 with ML05 or AIX 5.3 with ML01. Refer to the readme file for the latest fix requirements.
- Subsystem device driver (SDD) V1.6.0.2. For ESS 800, DS6000, or DS8000, either SDD or SDDPCM can be used.
- Subsystem device driver path control module (SDDPCM) V2.1.0.1. This is not supported for SVC, only SDD is supported here.
- Locale en_US.ISO8859-1, which can be checked using aix command **`locale -a`**.
- The **`rexecd`** daemon must run on production server. The backup server will execute commands on the production server using **`rexec`**.
- The **`rshd`** daemon must be running on the production server. The backup server will use **`rsh`** during installation and configuration.

- The database must reside on journaled file system (JFS or JFS2) using separate log devices. JFS2 inline logs are not supported. The Oracle database cannot reside on raw devices.
- NFS is required between production and backup server.
- Tivoli Storage Manager server V5.2 or higher. Tivoli Storage Manager backup-archive client V5.3 or higher.
- Tivoli Storage Manager API V5.3.0 or higher. Check the Data Protection for mySAP readme file for the Tivoli Storage Manager API requirements.
- Tivoli Storage Manager for Databases Data Protection for mySAP (Oracle) V5.3.1 or higher.
- If using ESS for storage, the ESS CLI V2.4.1.50 is required. The version must correspond to the microcode level installed in the ESS clusters.
- DS Open API CIM agent V5.1.0.47 for ESS, DS6000, or DS8000 environment. The CIM agent can be installed on any server accessible from the production and backup server. Only non-SSL mode is supported. In the SVC environment, the Master Console console has the required CIM software pre-installed.
- CIM server runtime (Pegasus) V2.3.2.2. Only the client libraries are used by Data Protection for FlashCopy. This is available as part of the AIX expansion pack.
- CIM server base providers for AIX (Pegasus) V1.2.4.2. This is available as part of the AIX expansion pack.
- OpenSSL. Available on the “AIX toolbox for Linux applications for POWER” CD-ROM.
- SAP R/3 4.6B to 4.6D or mySAP ERP solution.
- SAP software administration tools 6.20 patch118 or higher.
- Oracle server V9.2 (64 bit).
- SQLNET is required.

1.3.3 Functions

Data Protection for FlashCopy for mySAP (Oracle) provides some active functions such as an agent operating in conjunction with **brbackup** and Data Protection for mySAP (Oracle), and some passive functions.

The active functions include:

- Highly available Oracle database backup using FlashCopy
- Highly available Oracle database restore using FlashCopy
- Integrating with **brbackup** functions to support running copy services functions, including FlashCopy and withdraw
- Keeping the progress of the Data Protection for FlashCopy functions in a housekeeping file to monitor the proper sequential usage of the functions
- Sending information to the Data Protection for mySAP administration assistant while Data Protection for FlashCopy is running

The passive functions include:

- Integration with Tivoli Storage Manager Media Management functions
- Seamless augmentation of the functions of Data Protection for mySAP
- Centrally administered and scheduled backup operations

1.4 DB2 UDB Integration Module

The Tivoli Storage Manager for Advanced Copy Services DB2 UDB Integration Module, together with the Hardware Devices Snapshot Integration Module, performs integrated FlashCopy backup of DB2 databases.

1.4.1 Operating environment

The DB2 UDB Integration Module and Hardware Devices Snapshot Integration Module require a production server running the DB2 UDB database on an AIX operating system with one of the supported disk systems. The backup server must be another AIX server with access to the same disk system. The backup server will back up the FlashCopy'd data copied from the production server to the Tivoli Storage Manager server. The Tivoli Storage Manager can be installed on the backup server, or on another server with connectivity to the production and backup servers. If a separate server is used for the Tivoli Storage Manager server, this can be on any supported operating system platform.

The DB2 UDB Integration Module and Hardware Devices Snapshot Integration Module are supported in a DB2 multi-partitioned environment, as shown in Figure 1-1. In this way, the database application and backup workload can be distributed for better performance.

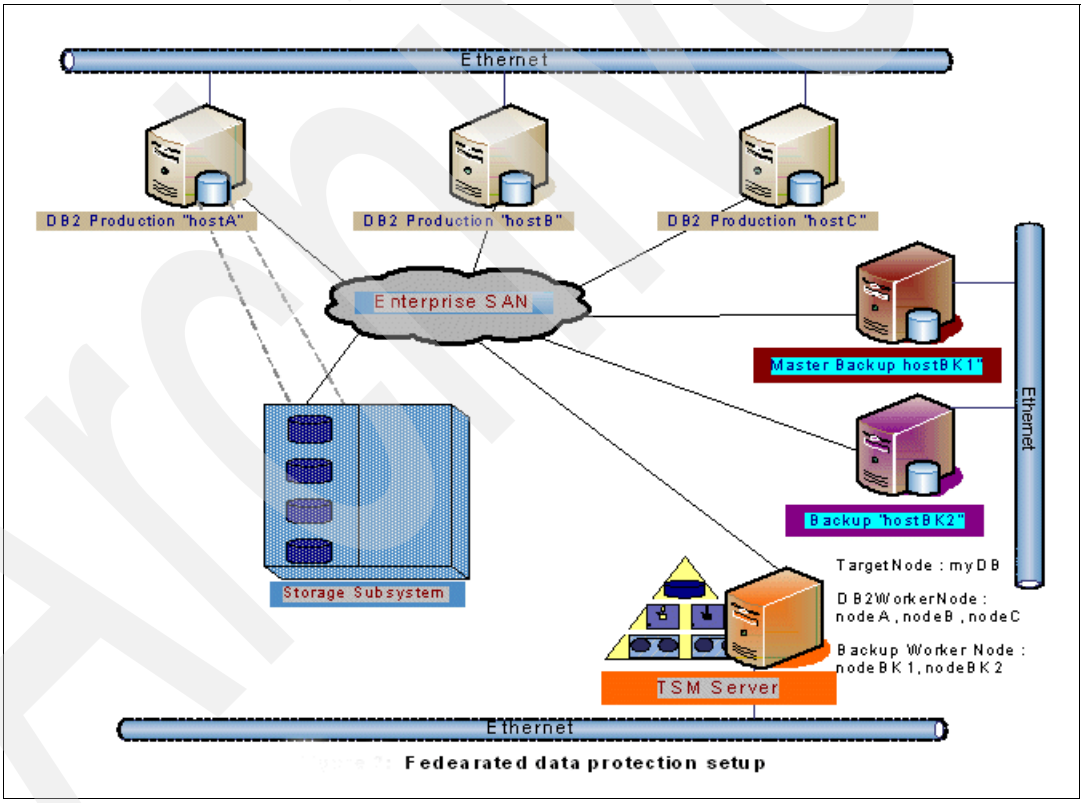


Figure 1-1 DB2 multi partition environment with multiple backup host

1.4.2 Prerequisites

Next we discuss the requirements for the DB2 UDB Integration Module and Hardware Devices Snapshot Integration Module.

Hardware requirements

The following hardware is required:

- IBM System p server for production and backup server (and optional take-over production server if HACMP is used)
- One of these disk systems:
  - DS6000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.0.600.16. Data Protection for FlashCopy currently does not work with the 6.0.600.20 microcode level.
  - DS8000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.1.0.38.
  - SVC storage system with V2.1 storage engine or higher.
  - ESS Model Fxx.
  - ESS 800 with FlashCopy license feature (FC 1830-1835), Microcode V2.
- Production and backup servers require SCSI or Fibre Channel adapter for connecting to the storage system.
- Production and backup servers require100 MB of free disk space for installing Data Protection for FlashCopy on each.
- Production and backup servers require 256 MB of memory for DB2 UDB Integration Module and Hardware Devices Snapshot Integration Module only. This does not include other components' memory requirements.
- LAN connection is required between:
  - Production and backup servers to the server running DS open API CIM agent in ESS, DS6000, or DS8000 environment. CIM agent, in turn, requires communication with the ESS, DS6000, or DS8000.
  - Production and backup servers to the SVC Master Console in SVC environment. The SVC Master Console, in turn, requires communication with the SVC.
  - Production and backup servers to Tivoli Storage Manager server for doing backup / restore.
  - Production and backup servers for rexec, NFS communication.
- The FlashCopy source volumes (where the DB2 UDB database is located) should be accessible only from the production server. Similarly, the FlashCopy target volumes should be accessible only from the backup server. The source and target volumes should be of matching size and should be contained within the same disk system.
- In an HACMP environment, there are two production servers in the HACMP cluster. In this case, a separate backup server is required, making a total of three servers required. The backup server *cannot* be part of the HACMP production server cluster. If a clustered production server is used, then the takeover server has identical requirements as the production server.

Software requirements

The following software is required:

- AIX 5.2 with ML05 or AIX 5.3 with ML01. Refer to the readme file for the latest fix requirements.
- Subsystem device driver (SDD) V1.6.0.2. For ESS 800, DS6000, or DS8000, either SDD or SDDPCM can be used.

- Subsystem device driver path control module (SDDPCM) V2.1.0.1. This is not supported for SVC, only SDD is supported here.
- All physical partitions (PPs) of JFS log logical volume (LV) should be positioned on a single physical volume (PV).
- Tivoli Storage Manager server V5.2 or higher. Tivoli Storage Manager backup-archive client V5.3 or higher.
- Tivoli Storage Manager API V5.3.0 or higher. Check the readme file for the Tivoli Storage Manager API requirements.
- If using ESS for storage, the ESS CLI V2.4.1.50 is required. The version must correspond to the microcode level installed in the ESS clusters.
- DS Open API CIM agent V5.1.0.47 for ESS, DS6000, and DS8000 environment. The CIM agent can be installed on any server accessible from the production and backup server. Only non-SSL mode is supported. In the SVC environment, the Master Console console has the required CIM software pre-installed.
- CIM server runtime (Pegasus) V2.3.2.2. Only the client libraries are used by Data Protection for FlashCopy. This is available as part of the AIX expansion pack.
- CIM server base providers for AIX (Pegasus) V1.2.4.2. This is available as part of the AIX expansion pack.
- OpenSSL. This is available on the CD-ROM, “AIX toolbox for Linux applications for POWER”.
- DB2 UDB server for AIX V8.2.

1.4.3 Functions

The following functions are provided:

- Multi-partition DB2 database and multiple backup server support:

  The DB2 UDB Integration Module provides the ability to back up and restore a DB2 database partitioned across multiple hosts (as shown in Figure 1-1 on page 10). A multi-partition database consists of multiple logical DB2 database partitions distributed across one or more hosts running on AIX operating systems. Database operations are performed concurrently across all database partitions, thereby allowing very large databases to be backed up and restored more efficiently. It performs a federated backup of a distributed multi-partition database from a single end user interface.

  DB2 UDB Integration Module also supports multiple backup servers. Multiple backup hosts can off load the backup of a very large multiple partition database from the production to the backup hosts. This distributes the otherwise very large workload of backing up such large databases.

- Centralized configuration:

  The configuration wizards launched via the Tivoli Storage Manager GUI provide a centralized interface from which to configure DB2 UDB, Tivoli Storage Manager and storage system settings. The presents a step by step configuration process asking for required information. The wizard validates the specified configuration values, so that mistakes can be corrected, leading to a cleaner initial installation and setup process. venting incorrect values.

- Integration with Tivoli Storage Manager command line interface:

  Uses the Tivoli Storage Manager backup-archive client command line interface exclusively, so that is familiar to pre-existing users.

- Multiple snapshot backups:

  Allows both active and inactive snapshot backups to exist simultaneously on local disks and on Tivoli Storage Manager storage. This gives flexibility in the types of backups kept, and assists in overall backup and disaster recovery planning.

- Policy based management of snapshot backups:

  Database backups with DB2 UDB Integration Module and Hardware Devices Snapshot Integration Module are managed through Tivoli Storage Manager server policy. This provides flexibility and customizability when planning the number of backups to maintain on both local disks and Tivoli Storage Manager storage.

1.5 Data Protection for FlashCopy for Oracle

Tivoli Storage Manager for Advanced Copy Services Data Protection for FlashCopy for Oracle performs integrated FlashCopy backup of Oracle databases.

1.5.1 Operating environment

Data Protection for FlashCopy for Oracle requires a production server running the Oracle database on an AIX operating system with one of the supported disk systems. The backup server must be another AIX server with access to the same disk system. The backup server will back up the FlashCopy'd data copied from production server to the Tivoli Storage Manager server. The Tivoli Storage Manager can be installed on the backup server, or on another server with connectivity to the production and backup servers. If a separate server is used for the Tivoli Storage Manager server, this can be on any supported operating system platform.

Data Protection for FlashCopy for Oracle has a prerequisite of Tivoli Storage Manager for Databases - Data Protection for Oracle to do the actual backup and restore. The Oracle server is required to be installed on the backup server.

1.5.2 Prerequisites

In this section we discuss the requirements for Data Protection for FlashCopy for Oracle.

Hardware requirements

The following hardware is required:

- IBM System p server for production and backup server (and optional take-over production server if HACMP is used)
- One of these disk systems:
  - DS6000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.0.600.16. Data Protection for FlashCopy currently does not work with 6.0.600.20 microcode level.
  - DS8000 with point-in-time copy license feature (FC 2244-PTC) and microcode level 6.1.0.38.
  - SVC storage system with V2.1 storage engine or higher.
  - ESS 800 with FlashCopy license feature (FC 1830-1835). Microcode V2 is required.
- Production and backup servers require SCSI or Fibre Channel adapter for connecting to the storage system.

- Production and backup servers require 100 MB of free disk space for installing Data Protection for FlashCopy on each.
- Production and backup servers require 256 MB of memory for Data Protection for FlashCopy only. This does not include other components' memory requirements.
- LAN connection is required between:
  - Production and backup servers to the server running DS open API CIM agent in ESS, DS6000, or DS8000 environment. CIM agent, in turn, requires communication with the ESS, DS6000, or DS8000.
  - Production and backup servers to the SVC Master Console in SVC environment. The SVC Master Console, in turn, requires communication with the SVC.
  - Production and backup servers to Tivoli Storage Manager server for doing backup / restore.
  - Production and backup servers for rexec, NFS communication.
- The FlashCopy source volumes (where the Oracle database is located) should be accessible only from the production server. Similarly, the FlashCopy target volumes should be accessible only from the backup server. The source and target volumes should be of matching size and should be contained within the same disk system.
- In an HACMP environment, there are two production servers in the HACMP cluster. In this case, a separate backup server is required, making a total of three servers required. The backup server *cannot* be part of the HACMP production server cluster. If a clustered production server is used, then the takeover server has identical requirements as the production server.

Software requirements

The following software is required:

- AIX 5.2 with ML05 or AIX 5.3 with ML01. Refer to the readme file for the latest fix requirements.
- Subsystem device driver (SDD) V1.6.0.2. For ESS 800, DS6000, or DS8000, either SDD or SDDPCM can be used.
- Subsystem device driver path control module (SDDPCM) V2.1.0.1. This is not supported for SVC, only SDD is supported here.
- All physical partitions (PPs) of JFS log logical volume (LV) should be positioned on a single physical volume (PV).
- Tivoli Storage Manager server V5.2 or higher. Tivoli Storage Manager backup-archive client V5.3 or higher.
- Tivoli Storage Manager API V5.3.0 or higher. Check the Data Protection for Oracle readme file for the Tivoli Storage Manager API requirements.
- Tivoli Storage Manager for Databases Data Protection for Oracle V5.2.0 or higher.
- DS Open API CIM agent V5.1.0.47 for ESS, DS6000, and DS8000 environment. The CIM agent can be installed on any server accessible from the production and backup server. Only non-SSL mode is supported. In the SVC environment, the Master Console console has the required CIM software pre-installed.
- CIM server runtime (Pegasus) V2.3.2.2. Only the client libraries are used by Data Protection for FlashCopy. This is available as part of the AIX expansion pack.
- CIM server base providers for AIX (Pegasus) V1.2.4.2. This is available as part of the AIX expansion pack.
- OpenSSL. Available on the "AIX toolbox for Linux applications for POWER" CD-ROM.

- Oracle server V9i (9.2.0.5 or later), 10g for AIX. Single server database or Real Application Cluster (RAC) environments are supported.

1.5.3 Functions

Here we describe the functions provided by Data Protection for FlashCopy for Oracle:

- Backing up Oracle databases with minimal impact and downtime on the production Oracle database server:

  Data Protection for FlashCopy uses the FlashCopy feature to create a point-in-time copy of the database volumes from the oracle production server. The copied database volumes are then made available on a backup server for backup to a Tivoli Storage Manager. Because the backup happens from the backup server, the production server can dedicate its processor time for other applications and is not affected by any backup related performance impact. A single backup server can handle backup from multiple databases running on multiple production servers.

- Restoring Oracle databases from Tivoli Storage Manager storage:

  Data Protection for FlashCopy uses the RMAN utility in conjunction with Data Protection for Oracle to perform restore procedures. After initiating a restore with the RMAN utility, Data Protection for Oracle uses the Tivoli Storage Manager API to interface with the Tivoli Storage Manager server to transmit data.

- Performing a quick restore using FlashCopy:

  Data Protection for FlashCopy devices uses the IBM FlashCopy feature to restore an Oracle database from the FlashCopy image available on the storage system. It provides quick recovery of the production database in the event of a major failure.

For the rest of this book, we discuss only backup of SAP software environments using Tivoli Storage Manager for Advanced Copy Services, Data Protection for FlashCopy for mySAP (Oracle), and Data Protection for FlashCopy for mySAP (DB2 UDB).

1.6 Introduction to storage

Storage — in particular, the underlying snapshot functions — is at the heart of the Tivoli Storage Manager for Advanced Copy Services product. Therefore, we provide some basic introductory material on storage and copy techniques. For more information, you can consult the documentation provided with your specific storage system.

1.6.1 Introduction to supported storage hardware

Tivoli Storage Manager for Advanced Copy Services is supported on the following IBM System Storage disk systems.

DS8000

The IBM System Storage DS8000 is a high performance, high capacity series of disk storage systems. It provides around 6 times higher performance than the earlier ESS model and also scales from 1.1 TB to 320 TB. The IBM POWER5™ server technology in the DS8000 makes it possible to create storage system logical partitions that can be used for completely different environments. For more details, see:

http://www.ibm.com/servers/storage/disk/ds8000/index.html

DS6000

DS6000 is a mid-range storage system with all the features and functions of an enterprise storage system. It also offers excellent price, performance, and scalability. You can expand the DS6000 system by adding an expansion enclosure to the DS6800 controller, or grow horizontally by adding other DS6800 controllers. For more details, see:

http://www.ibm.com/servers/storage/disk/ds6000/index.html

SAN Volume Controller (SVC)

The SVC is a virtualization layer that allows addressing a heterogeneous configuration of IBM and non-IBM storage devices through one interface to an open systems host. Traditionally, LUNs that are defined within a storage system are directly presented to the host. SVC provides virtualization by creating a pool of managed disks from the attached storage systems, which are then mapped to a set of virtual disks for use by attached host computer systems. SVC provides a single interface to the management and provisioning of diverse disk systems, as well as a single set of FlashCopy, Metro Mirror and Global Mirror functions. For more details, see:

http://www.ibm.com/servers/storage/software/virtualization/svc/index.html

Enterprise Storage Server

The IBM TotalStorage Enterprise Storage Server (ESS) architecture is the basis for subsequent enterprise disk systems. It can be attached to IBM and non-IBM servers of many types, and provides high capacity and function. Because it has been replaced by the next generation disk products below, it is no longer marketed; however, it is still commonly found in client environments. For more details, see:

http://www.ibm.com/servers/storage/disk/ess/index.html

1.6.2 Introduction to copy services

Copy services are a collection of functions that provide disaster recovery, data migration, and data duplication. Copy services provide point-in-time copy (known as FlashCopy in IBM disk systems) as well as remote mirror and copy functions. Generally, point-in-time copy is used for data duplication and backups, while remote mirror and copy functions are used for data migration and disaster recovery. With copy services you can create backup data with little or no disruption to your application and also back up the application data to a remote site for disaster recovery purposes.

FlashCopy

FlashCopy enables you to create full volume copies of data. When you set up a FlashCopy operation, a relationship is established between the source and target volumes and a bitmap of the source volume is created. Once this relationship and bitmap are created, the target volumes can be accessed as though all the data had been physically copied.

While a relationship between the source and target exists, optionally a background process copies the tracks from the source to the target volume. When a FlashCopy operation is started, it takes only a few seconds to complete the process of establishing the relationship and creating the necessary bitmaps. Thereafter you have access to the point-in-time copy of the source volume. If you access the source or the target volumes during the background copy, FlashCopy manages these I/O requests and facilitates both reading from and writing to both the source and target volumes. Once all the data has been copied to the target, the FlashCopy relationship is ended, based on the type selected. The FlashCopy types, full volume copy (COPY), no copy (NOCOPY), and incremental (INCR), are available.

FlashCopy type COPY

In this FlashCopy type, a background process is started after the relationship and bitmaps are established. This background process copies all data from the source to the target. When the background copy completes, the relationship between source and target ends automatically. The default COPY type relationship is not persistent. A target volume can be used for doing a FlashBack restore.

FlashCopy type NOCOPY

In this FlashCopy type, no background process is started. If any write request comes for a source volume block, the bitmap is checked. If the block has not already been copied, then the original block is copied to the target and the bitmap is updated. The source block is then allowed to be modified. So blocks for which no write occurred on the source or on the target will not be copied to the target and will stay as they were at the time when the FlashCopy was established. The relationship is a persistent one until it is explicitly ended. A target volume of this type cannot be used for doing a FlashBack restore.

FlashCopy type INCR

Incremental FlashCopy provides the capability to refresh a FlashCopy relationship. Incremental FlashCopy uses a second bitmap to keep track of changes made to the source and target volumes. This bitmap allows subsequent FlashCopies to propagate only the data for those blocks for which changes occurred on both source or target volumes. So with incremental FlashCopy, less data has to be copied at the storage end by the back ground copy process. The target volume can be used for FlashBack restore. The relationship with incremental FlashCopy is persistent.

1.6.3 Introduction to Common Information Model (CIM)

Each vendor's particular storage systems include their own specialized interface for configuration and management. This poses a challenge for other applications that have to interface with these storage systems. In order to establish a common way to handle different storage systems, the Storage Networking Industry Association (SNIA) developed a standard called the Storage Management Initiative Specification (SMI-S).

SMI-S is based on existing industry standards like the Common Information Model (CIM), which is an object model for data storage and management developed by the Distributed Management Task Force (DMTF). CIM makes it possible to organize devices and components of devices into an object oriented model. Basically, CIM is a conceptual information framework for describing management properties for managing disk storage without any binding to any particular implementation.

Web Based Enterprise Management (WBEM)

WBEM is a tiered enterprise management architecture also developed by the Distributed Management Task Force, which provides the management design framework that consists of devices, device providers, the object manager, and the messaging protocol for the communication between client applications and the object manager. In the case of CIM, the object manager is the CIMOM and the messaging protocol is CIM-over-HTTP. The CIM over HTTP approach specifies that the CIM data is encoded in XML and sent in specific messages between the client applications and the CIMOM over the IP network.

CIM agent

A CIM agent is a tailored CIM interface for a selected storage system that allows the use of common building blocks rather than proprietary software or device specific programming interfaces to manage CIM compliant devices. A CIM agent normally resides on either the storage system host or on a separate server. The CIM agent consists of the CIM object manager (CIMOM), service location protocol (SLP) and the provider for the specific storage system. SLP provides a directory service used by client applications to locate the CIMOM.

Here are some components of CIM agent environments:

- Agent code:

  An open systems standard that interprets CIM requests and responses as they transfer between the client application and the device.

- CIM object manager (CIMOM):

  The common conceptual framework for data management that receives, validates, and authenticates the CIM requests from the client application. It then directs the requests to the appropriate device provider.

- Device:

  The storage systems that processes client application requests, such as ESS 800, DS6000™, DS8000, or SVC.

- Device provider:

  A device specific handler that serves as a plug-in for the CIM. CIMOM uses the handler to interface with the device.

- Service Location Protocol (SLP):

  A directory service that the client application calls to locate the CIMOM.

Pegasus

OpenPegasus is an open source implementation of the DMTF CIM and WBEM standards. The CIM standard schema provides the actual model descriptions. The schema supplies a set of classes with properties and associations that provide a conceptual framework within which it is possible to organize the available information about the managed environment. Platform specific objects such as AIX that must be managed are defined as extensions to this standard CIM model.

Providers collect the management data from the underlying platform resources and populate the CIM objects described in the conceptual CIM model. These objects are then ready to be served by the CIMOM to the client management applications for managing the resources of the underlying platform. This mechanism provides an open standard way for a management application to manage the resources of the underlying platform. The Pegasus software is provided with AIX V5.2 maintenance level 5 or higher as part of the AIX expansion pack and must be installed separately. Pegasus requires the OpenSSL package, even though SSL security is currently not implemented in the Data Protection for FlashCopy environment.

CIM Agent used by Tivoli Storage Manager for Advanced Copy Services

Two separate CIM agents are employed by Tivoli Storage Manager for Advanced Copy Services: one for ESS and DS configurations and the other for SVC. While both implement copy services in an SMI-S compliant manner, the following elements are different:

- Parameter and specification modes in certain software components
- Properties for monitoring background copy processes
- Procedures for querying information from the storage system
- FlashCopy approaches

DS Open API CIM agent

The ESS 800, DS6000, and DS8000 are supported by a CIM agent through the DS Open API. The DS Open API is an industry standard API that is SMI-S and CIM compliant. The agent includes the ESS NI client, apart from CIMOM, SLP, and device provider. The ESS NI server is pre-installed with the hardware management console (HMC) that comes with the DS8000 and the storage management console (SMC) of the DS6000. The interface to the ESS 800 is provided by the ESS copy services Command Line Interface (ESSCLI).
Figure 1-2 shows the DS Open API CIM agent structure.

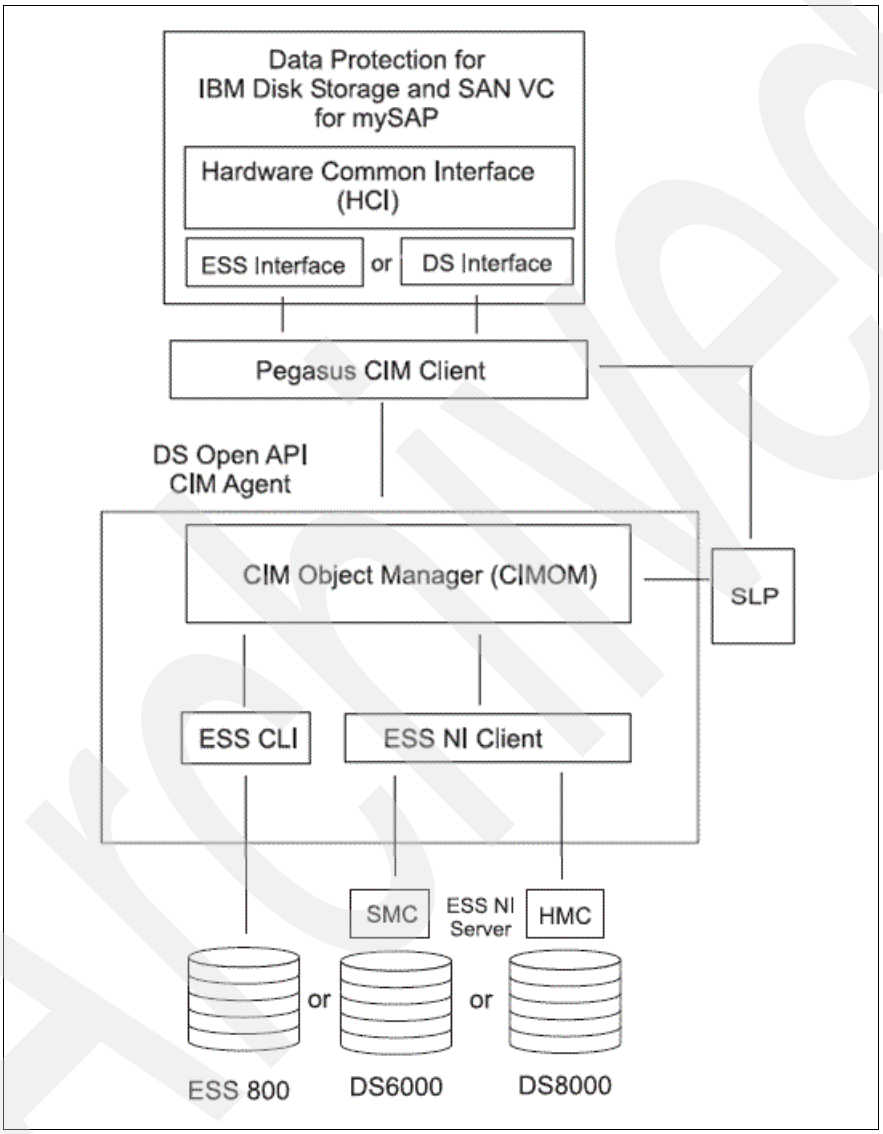


Figure 1-2 Data Protection Open API CIM Agent

CIM Agent for SVC

The CIM agent for SVC is provided as part of the software shipped with the SVC's Master Console. Its structure is shown in Figure 1-3.

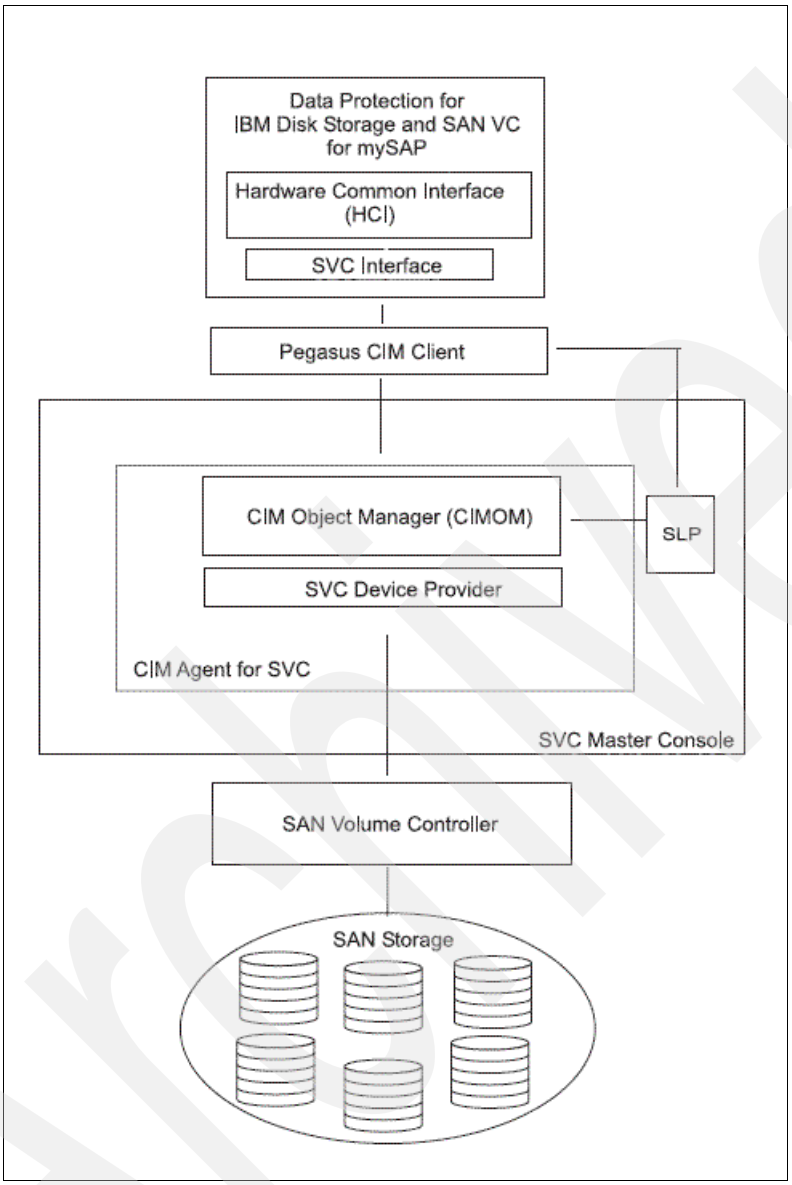


Figure 1-3 SVC CIM Agent

1.7 Data Protection for mySAP

Tivoli Storage Manager for ERP Data Protection for mySAP is an intelligent client/server program that manages backup and restore of SAP databases to Tivoli Storage Manager. Data Protection for mySAP lets you manage backup storage and processing independently of normal SAP software operations. Data Protection for mySAP and Tivoli Storage Manager provide a reliable, high performance, repeatable backup and restore process so that system administrators can manage large databases more efficiently.

Data Protection for mySAP (DB2) does backup and restores of data blocks using the DB2 vendor API as shown in Figure 1-4.

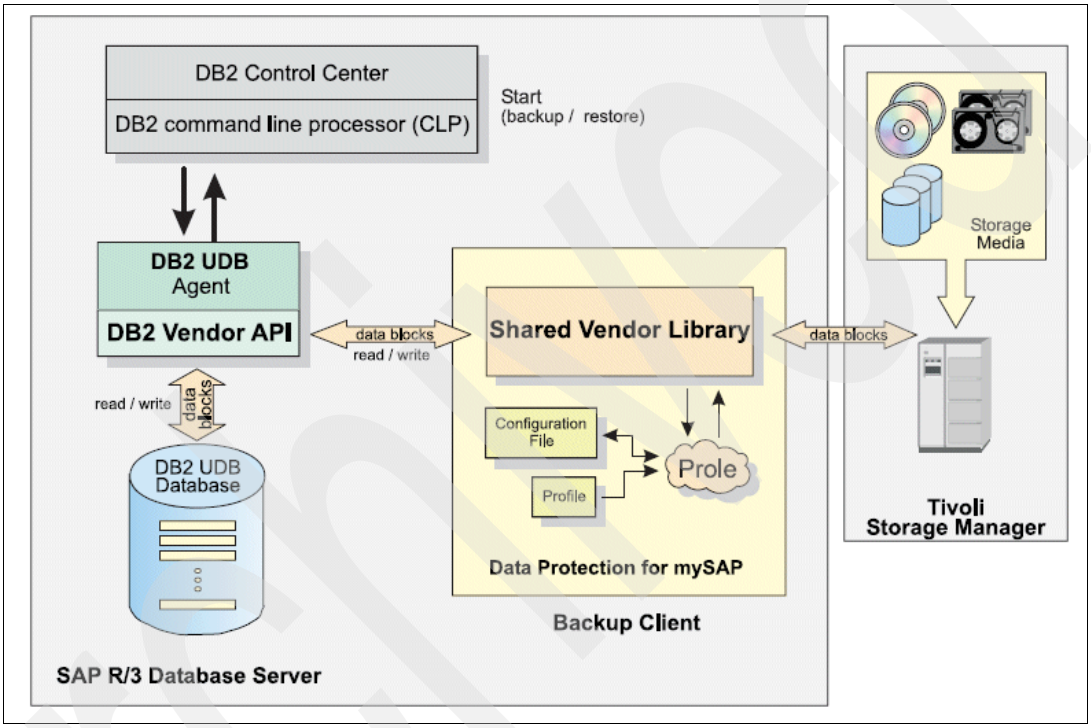


Figure 1-4 Data Protection for mySAP (DB2) overview

Data Protection for mySAP (Oracle) allows system administrators to follow SAP procedures and use the integrated SAP software database utilities such as **brbackup**, **brarchive**, and **brrestore** for backup and restore. An overview of Data Protection for mySAP (Oracle) is shown in Figure 1-5.

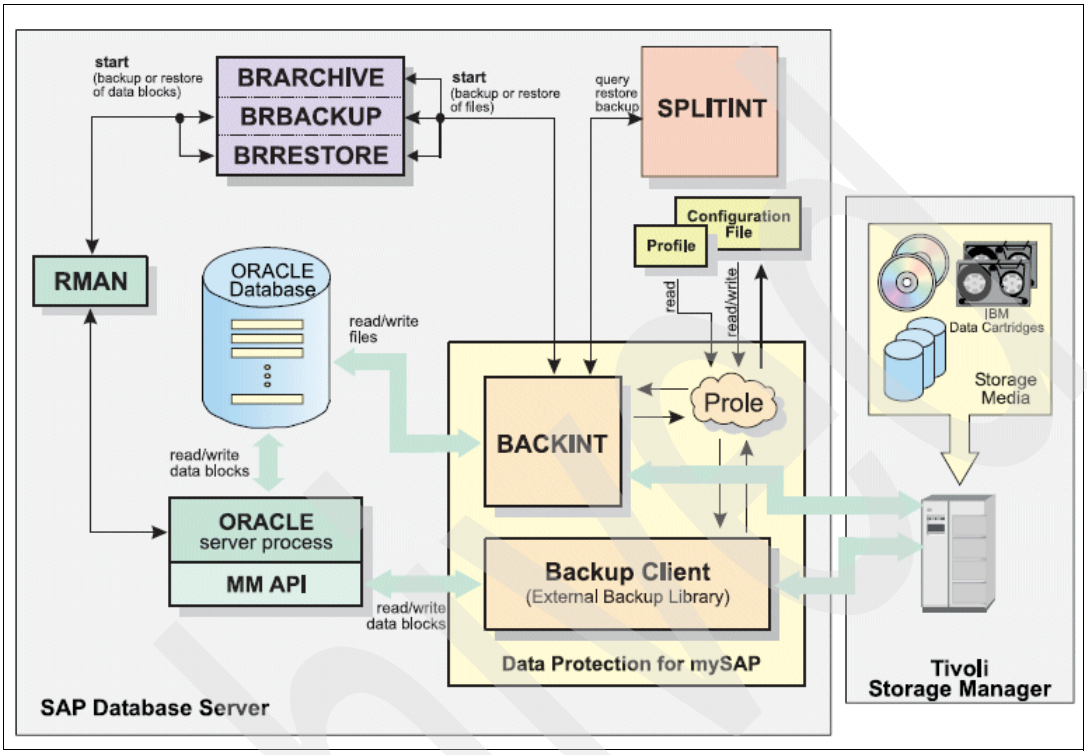


Figure 1-5 Data Protection for mySAP (Oracle) overview

Other SAP files, such as executables and configuration files, have to be backed up using Tivoli Storage Manager standard backup-archive client for file backup.

For the rest of this book, we will focus on Tivoli Storage Manager for Advanced Copy Services Data Protection for FlashCopy for mySAP (DB2) and Data Protection for FlashCopy for mySAP (Oracle).

2

Preinstallation and planning

In this chapter we discuss important prerequisite information you should obtain and actions you must do before you can actually install and set up Tivoli Storage Manager for Advanced Copy Services.

2.1 Structure of an SAP software system

The mySAP Business Suite is a world wide solution for companies and enterprises of varying sizes. Its key features include complete integration of frequently used functions, unlimited scalability and connectivity via the Internet. The SAP system is a collection of programs and the data, produced and used by those programs. The data is organized in databases so that it is easy for the programs to find and collect the necessary information.

The following industry-standard database vendors are supported by SAP:

- Microsoft® SQL Server
- MySQL MaxDB (previously known as Adabas)
- IBM DB2 (in different versions)
- Oracle

> **Note:** IBM Tivoli Storage Manager for Enterprise Resource Planning and IBM Tivoli Storage Manager for Advanced Copy currently support SAP systems using IBM DB2 UDB and Oracle databases only.

The database is the heart of the SAP-system, and hosts all the SAP-related data. SAP databases are typically very large, because they contain so much company-critical information.

The structure of the SAP database impacts both security and performance. This a big consideration when setting up SAP, but is essentially beyond the scope of this book. Consult your SAP support or consultant for more information.

In general, the SAP structure includes system files (called system devspace), data files (called data devspace), and log files (called log devspace), as shown in Figure 2-1.

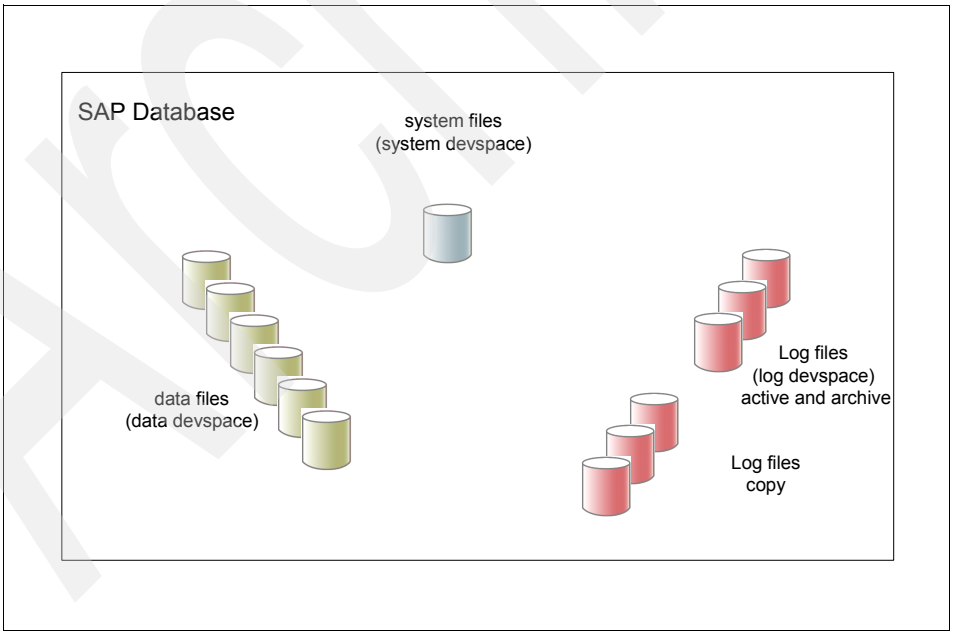


Figure 2-1 Principle structure of an SAP system

The *system devspace* consists of all the program executables and configuration files.

The *data devspace* contains all the database tables. This is the key information that you must regularly back up.

The log files contain all changes to the database instance. This information is required for a proper recovery in case a restore of the database is required. The log files can be copied by setting the LOG_MODE to DUAL. There must be sufficient space allocated to the log files to hold all changes between successful backups.

Traditional backup of an SAP system to tape can take many hours, depending on the size of the database, network connectivity and backup device performance. Frequent backups of this type can therefore affect daily processing.

Tivoli Storage Manager for Advanced Copy Services reduces the backup time required by exploiting storage hardware-provided FlashCopy functionality. A FlashCopy is a point-in-time copy of one or more so-called source disk volumes to a set of equivalent target disk volumes. Tivoli Storage Manager for Advanced Copy Services makes a FlashCopy of the database's data files only. The log files must be backed up separately — but this function is not provided by Tivoli Storage Manager for Advanced Copy Services Data Protection for FlashCopy. We discuss methods to back up the log files in 2.6, "Backup of offline transaction logs" on page 43.

2.2 The FlashCopy function

The FlashCopy function is executed by the copy services of the data storage system. The copy services are a collection of functions for disaster recovery, migration, and duplication of data. See your disk system's documentation for more specific information on copy services.

A FlashCopy operation always works on a full disk volume — there is no partial volume FlashCopy. Similarly, on a flashback restore, all data on the volume is over-written. Therefore, you should only store SAP data files on the volumes which will be FlashCopy'd. Defining a separate volume group or groups for the SAP data devspace should prevent this. For performance reasons, you might want to define more than one volume group, so that those tablespaces with higher activity can be separated onto different volume groups or storage arrays in the disk storage system.

A relationship is then established between the source and the target volumes, and a bitmap of the source volume is created. When this step is finished, the data can be accessed on the target volume just as though the data had already been copied; for example, we could start a backup of the target volume to a Tivoli Storage Manager server at this point. The copy process continues in the background. See Figure 2-2.

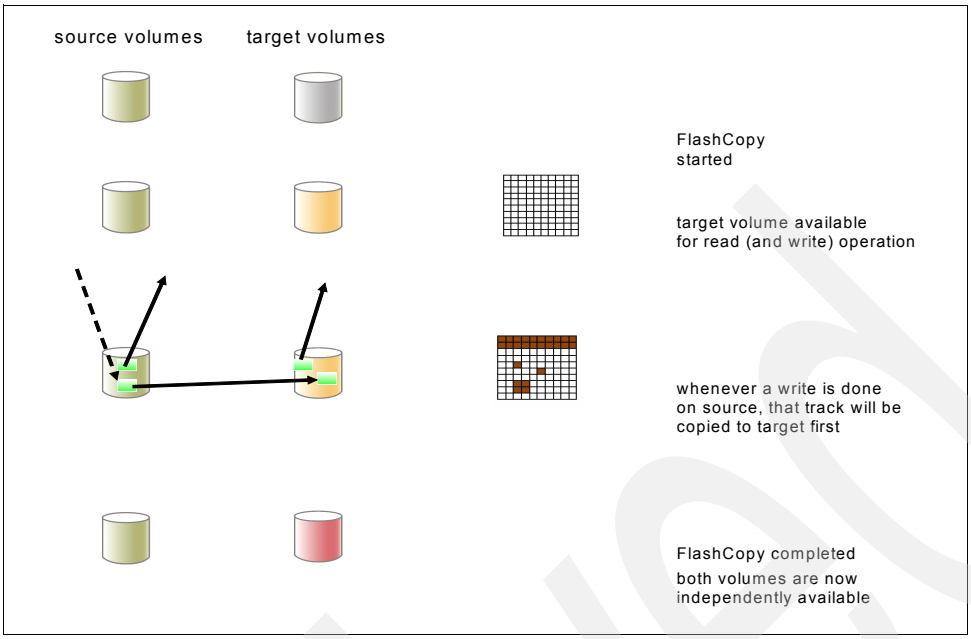


Figure 2-2 Basic operation of FlashCopy

In the bitmap-table, used for the relationship between source and target volumes, each track copied by the FlashCopy service will be marked as processed. Reads can be done on both volumes, on the source as well as on the target side. Whenever a track is not yet copied to the target, the track will be read from the source volume. Whenever a write operation is done to the source volume, that track has to be copied to the target volume first, because we must know the status at the time of starting the FlashCopy process.

This process ensures that both the production server is minimally affected by the backup operation, which can be started as soon as the relationship is established between source and target volumes.

Remote Mirror is another option for volume replication; however, it does not allow the concurrent access to the target volumes while the copy process is running. The FlashCopy service provides this capability by creating a bitmap for the source volume. FlashCopy is the copy service method used by Tivoli Storage Manager for Advanced Copy Services.

2.2.1 Tivoli Storage Manager for Advanced Copy Services on SAP software

There are two main advantages to using Tivoli Storage Manager for Advanced Copy Services Data Protection for FlashCopy for backing up an SAP system:

- The SAP databases only have to be quiesced for a short time while the relationship between the FlashCopy source and target volume is set up and the relationship-bitmap table is created. Thus the outage time for the SAP system during backup is reduced from hours to just seconds.
- The time to restore from FlashCopy backup is just seconds. It is not necessary to transfer data from a from a tape device of a backup server — the restore is done at a hardware level. Naturally, you will then have to recover the database by applying transaction logs (rollforward); however, typically this takes much less time than a traditional tape restore.

Data Protection for mySAP will be used for backing up and restoring the SAP databases. This product is certified by SAP for Split Mirror Disk Backup. The BR*tools, if the SAP system uses an Oracle-database, or the DB2-interface, if the SAP system is on DB2 UDB, communicate with Data Protection for mySAP for executing a database-backup or -restore. Data Protection for mySAP communicates with Data Protection for FlashCopy, which communicates with the CIM agent for the storage system. The CIM agent then instructs the storage system to perform the FlashCopy operation.

In order to minimize the load on the SAP production system, the backup process is executed on a different system, known as the backup system, connected to the same DataStorage system.

Figure 2-3 summarizes the backup process flow on Oracle.

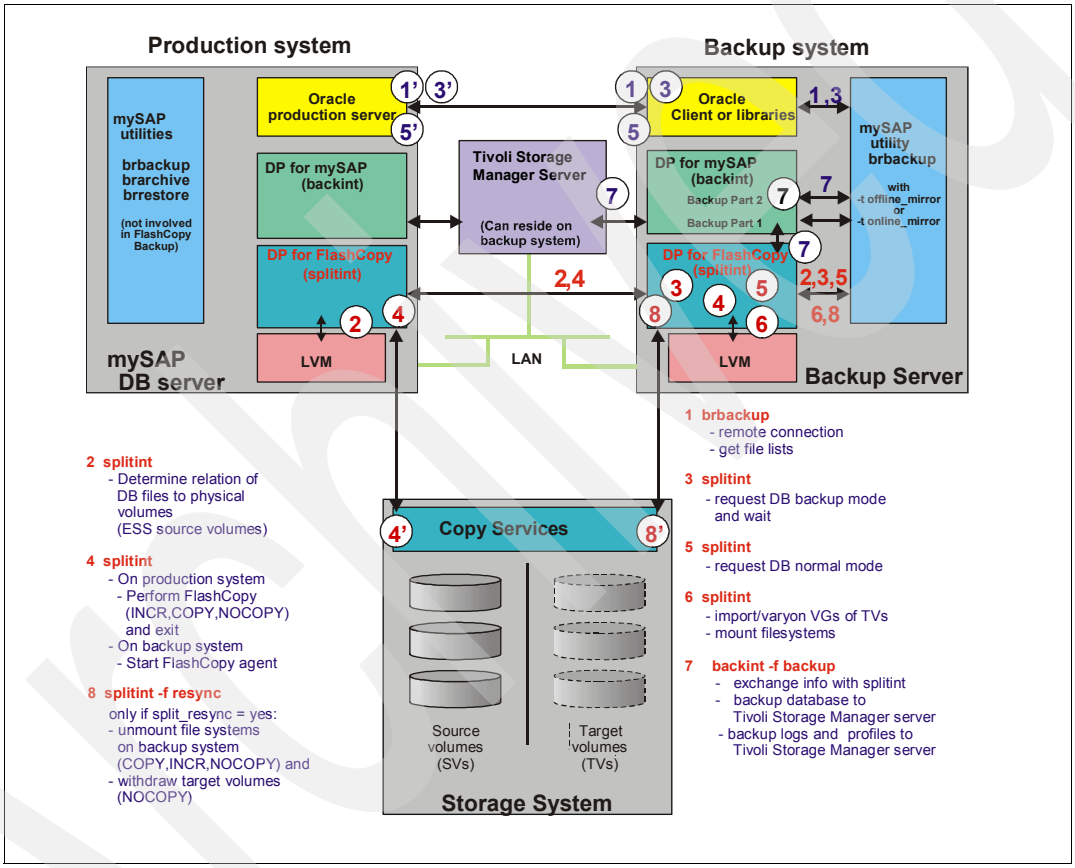


Figure 2-3 Principle of Data Protection for FlashCopy on an Oracle based SAP system

The process flow on DB2 is shown in Figure 2-4.

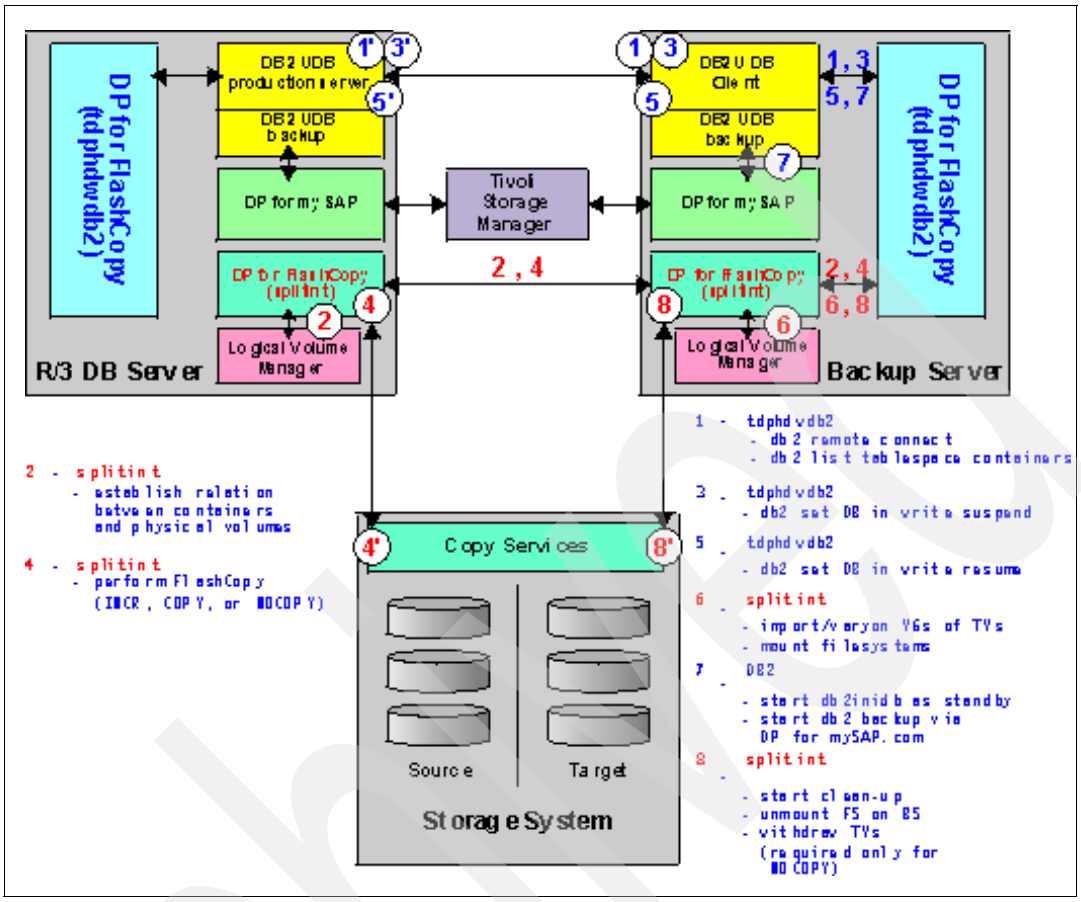


Figure 2-4 Principle of Data Protection for FlashCopy on a DB2 based SAP system

2.2.2 Operating environment

The operating environment consists of an SAP system using either Oracle or DB2 UDB for the database, running AIX (currently only AIX is supported) and attached to a supported disk storage system. This system is called the *production server*. Another AIX system, known as the *backup server*, is attached to the same Disk Storage system, and performs the backup of the FlashCopy'd database on the target volumes to the Tivoli Storage Manager server. In this way, the backup to Tivoli Storage Manager is offloaded from the production to the backup server. The entire operation is done by a proper sequence of actions of Data Protection for FlashCopy: **tdphdwdb2** (DB2) / **tdphdwora** (Oracle) and **splitint** (both); and of Data Protection for mySAP: **backint** (Oracle only) and **prole** (both).

Using a separate backup server:

- Shortens the time of the database for backup from hours to seconds:

  The database volumes will be copied by FlashCopy to the target volumes. When this FlashCopy is started, the database can be resumed and processing can continue on the production server. The FlashCopy continues in background, and also the backup to the Tivoli Storage Manager server starts and is running in background. The FlashCopy is done by the Disk Storage system and the backup is done by the backup system, therefore there is no impact on the production system when the FlashCopy target is complete.

- Allows a restore from the target volume also in seconds:

  The database volumes will be copied back by FlashCopy to the source volumes. When this FlashCopy restore is complete, the database volumes are available on the production system and recovery can be started. For the restore operation no data has to be transferred from the Tivoli Storage Manager server, only the transaction logs, required for the recovery, are required to be restored from the Tivoli Storage Manager server.

Storage systems

Currently Data Protection for FlashCopy supports the following IBM disk systems:

- IBM System Storage DS6000
- IBM System Storage DS8000
- IBM System Storage SAN Volume Controller (SVC)
- IBM TotalStorage Enterprise Storage Server (ESS) Model 800

Only one of these can be used at a time in a Data Protection for FlashCopy environment, and the entire SAP database must reside on that system. However, the SAN Volume Controller itself can use multiple systems from the same or different vendors as underlying storage — and present all the storage to the attached hosts as a single system. This is transparent to Data Protection for FlashCopy.

Here are some limitations to be aware of:

- The SVC does not support incremental FlashCopy. Specifying INCR in the FLASHCOPY_TYPE parameter or the -C option of the user interface will result in an error message.
- The SVC does not directly support multiple target sets. However, Data Protection for FlashCopy provides this support within the limitations of the SVC.
- A maximum of 512 virtual disks per host per SVC cluster are supported.
- If the configuration includes both SVC vdisks and native ESS LUNs, SDD limits the number of vpaths: On AIX 5.2, SDD allows a maximum of 1200 ESS vpaths and 512 SVC vpaths to be configured.
- AIX's native multipathing I/O (MPIO) is not supported. This prevents the use of SDDPCM (SDD Path Control Module) with an SVC configuration.

Further details are listed in the Introduction chapter in *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP Installation and User's Guide for DB2 UDB,* SC33-8208 and *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP Installation and User's Guide for Oracle,* SC33-8207.

Now we will provide some more specifics for DB2 and Oracle SAP environments.

DB2 UDB environment

Figure 2-5 shows the environment required, with all software components for a DB2 UDB configuration.

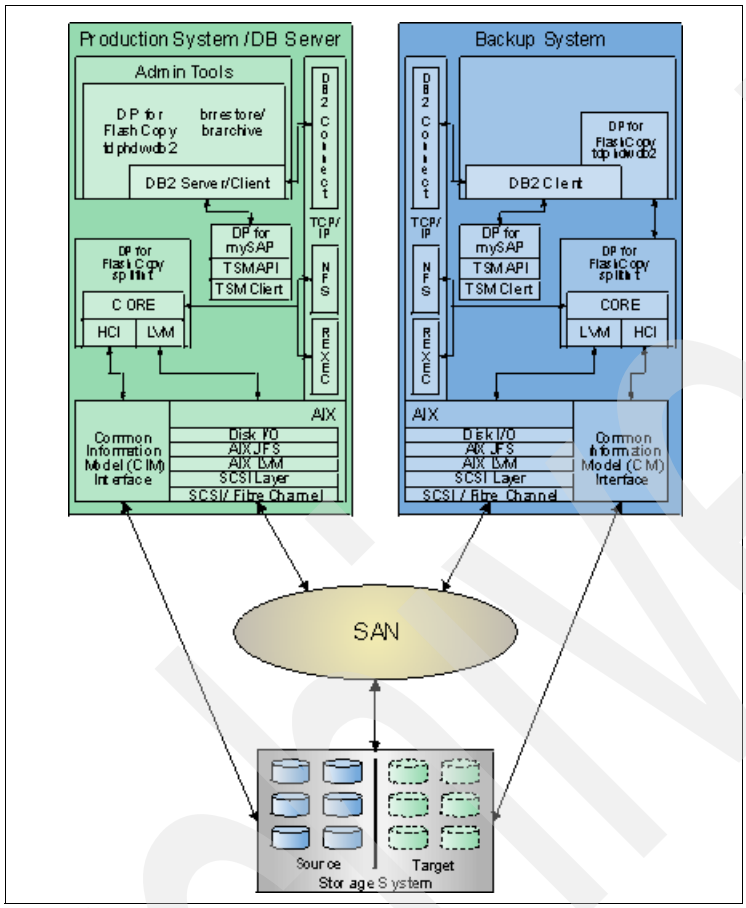


Figure 2-5 Data Protection for FlashCopy for DB2 UDB environment

The products and hardware elements shown must be available on the production and backup server. The exception is that only the DB2 client is required on the backup server as opposed to the DB2 client and server as required on the production server. It is not necessary to physically install the SAP program code on the backup system, as these executables are accessed via NFS from the production server.

Before invoking the FlashCopy service, the DB2 client on the backup server queries the production DB2 server for the list of database volumes which will be FlashCopy'd. The backup system never has physical access to the source data volumes, only the target volumes.

Proper synchronization of the DB2 database is required before making the FlashCopy. DB2 provides these two commands:

```
db2 set write suspend for database
db2 set write resume for database
```

This will quiesce the database before the FlashCopy copy service is started, and then resume the database as soon as the source/target connection is established. The downtime of the database lasts just a few seconds.

From various possible backup strategies, Data Protection for FlashCopy supports full, incremental, or nocopy FlashCopy. DB2 also has the capability to set the database into a “hot standby” state after the FlashCopy is initialized to perform a DB2 backup from that copy. However, this “hot standby” feature is not supported Data Protection for FlashCopy.

Note: There is a limitation that all tablespaces must use DMS containers only. Temporary tablespaces might use SMS containers as well.

Role of tdphdwdb2

The command **tdphdwdb2** is called to:

- Perform a backup of a FlashCopy to Tivoli Storage Manager
- Perform a restore from Tivoli Storage Manager of a previous FlashCopy backup and perform a rollforward recovery
- Perform a FlashCopy to disk only (no backup to Tivoli Storage Manager)
- Perform a FlashCopy restore (FlashBack restore) of a previous FlashCopy backup and perform a rollforward recovery
- Perform an online or offline backup to Tivoli Storage Manager on the production system without FlashCopy
- Perform a restore from Tivoli Storage Manager and perform a rollforward recovery

If **tdphdwdb2** is started on the backup system with options to perform a backup from a FlashCopy target set, it first calls DB2 on the production system via DB2 remote connect to get the DB2 database information. Then it calls **splitint**, which will ensure that **tdphdwdb2** gets all the volumes (target volumes) required for a full DB2 database backup. Next the **DB2 backup** command is called by **tdphdwdb2** to run the backup. **DB2 backup** calls its vendor library (Data Protection for mySAP), which performs the actual backup.

Role of splitint

splitint is a collection of three components: CORE, LVM, and HCI.

The CORE component interacts with **tdphdwdb2**, checks the environment, does housekeeping and controls the proper sequence of functions (FlashCopy, unmount, and withdraw). It also interacts with the LVM and HCI components.

The HCI (Hardware Common Interface) component interacts with the Copy Services server or the SVC Master console via TCP/IP using the CIM interface. It uses the client component of the Pegasus CIM Server package (referred to in the Data Protection for FlashCopy environment as the CIM Client) to contact the CIM Object Manager (CIMOM) on any of the AIX systems or the SVC master console. The CIMOM contacts the DS CopyServices server or the ESS Command line interface which then contacts the ESS system. The CIMOM on the SVC master console contacts the SVC.

The LVM (logical volume manager) component is a standard piece of AIX. LVM interacts with the operating system to provide information about volumes, volume groups, and file systems required for a backup or restore of the DB2 database, and manage these resources.

Oracle environment

Figure 2-6 shows the environment required, with all software components for an Oracle configuration.

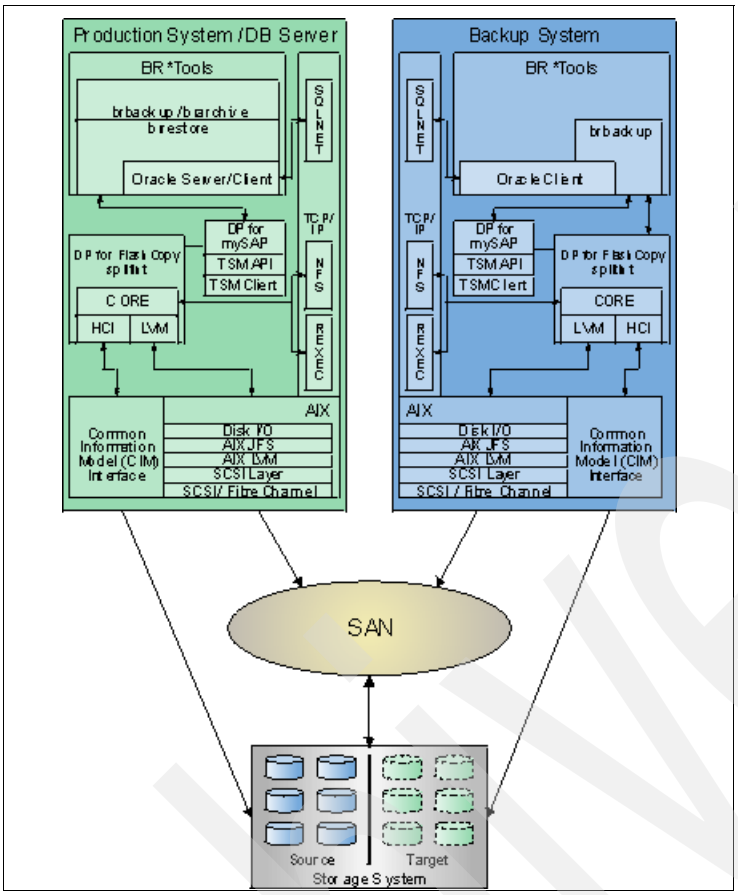


Figure 2-6 Data Protection for FlashCopy for Oracle environment

The products and hardware elements shown in Figure 2-6 must be available on the production and backup servers. The exception is that only the Oracle client is required on the backup server, as opposed to the DB2 client and server as required on the production server. It is not necessary to physically install the SAP program code on the backup system, because these executables are accessed via NFS from the production system.

Before invoking the FlashCopy service, the Oracle client on the backup server queries the production Oracle server for the list of database volumes to be FlashCopy'd. The backup system never has physical access to the source data volumes, only the target volumes.

Proper synchronization of the Oracle database is required before making the FlashCopy. This function is performed by BR*Tools. This will quiesce the database before the FlashCopy copy service is started, and then resume the database as soon as the source/target connection is established. The downtime of the database lasts just a few seconds.

*Role of BR*Tools*

BR*Tools is a collection of programs for backup and restore, provided by SAP. The BR*Tools programs are invoked by Data Protection for mySAP for sending and receiving data to and from the Tivoli Storage Manager server.

Some of the BR*Tools functions are:

- **`brbackup`** for backing up the SAP database
- **`brarchive`** for backing up the transactionlogs of an SAP system
- **`brrestore`** for restoring the SAP database and the transactionlogs

Although the BR*Tools names implies that backups and archives are done, the Data Protection for mySAP always binds the objects to an archive copygroup on the Tivoli Storage Manager server.

Role of brbackup

When **brbackup** is started on the backup system with options to perform a backup from a FlashCopy, it first calls Oracle on the production system via SQLNET to get information from the Oracle database. Then **brbackup** calls Data Protection for FlashCopy, which will provide the list of target volumes required for a full Oracle database backup. Certain profiles and control files, located on the NFS shared volume, will also be backed up by **brbackup**.

To restore the database, **brrestore** will be called by **tdphdwora** on the production system, This will interact with the Data Protection for FlashCopy, in case the FlashBack function was invoked.

Role of tdphdwora

The **tdphdwora** program is a component of Data Protection for FlashCopy which works with BR*Tools program set.

It will be used for restoring an Oracle SAP database and includes all the required pre- and post-processing steps, required for restore and recovery processing. **tdphdwora** provides a convenient listing of previous backups made to a FlashCopy target set as well as to the Tivoli Storage Manager server, and reports the status of each. To do this, **tdphdwora** collects data from the **brbackup** logs, the FlashCopy idssave and agent control files and from the Tivoli Storage Manager server database.

The **tdphdwora** program provides equivalent functionality to **tdphdwdb2 -f restore**' in a DB2 environment. That is, **tdphdwora** is used only for restores, unlike **tdphdwdb2**, which provides backup, restore, and inquire functions.

Role of splitint

The split function of **splitint** is used by **brbackup** for FlashCopy operations; there are other functions (such as unmount, withdraw, password, inquire, ts_inquire, and modify_copyrate) that can be requested when calling **splitint** as a command not under control of **brbackup**. Optionally, after the call for the backup has completed, **brbackup** can call the resync function of **splitint** to perform resynchronization.

splitint is a collection of three components: CORE, LVM and HCI.

The CORE component interacts with **tdphdwdb2**, checks the environment, does housekeeping and controls the proper sequence of functions (FlashCopy, unmount, and withdraw). It also interacts with the LVM and HCI components.

The HCI (Hardware Common Interface) component interacts with the Copy Services server or the SVC Master console via TCP/IP using the CIM interface. It uses the client component of the Pegasus CIM Server package1 (referred to in the Data Protection for FlashCopy environment as the CIM Client) to contact the CIM Object Manager (CIMOM) on any of the AIX systems or the SVC master console. The CIMOM contacts the DS CopyServices server or the ESS Command line interface which then contacts the ESS system. The CIMOM on the SVC master console contacts the SVC.

The LVM (logical volume manager) component is a standard piece of AIX. LVM interacts with the operating system to provide information about volumes, volume groups and file systems required for a backup or restore of the Oracle database, and manage these resources.

2.3 Setup of our environment

The product manuals give you brief instructions regarding what has to be done and in which sequence. We are using a slightly different installation sequence.

Important: Unless otherwise stated, software required on both the production and backup systems must be installed and configured identically. This includes the AIX operating system version and configuration, SAP database, and Tivoli software.

First we set up the production server and connected it to the storage system, a DS8000 in our case. Then we installed the SAP software, and set up and populated the database.

Next we installed the Tivoli Storage Manager component. The Tivoli Storage Manager server was installed on the backup server at V5.3.2.0, with just a disk storage pool defined. The V5.3 Tivoli Storage Manager client was installed on both production and backup servers. Check the Tivoli Web site for the most current supported client and server environments.

- http://www-1.ibm.com/support/docview.wss?rs=667&context=SSZHVN&uid=swg21229233&loc=en_US&cs=utf-8&lang=en
- http://www-1.ibm.com/support/docview.wss?rs=3043&context=SSRUS7&uid=swg21231464&loc=en_US&cs=utf-8&lang=en

Then we installed Data Protection for mySAP on the production server and did a first backup test. The detailed installation and initial steps are shown in Chapter 3, “Installation for SAP software on DB2 UDB” on page 51 and Chapter 4, “Installation for SAP software on Oracle” on page 91.

At this point our configuration can be used by Data Protection for mySAP to back up the SAP database without Data Protection for FlashCopy. Our configuration is shown in Figure 2-7.

To prepare for using Data Protection for FlashCopy, we double-checked that the database volumes are in a separate volume group on the DS8000.

2.3.1 Logical storage model

We can now explain the logical storage layout, as shown in Figure 2-7.

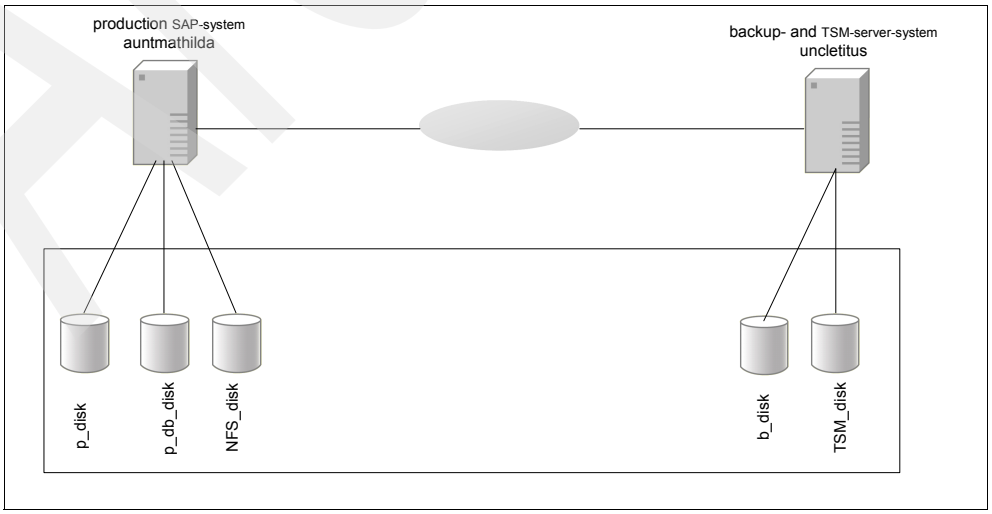


Figure 2-7 Basic Data Protection for mySAP logical storage model

On the production system, auntmathilda, the SAP software program files, the database system, the Tivoli Storage Manager client, and the Data Protection for mySAP and Advanced Copy Services programs are referred to here as a logical component, called *p_disk*. The *p_disk* also contains the DB2 log volumes, if a DB2 environment is used.

The data volumes of the databases (and the log volumes, in the case of an Oracle installation) are referred to here as *p_db_disk*. These are the data devspaces (and also the log devspaces in an Oracle installation).

We stored the program configuration files and the directory for keeping backup and restore logs and traces on a directory that was exported via NFS from the production server. We then mounted this directory as an NFS file system on the backup server. On a DB2 installation, just the /db2/PR1/dbs directory of the *DB2 Instance directory* has to be shared. On an Oracle installation, it is required to share:

- The /oracle/R31/920_64 directory — the Oracle executables directory
- The /oracle/R31/sapbackup directory
  - The destination for the logs from **brbackup** and **brrestore**
- The /oracle/R31/sapreorg directory — the temporary data staging directory
- The /sapmnt/R31 — the SAP executables

These shared directories are referred to above as *NFS_disk*. For more information about the NFS export and mount process, see Appendix A of the *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP, Installation and User´s Guide for DB2 UDB*, SC33-8208, or the *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP, Installation and User´s Guide for Oracle,* SC33-8207.

On the backup system, uncletitus, the SAP software program files, the database system, the Tivoli Storage Manager client and the Data Protection for mySAP and Advanced Copy Services programs (as far as it had to be installed on this system) are referred here as *b_disk*.

The *TSM_disk* refers to the Tivoli Storage Manager server executables and disk storage pools.

2.3.2 Software preconfiguration

The Remote Shell had to be set up as recommended to allow inter-system access by our two servers.

We also required Subsystem Device Driver (SDD) — for the DS8000 to be installed on the backup and production servers. For more information about this, see the *IBM System Storage Multipath Subsystem Device Driver User's Guide SC30-4131* at:

```
http://www-1.ibm.com/support/docview.wss?rs=0&context=SWJ20&q1=SDD&q2=sddpcm&uid=ssg1S7000303&loc=en_US&cs=utf-8&cc=us&lang=en
```

For the communication between the Data Protection for FlashCopy and the storage system, the CIM interface is required. This consists of:

- Open SSL
- Pegasus CIM Server package
- DS Open API CIM Agent (ESS or DS configuration)
- ESS Copy Services CLI (ESS configuration)
- ESS NI Server (DS configuration) - part of the DS-hardware
- The CIM Agent for SVC, which is automatically installed with and integrated into the SVC Master Console

These packages have to be downloaded and installed separately. Use the following link for downloading the current versions:

- http://www.ibm.com/servers/aix/products/aixos/linux/download.html
- http://www.ibm.com/servers/storage/support/software/cimdsoapi/installing.html

OpenSSL is a prerequisite for the CIM client, which interferes with the libssl.a library of the OpenSSl.

From the CIM (Common Interface Model) server package, we must have the client libraries, interfering with the Data Protection for FlashCopy (referred as CIM Agent). This has to be installed on both AIX systems, the production system, and the backup system.

Detailed installation steps are described in 3.5, “CIM software installation and configuration”.

2.3.3 Volume group configuration

The SAP instance for our test DB2 environment was installed on three volume groups:

```
PR1vg for the system devspace
PR1datavg for the data devspace
PR1logvg for the log devspace
```

For the FlashCopy function, only the volume group PR1datavg will be copied. It consists of nine volumes in the DS8000. We have to use the same number of volumes for the target LUNs, and we enter in the serial numbers in the TARGET_VOLUME option in the file initPR1.fct when configuring the Data Protection for FlashCopy. See “Customizing Data Protection for FlashCopy target volume file” on page 73.

The SAP instance for our test Oracle environment, was also installed on three volume groups:

```
R31vg for the system devspace
R31datavg for the data devspace
R31logvg for the log devspace
```

For the FlashCopy function on the two Oracle environment the volume groups R31datavg and R31logvg will be copied. The R31datavg consists of eight volumes in the DS8000, the R31logvg consists of 1 volume. We have to use the same number of volumes for the target LUNs, and we enter in the serial numbers in the TARGET_VOLUME option in the file initR31.fct when configuring the Data Protection for FlashCopy. See “Customizing Data Protection for FlashCopy target volume file” on page 109.

Similar to that is the DB2 environment. We have there the PR1datavg and the PR1logvg, but here we only require the PR1datavg (that consists of 8 volumes) for the FlashCopy function. We have to use the same number of volumes for the target LUNs, and we enter in the serial numbers in the TARGET_VOLUME option in the file initPR1.fct when configuring the Data Protection for FlashCopy. The remaining information consists of the offline log files and backup control files, which are sent to the TSM server from the production system.

Our final test environment is shown in Figure 2-8.

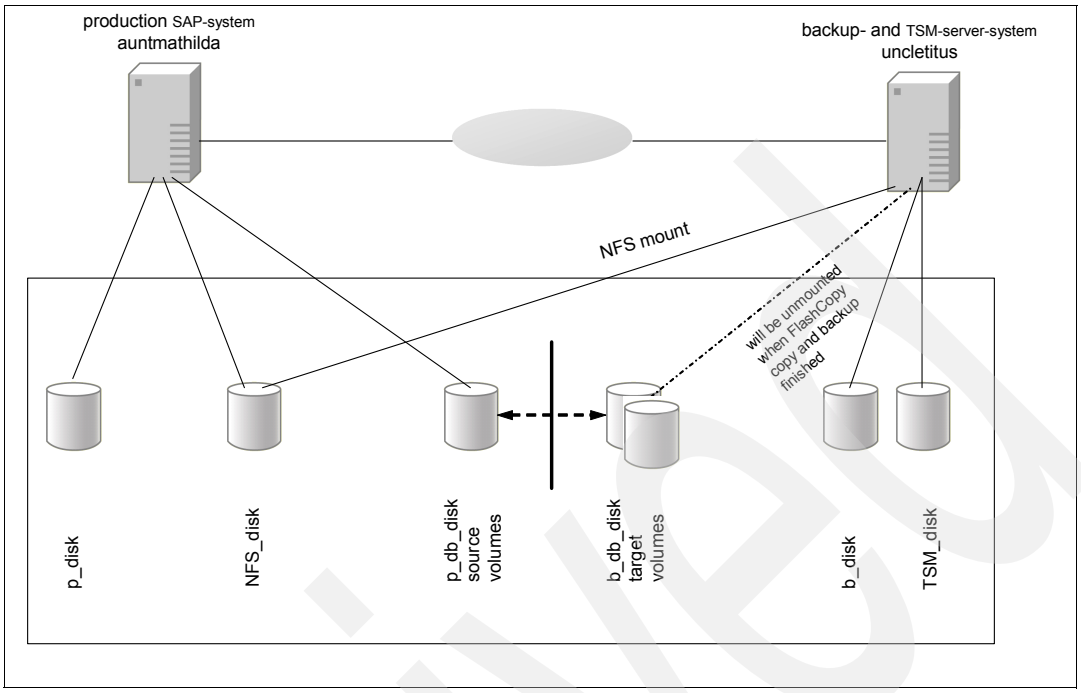


Figure 2-8 Basic Data Protection for FlashCopy environment

The *NFS_disk*, consisting of configuration-, log- and trace files, is now mounted to the backup system. The target volumes are set up for FlashCopy copy services. Two sets of target volumes were made available for use on the DB2 installation and one set of target volumes were made available for use on the Oracle installation.

Table 2-1 lists the volumes and file systems used by the SAP system PR1, using DB2 UDB.

Table 2-1 Storage configuration of DB2 SAP system

Volume groups	File system names	Function	LUNs / Range
PR1vg	/db2/PR1 /db2/db2pr1 /db2/PR1/db2dump /sapmnt/PR1 /usr/sap/PR1 /db2/PR1/log_archive /db2/PR1/log_retrieve	DB2 Instance directory DB2 Instance specific directory diag log and dump directory SAP executables work and global directory archived log files retrieved log files	1284
PR1datavg	/db2/PR1/db2pr1 /db2/PR1/sapdata1 /db2/PR1/sapdata2 /db2/PR1/sapdata3 /db2/PR1/sapdata4 /db2/PR1/sapdata5 /db2/PR1/sapdata6 /db2/PR1/saptemp1	DB2 local database directory SAP NetWeaver® data files	137D to 1380 1281 to 1283 1286 1289
PR1logvg	/db2/PR1/log_dir	database redo logs	1285 and 1288

Table 2-2 lists the volumes and file systems used by the SAP system R31, using Oracle.

Table 2-2 Storage configuration of Oracle SAP system

Volume groups	File system names	Function	LUNs / Range
R31vg	/oracle/R31 /oracle/client /oracle/R31/920_64 /usr/sap/R31 /sapmnt/R31 /usr/sap/trans /oracle/R31/sapreorg /oracle/R31/oraarch	Oracle Instance specific directory Oracle Client Oracle Executables work & global directory SAP executables Transport Directory Temporary data staging Archive log files	110E
R31datavg	/oracle/R31/sapdata1 /oracle/R31/sapdata2 /oracle/R31/sapdata3 /oracle/R31/sapdata4	SAP NetWeaver data files	1038 to 103B 110C and 110D 1128 1117
R31logvg	/oracle/R31/origlogA /oracle/R31/origlogB /oracle/R31/mirrlogA /oracle/R31/mirrlogB	Online redo log files and mirror	110F

2.4 HACMP and LVM considerations

Your configuration might be different from the foregoing one, particularly if you have a HACMP environment.

AIX systems, when configured in an HACMP cluster, are seen as one single system. If your production server is clustered for high availability, the standby server cannot be used as the backup server — that is, the backup server cannot be in the same HACMP cluster as the production server. You will require a separate AIX server to act as the backup server.

LVM mirroring is supported by Data Protection for FlashCopy, in a single system environment as well as in a HACMP environment.

Details are discussed in “Chapter 8. Data Protection for FlashCopy Functionality for AIX LVM Mirrored Environments” of *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP, Installation and User´s Guide for DB2 UDB,* SC33-8208, and of *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP, Installation and User´s Guide for Oracle,* SC33-8207.

An SAP-environment set up with mirrored volumes in different hardware units will be protected for an outage, even one mirror fails completely. Data Protection for FlashCopy backup currently supports only a 2-way mirrored AIX LVM environment. Only one of the mirrors becomes eligible for the FlashCopy process. The FlashCopy process and the LVM mirror process run concurrently and independently. Therefore the LVM mirrors will be in sync, even while the FlashCopy process is running. Refer to the specified chapter in the manual above for detailed information.

2.5 Types of backup and restore

In this section we describe the different types of backup, supported by Data Protection for FlashCopy as well as the recovery strategies, resulting from the type of the backup in principle. For detailed information, see Chapter 5, “Backup and restore in DB2 environments” on page 119 and Chapter 6, “Backup and restore in Oracle environments” on page 169. Also, you can refer also to the following product manuals:

- *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP Installation and User’s Guide for DB2 UDB,* SC33-8208
- *Tivoli Storage Manager for Hardware Data Protection for FlashCopy Devices for mySAP Installation and User’s Guide for Oracle,* SC33-8207

In general, all backups done by Data Protection for FlashCopy are full DB backups. The transaction logs must be backed up separately by Data Protection for mySAP. We differentiate:

- Backup of the database to the Tivoli Storage Manager server without a FlashCopy copy
- Backup of the database to the Tivoli Storage Manager server from a FlashCopy copy
- Backup of the database just as a FlashCopy copy

The FlashCopy function itself has three options:

- FlashCopy with option *copy*
- FlashCopy with option *incremental*
- FlashCopy with option *nocopy*

In general, you can issue a backup and a restore of an SAP database using either the native backup utility, provided by the DB-application (available for DB2 only); the Data Protection for mySAP or the Data Protection for FlashCopy. If you have installed Data Protection for FlashCopy, we recommend using it for all backup functions — even backups to the Tivoli Storage Manager server without FlashCopy.

Each backup method has its own query function to list the backups made. If you have made backups to Tivoli Storage Manager using Data Protection for FlashCopy (as recommended), these backups are listed by queries from all methods.

Example 2-1, Example 2-2, and Example 2-3 show how a backup is listed in queries from DB2, Data Protection for mySAP, and Data Protection for FlashCopy, after an offline backup of a DB2 SAP database from the production system to the Tivoli Storage Manager server.

Example 2-1 “db2 list history backup all for PR1”

```
Op Obj Timestamp+Sequence Type Dev Earliest Log Current Log  Backup ID
-- --- ------------------ ---- --- ------------ ------------ --------------
 B  D  20060724211839001   F    O  S0000037.LOG S0000037.LOG
----------------------------------------------------------------------------
 Contains 26 tablespace(s):

 00001 SYSCATSPACE
 00002 SYSTOOLSPACE
 00003 PR1#STABD
 00004 PR1#STABI
 00005 PR1#BTABD
 00006 PR1#BTABI
 00007 PR1#CLUD
 00008 PR1#CLUI
 00009 PR1#POOLD
```

```
  00010 PR1#POOLI
  00011 PR1#DDICD
  00012 PR1#DDICI
  00013 PR1#DOCUD
  00014 PR1#DOCUI
  00015 PR1#EL620D
  00016 PR1#EL620I
  00017 PR1#LOADD
  00018 PR1#LOADI
  00019 PR1#PROTD
  00020 PR1#PROTI
  00021 PR1#ES620D
  00022 PR1#ES620I
  00023 PR1#SOURCED
  00024 PR1#SOURCEI
  00025 PR1#USER1D
  00026 PR1#USER1I
 ------------------------------------------------------------------------------
    Comment: DB2 BACKUP PR1 OFFLINE
 Start Time: 20060724211839
   End Time: 20060724214057
     Status: A
 ------------------------------------------------------------------------------
  EID: 95 Location: /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
```

Example 2-2 “backom -c q_all -m detailed”

```
================================================================================
              Data Protection for mySAP(R) - Backup Object Manager

        - Version 5, Release 3, Modification 2 Level 2 for AIX LF 64-bit -
                  Build: 278R compiled on Mar  3 2006
        (c) Copyright IBM Corporation, 1996, 2006, All Rights Reserved.
================================================================================

===> Backup images for database 'PR1' <===

    >> DATABASE BACKUP
        Time: 20060724211839   Node: 0000   Session(s): 1   TDI: no
        BID: PR1___AOEQ1N3XXQ  Server: UNCLETITUS   Mgmt Class: PR1DBS
```

Example 2-3 “tdphdwdb2 -f inquire -p ./auntmathilda/initPR1.fcs”

```
                  IBM Tivoli Storage Manager for Hardware
            Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                                (TDPHDWDB2)

              FlashCopy Backup utility for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
                Build: 304 generated at 14:32:19 on Mar 14 2006
        (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

:::::::::
```

```
IDS2014I 00023 BSI_TAPEONLY - 20060724211839 - 20060724211833 - - exchange.00023
/db2/PR1/dbs/initPR1.utl :0000:20060724211839 - :0000:/db2/PR1/log_dir/NODE0000/
FULL_OFFLINE :0000:S0000037.LOG - - - 531304 - - -
```

In this book, we are focusing on Data Protection for FlashCopy, so we always use **tdbhdwdb2** or **tdphdwora** for backups and restores.

2.5.1 Database backup to Tivoli Storage Manager server without FlashCopy

In this scenario, we back up the SAP database only to the Tivoli Storage Manager server — there is no FlashCopy made.

Backup

This type of backup can be initiated from Data Protection for FlashCopy, even though it will not make a FlashCopy. It must be initiated from the production server, because the backup server has no access to the database volumes. The backup can be either online or offline, and can be full or partial (for example, a single database). You might do this type of backup for migrating or moving a database (so that it is restored to another system), or in the event that the backup server is currently not available.

Data Protection for FlashCopy calls Data Protection for mySAP to perform the backup and keeps track of that backup in the IDS_CONTROL_FILE.

Restore

Restores are always initiated from the production server. In this scenario, even though the backup has to come from the Tivoli Storage Manager server, we can start the restore using Data Protection for FlashCopy program **tdphdwdb2** or **tdphdwora**.

2.5.2 Database backup to Tivoli Storage Manager server from a FlashCopy

In this scenario, we make a FlashCopy of the database, then back up the copied database to the Tivoli Storage Manager server.

Backup

Backing up the FlashCopy'd SAP database from the backup server to Tivoli Storage Manager using Data Protection for FlashCopy is the most common way of using the product.

Issuing **tdphdwdb2** or **brbackup** on the backup server will first contact the database-server on the production side to gather information about the volumes where the database is located. The volume names are passed to **splitint**. Then **splitint** takes the names of the source-volumes and puts them into the file initPR1.fct together with the target-volumes. The FlashCopy copy is then started by **splitint** and, after a few seconds (when source and target volumes are connected), the backup of the SAP-database to the Tivoli Storage Manager server will be started by Data Protection for my SAP on the backup server.

If both operations (FlashCopy and backup to Tivoli Storage Manager) finish without error, the target volumes are unmounted from the backup server.

Restore

In this case, because there are two backups made, you have the choice of restoring the SAP-database from either the FlashCopy copy or from the backup on the Tivoli Storage Manager server. We refer to the restore from a FlashCopy copy as a *FlashBack Restore*.

For a DB2 system, using **tdphdwdb2**, you will be guided through the restore and recovery process and you will be prompted for all required actions. For an Oracle SAP system using **tdphdwora**, you have to follow the product manual for pre- and post-restore activities. More details are provided in Chapter 6, “Backup and restore in Oracle environments” on page 169

Note: If you withdraw a target volume set, you can no longer use this set for a FlashBack restore, because the relationship is broken.

The target volumes will be unmounted by default after the FlashCopy operation and the backup to the Tivoli Storage Manager server is complete.

If the FlashCopy type is NOCOPY, the target volumes are also withdrawn, because this type of FlashBack is not eligible for a FlashBack restore. See 2.5.4, “Different options for the FlashCopy function” on page 42.

2.5.3 Database backup using FlashCopy copy only

In this case, we make a FlashCopy backup only — there is no Tivoli Storage Manager backup.

Backup

This type of backup, also referred as a disk-only backup, will produce a backup of the SAP database on the FlashCopy target volumes only. However, log files should always be backed up whenever a FlashCopy backup is made — these will be sent to the Tivoli Storage Manager server. See 2.6, “Backup of offline transaction logs” on page 43 for more information about techniques to do this.

Note: At the end of a disk-only backup, the target volumes remain mounted on the backup server with the volume group varied on. This is done so that the backup consistency can be verified. You can then manually unmount the volumes, and optionally withdraw the volumes.

Restore

Because no backup is done to the Tivoli Storage Manager server, only FlashBack restore is available. However, the Tivoli Storage Manager server has to be available for restoring transaction logs and control files for completing the recovery process.

2.5.4 Different options for the FlashCopy function

As mentioned before, there are three options for a FlashCopy copy:

- FlashCopy with option COPY:

  This makes a complete copy of the source volumes to the target volumes. This FlashCopy copy can be used for FlashBack restore.

- FlashCopy with option INCREMENTAL:

  The first time FlashCopy is run with the INCREMENTAL option, the source volumes will be copied to the target volumes.

  Subsequent FlashCopy INCREMENTAL operations will copy just the changes on the source volumes to the target volumes. You must make sure the target volumes are still associated with the source volumes, therefore no withdraw should be issued. This type of FlashCopy can be used for FlashBack restore as well.

  Incremental FlashCopy is not supported by the SAN Volume Controller.

- FlashCopy with option NOCOPY:

  This FlashCopy type is used for backup to the Tivoli Storage Manager server only.

  You cannot run a FlashBack restore from this, because only tracks which were changed while the backup of the SAP database is running are copied from the source volumes to the target volumes,

  A withdraw is done by the process after the backup to Tivoli Storage Manager is complete.

2.6 Backup of offline transaction logs

In SAP software environments installed on both DB2 and Oracle databases, we have to perform the backup of the offline logs (also known as the archive logs) for forward recovery after a restore of the database. These logs must be backed up from the production system. Currently, this function is not provided within Data Protection for FlashCopy.

Important: Each time you back up the SAP database, either online, or using FlashCopy, make sure to save the transaction logs using the methods described here.

2.6.1 DB2 logs

When the SAP software is installed on the DB2 database, we have two methods to perform the backup of the offline logfiles:

- The SAP-DB2 Administration Tools include a utility called **BRARCHIVE**. This utility archives the offline logs to the Tivoli Storage Manager server and then deletes them from the logspace. A sample command is:

  ```
  /db2/<SID>/admintools/bin> brarchive -sd
  ```

- Because V5.3 of Data Protection for mySAP, you can also use the DB2 archive_log utility. This is the recommended method. A sample command is:

  ```
  > db2 archive log for database <SID>
  ```

  This will close the current log and mark it inactive. In an SAP software environment, the LOGARCHMETH1 option of the DB2 configuration file has to be set to vendor, followed by colon(:) and the name of the library, and the LOGARCHOPT1 option has to point to the Data Protection for mySAP vendor environment file vendor.env. This file is created by Data Protection for mySAP at installation time and will point to the initSID.utl file. You can see our settings for these variables in Example 2-4.

  Use the command **> db2 get db cfg for <SID> | grep log** to verify the proper settings

Example 2-4 Configuration settings for archiving logs

```
pr1adm> db2 get db cfg for pr1 | grep log
 User exit for logging status                         = YES
 Catalog cache size (4KB)              (CATALOGCACHE_SZ) = 2560
 Number of primary log files                (LOGPRIMARY) = 20
 Number of secondary log files               (LOGSECOND) = 40
 Changed path to log files                  (NEWLOGPATH) =
 Path to log files '
        /db2/PR1/log_dir/NODE0000/
 Overflow log path                     (OVERFLOWLOGPATH) =
 Mirror log path                         (MIRRORLOGPATH) =
 First active log file                                   = S0000070.LOG
 Block log on disk full                (BLK_LOG_DSK_FUL) = YES
```

```
Percent of max active log space by transaction(MAX_LOG) = 0
Num. of active log files for 1 active UOW(NUM_LOG_SPAN) = 0
Percent log file reclaimed before soft chckpt (SOFTMAX) = 300
User exit for logging enabled                (USEREXIT) = OFF
HADR log write synchronization mode     (HADR_SYNCMODE) = NEARSYNC
First log archive method                 (LOGARCHMETH1) =
       VENDOR:/usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
Options for logarchmeth1                  (LOGARCHOPT1) = /db2/PR1/dbs/vendor.env
Second log archive method                (LOGARCHMETH2) = OFF
Options for logarchmeth2                  (LOGARCHOPT2) =
Failover log archive path                (FAILARCHPATH) =
Number of log archive retries on error   (NUMARCHRETRY) = 5
```

These settings for LOGARCHMETH1and LOGARCHOPT1 DB2 will automatically send offline logs to the VENDOR library, which is the Data Protection for mySAP library. See “Chapter 5. Adjusting Your System” in *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for mySAP Installation & User’s Guide for DB2 UDB*, SC33-6341 for details on that definitions.

2.6.2 Oracle logs

When the SAP software is installed on the Oracle database, there is only one method available. Use the BR*Tools **BRARCHIVE** utility to perform a backup of the offline log files. This utility calls Data Protection for mySAP to perform the actual backup of the offline logfiles. The command is the same as for DB2:

```
@:/usr/sap/R31/SYS/exe/run> brarchive -sd
```

For details on setting up and using the BR*Tools, refer to the SAP documentation, for example, the current *SAP Database Guide: Oracle*.

2.7 Expiration considerations

Expiration of backups can be handled in three ways — you should pick one:

- Tivoli Storage Manager server
- Data Protection for mySAP
- Data Protection for FlashCopy

Expiration managed by Tivoli Storage Manager

The expiration of backup and archived objects is handled by expiration definitions in the active copy groups within the policy. Data Protection for mySAP uses only the archive copy group. For archived objects (Data Protection for mySAP stores all files in an archive storage pool), you have to set the option *RETVer*, which controls how long the objects will be kept. You can either set this value to an appropriate number of days for your environment, or set it to NOLIMIT, if you want Data Protection for mySAP to control the expiration of SAP database backups.

Expiration managed by Data Protection for mySAP

Data Protection for mySAP handles the expiration using versioning.

A version number is part of the description, which is part of the metadata sent for each archived object to the Tivoli Storage Manager server. This version number is incremented on each full backup, kept on the Tivoli Storage Manager server, and is maintained in the initSID.bki file. Use the *MAX_VERSIONS* option in the Data Protection for mySAP profile — init<*SID*>.utl to set the number of versions of database backups which you want to keep on the Tivoli Storage Manager server. If you set MAX_VERSIONS to 0, then there will be no version control by Data Protection for mySAP.

Note: If the Data Protection for mySAP binary profile init<SID>.bki is deleted or replaced by an older version, the versioning will be invalidated. New full backups, sent to the Tivoli Storage Manager server, will have a lower version number than the older backup versions already stored, which means that older backup versions will not be deleted.

Expiration managed by Data Protection for FlashCopy

Data Protection for FlashCopy honors the same option MAX_VERSIONS in the initSID.bki file, because it calls Data Protection for mySAP to do the actual archive to the Tivoli Storage Manager server. Therefore the initSID.bki file and the initSID.utl file must be accessible by both the production and backup server — which we achieve by keeping these files on the NFS shared volume.

However, there is another option, BACKUP_MAX, defined in the Data Protection for FlashCopy profile init*<SID>*.fcs. This option maintains the number of entries in the IDS_CONTROL_FILE (we set that to “/db2/PR1/dbs/auntmathilda/save/idssave” on our system). Each entry in the IDS_CONTROL_FILE represents a backup cycle, even a failed one. Logs and traces, produced by a backup cycle, will be deleted when the associated backup is deleted from the IDS_CONTROL_FILE, as long as the logs and traces are at least 3 days older than the next oldest entry.

2.8 Recommendations from the previous information

Here are some recommended policies and practices, based on the information we have just presented. As with any backup configuration, careful planning done before installing is absolutely essential.

- Use Tivoli Storage Manager backup only for an initial backup, for a partial backup, or if the backup system is not available. In other cases, use FlashCopy backups to minimize the impact on the production server, and allow for fast FlashBack restore.
- Use FlashCopy_Type NOCOPY where possible — providing that you do not have to use FlashBack restore (which is not possible from this type of FlashCopy). FlashBack NOCOPY is faster, because only tracks that have to be updated are written. Be aware that you must still provide a full, equivalent-size set of target volumes, corresponding to the source volumes.
- Use FlashCopy_Type INCREMENTAL for huge SAP databases. This enables you to perform a FlashCopy copy more frequently. The next FlashCopy copy cannot be started until the previous INCREMENTAL copy is complete. Moreover, if you are making a backup from this FlashCopy to the Tivoli Storage Manager server, this process must also be finished. The target volumes must be the same size and number as the source volumes. Note that Incremental FlashCopy is not supported by the SAN Volume Controller.
- Use FlashCopy_Type COPY when you want to maintain multiple version for FlashBack restore — to different points in time. Of course, to do this, you must have multiple target sets of the same size and number as the source volumes. In case of a failure on the source volumes while an ongoing FlashCopy copy is progress, you will have a valid backup available from another target set for a FlashBack restore at any time.

- You can install a second disk storage system to use AIX LVM mirroring for further data redundancy. In this case, the maximum number of FlashCopy backups (disk only backups) increases from n to (n * m), where n is the number of target volume sets in one disk storage system (currently 12 copies are allowed, but only one can be an incremental copy) and m is the number of LVM mirrors.
- An HACMP configuration on the production server gives processing redundancy for SAP. However, it does not increase the availability or functionality of the backup strategy.
- If a data corruption occurs, but is not detected until after a backup is run, in previous versions of Data Protection for FlashCopy, a restore from the last good Tivoli Storage Manager server backup would have been required. Beginning with V5.3.1 of Data Protection for FlashCopy, up to 12 target volume sets can be maintained. If additional target volume sets are used, in the corruption scenario just mentioned, you can also run a FlashBack restore from an older FlashCopy backup version. In 5.4.4, “FlashCopy backup with multiple target volume sets” on page 165 and 6.5.4, “FlashCopy backup with multiple target volume sets” on page 227.

A FlashCopy backup does not replace backups to the Tivoli Storage Manager server — it should be used as a supplement for providing faster backups and restores. Backups to the Tivoli Storage Manager allow you to manage the number of versions and the life cycle of an individual backup. You also require a Tivoli Storage Manager server for backups of the transaction logs and configuration files.

As mentioned before, the SAP data-devspaces (also refered as p_db_disks) have to be separated from other data. The recommended way to do this is to have them on a separate volume group.

The number of target volumes for the FlashCopy process in each set has to be the same as the number of source volumes — this is true for both backups, as well as FlashBack restores. Therefore, if you add or remove volumes on the production server, make sure to keep the target volumes consistent, and perform a new FlashCopy backup to synchronize the configurations. Example 2-5 shows what happens if you have to do a FlashBack restore from a FlashCopy with a different LUN configuration. In this case, you must manually re-add the LUN to the volume group before running forward recovery. This is because Data Protection for FlashCopy is unable to issue the required AIX commands to extend the volume group.

Example 2-5 Example of a timeline for changing the LUN configuration of the database

```
06:00 am FlashCopy was done while source (& target) set consists of 9 volumes
09:00 am The mySAP database had to be enlarged - a LUN was added, making 10
         volumes now
09:15 am New tablespaces were created in the database
11:00 am The mySAP database system crashed and restore is required
11:15 am A FlashBack restore was done, but the database consisted of only 9
         volumes at this time of the backup.
        Data Protection for FlashCopy will give you two messages at this restore
        process, reminding you that you may have to add additional volumes
        manually to the production set of volumes, so that all recovery data will
        fit, and to run forward recovery. Adding the newly created tablespaces
        will be done by the forward recovery process.
```

See also 5.4.2, “FlashBack restore” for a detailed example.

2.9 Multiple systems: Considerations

An SAP database can span across multiple disk storage systems. You can also use target sets stored on multiple disk storage systems. However, all volumes within a target set must reside in a single disk storage system.

In installations with multiple SAP software production systems, you might decide to share one backup server between them all, in order to reduce the configuration overhead and expense of maintaining multiple backup servers. Technically this is possible, however, there are some important considerations:

- As previously stated, the operating system environment and configuration has to be the same on the production and the backup system. If multiple production systems are to be backed up by one single backup system, any upgrade or maintenance action must be performed on all the production and backup systems, so that the same versions are preserved. If this is not possible for any reason (for example, if one production system requires a special operating system patch which cannot be applied to the others), the inconsistent system can no longer use the same backup server. It must be backed up separately, such as by using Data Protection for mySAP by itself, using Data Protection for FlashCopy on a separate backup system with the same patch level installed.
- Backing up multiple SAP software servers, (or indeed, backing up multiple SAP database instances on a single server) to a single backup system will of course have performance implications because of the increased workload. If multiple SAP databases are backing up concurrently, backup performance will decrease — especially if the backup system is also the Tivoli Storage Manager server. Therefore, you should carefully test the achievable throughput on your backup system, bearing in mind all components such as network, memory, CPU, tape drive, and so on.

  You can have a certain amount of control of workload distribution using scheduling. Another way is to help to serialize multiple backup operations, with the options DB2_FRONTEND/DB2_BACKEND (in .fcs profile for DB2) or FRONTEND/BACKEND (in the .utl profile for either DB2 or Oracle). These work similarly to the PRESCHEDULECMD/POSTSCHEDULECMD Tivoli Storage Manager client options. Here you can call a script to be executed before or after the backup, respectively. Scripts can be started here to issue a sleep waiting for the server to be idle, to wait for availability of a mountpoint, to monitor for the completion of a process, to set a flag that a process is complete, for example.
- You have to maintain different sets of configuration files for each SAP database system, which will point to the different SIDs.
- If the SAP database systems are using different versions (for example, 32 bit and 64 bit), then all versions must be installed also on the backup system, in different directories.
- The user, the user-ids, the groups, and the group-ids used for the different SAP database systems must match with the definitions on the backup system. No duplication is possible.

Because these guidelines are very strict, we recommend that you use a dedicated backup system for each production system, if possible.

2.10 A service offering: FlashCopy cloning of SAP databases

There is an additional offering available to clone an SAP database on the backup system. FCClone is a service offering from BM Tivoli Solution Development, which uses the functionality of Data Protection for FlashCopy for cloning an SAP system. We give more information on installing this offering in Appendix B, “Installation and usage of the FlashCopy Cloning offering” on page 247.

For additional information about this IBM QuickStart Services for Tivoli Storage Manager for Advanced Copy Services offering, see your IBM account manager or IBM Sales representative. It prepares you for the successful implementation of FlashCopy Cloning by installing and configuring the product in your pilot environment and by providing transfer of information for you to be able to deploy FlashCopy Cloning into your operational environment.

2.10.1 Why cloning is necessary

There are many reasons for cloning an SAP database. It might be done for test purposes, to replicate a production environment, so that new releases, functions or upgrades can be validated in a test environment. A cloned database can also be used for stress or performance testing. It can also be used in a learning environment — to set up a current image before each class. Finally, reporting and batch jobs can be done from a copy of a database to free the production database from the workload and to make a batch job restartable in case of an unexpected termination.

2.10.2 Different methods of cloning

SAP supports different ways for cloning. That is described in the SAP manual Homogeneous System Copy, or at:

http://www.sapdb.org/7.4/htmhelp/21/692225b246b24f9202cb4433b5d691/content.htm

The following methods can be used:

- SAP copy tools R3SETUP and R3LOAD
- Database-specific copy tools:
  - Oracle: Use BRBACKUP and BRRESTORE to back up and clone with a new SID.
  - DB2 UDB: Use SAP DBA tool brdb6brt for a redirected restore.
- Using Data Protection for FlashCopy cloning. This method significantly reduce s the time required for cloning without impacting the production database.

2.10.3 Process flow of FCClone

The general process of cloning, using FlashCopy, is to make a FlashCopy of the production database onto a target set, then to make the new clone copy onto another target set. You can then access the cloned database on the backup server, or it could also be accessed on another suitably installed SAP software server, providing this server has access to both the FlashCopy and cloned database target sets.

The actual cloning process when using Data Protection for FlashCopy is slightly different, depending on the database.

For SAP software installed on Oracle databases, the steps are as follows:

1. The FCClone process is started by the script FCclone.sh.
2. This executes pre-processing scripts.
3. The last FlashCopy clone is unmounted.
4. FCClone calls **`brbackup`**, which calls Data Protection for FlashCopy. That starts an online or offline FlashCopy backup. When all resources are mounted on the backup server (that is, when **`splitint`** is complete), Data Protection for FlashCopy stops the **`brbackup`** processing.
5. A copy of the original database is now accessible on the backup server.
6. FCClone now starts the process **`oraclonedb`** to perform all the required steps for cloning.
7. The cloned database is now operational and FCClone will execute post-processing scripts.

For SAP software installed DB2 databases, the steps are:

1. The FCClone process is started by the script FCclone.sh.
2. This executes pre-processing scripts.
3. The last FlashCopy clone is unmounted.
4. FCClone calls **`tdphdwdb2`** to start an online FlashCopy backup.
5. A copy of the original database is now accessible on the backup server.
6. FCClone now starts db2clonedb to perform all the required steps for cloning.
7. The cloned database is now operational and FCClone will execute post-processing scripts.

2.10.4 Installation requirements for FCClone

The requirements for the hardware, the software and the environment are the same as for DB for FlashCopy. The cloning system and the backup system can be installed on the same or on a different AIX server, but cannot be installed on the production system.

Different target volume sets should be used for FlashCopy backup and FlashCopy cloning.

Additional requirements for SAP software installed on Oracle

Here are some additional requirements on Oracle:

- Oracle has to be installed at the same level on both the production and the backup servers.

> **Note:** Oracle 8 is no longer supported.
>
> Raw devices or JFS2 file systems with JFS2 inline logs are not supported.

- Verify settings for users ora<*SID*> and ora<*NEWSID*> for both csh **and** ksh.
- If the SAP Kernel release >= 6.10 then environment variable DBS_ORA_SCHEMA has to be set for user ora<*SID*> and <*SID*>adm to the production system database schema.
- User ora<*NEWSID*> has to use ksh as login shell.

Additional requirements for SAP software installed on DB2

Here are some additional requirements on DB2:

- DB2 UDB ESE v8.1/8.2 has to be installed at the same level on both the production and the backup servers.
- DB2 UDB ESE v8.1/8.2 databases can be single partitioned as well as multi partitioned.

> **Note:** Multiple partitions on multiple production servers are not yet supported.
>
> Raw devices or JFS2 file systems with JFS2 inline logs are not supported.

- All files and volumes required for backup and cloning must reside on the same disk storage system.
- Verify settings for users db2<*SID*> and db2<*NEWSID*> for both csh *and* ksh.
- If the SAP Kernel release >= 6.10, then environment variable DBS_ORA_SCHEMA has to be set for user db2<*SID*> and <*SID*>adm to the production system database schema.
- A remote shell connection for user db2<*SID*> should already be established between the backup and the production system at the pre-installation steps for Data Protection for FlashCopy.

> **Hint:** Data Protection for FlashCopy uses **rsh** and **su** commands while running several setup scripts.
>
> The output of these commands will be traced from the scripts. If the /etc/profile or other profiles called during the login process (done by **rsh** or **su**) will produce output to “standard output” (as, for example, an echo command in the /etc/profile), the setup script will probably fail.
>
> For proper installation and customizing of Data Protection for FlashCopy, comment out all commands which produce output on standard output (such as echo commands). This should be done for user db2<SID> only. After successfully running all setup scripts, these commands can be included again.

3

Installation for SAP software on DB2 UDB

In this chapter we provide details regarding required customization of the Tivoli Storage Manager server, Tivoli Storage Manager client, and DB2. We also supply information about installation, configuration of Data Protection for mySAP (DB2), CIM client (Pegasus), DS Open API CIM agent, and Data Protection for FlashCopy.

3.1 Overview of software components required on the servers

First we give you an overview of the required software components (see Table 3-1).

Table 3-1 Software components for servers

Software component	Required on
Tivoli Storage Manager server	Any server — recommended to be on a separate server or on the backup server.
Tivoli Storage Manager client (AIX)	Production and backup server.
CIM client (Pegasus)	Production and backup server.
OpenSSL	Production and backup server.
DS Open API CIM agent	Any server — recommend to be on a separate server or on the backup server. Required only for ESS, DS6000, or DS8000 storage. For the SAN Volume Controller, this is installed on the Master Console.
Data Protection for mySAP (DB2)	Production and backup server.
Data Protection for FlashCopy (SAP software-DB2)	Production and backup server.
DB2 server	Production server only.
DB2 client	Production server and backup server.
SAP application	Production server only. Including BR*Tools

The production server is the server on which the production SAP application with DB2 database is running. In an HACMP cluster environment, any software on the production server must be installed also on the fallback server. In our configuration, the production server is *auntmathilda*, as shown in Figure 6-1 on page 173.

The backup server is the server on which the FlashCopy target volumes will be mounted and the backup initiated to the Tivoli Storage Manager server. In our configuration, the backup server is *uncletitus*, which also hosts the Tivoli Storage Manager server. The Tivoli Storage Manager server can also run on a completely separate system (but not recommended on the production server). In this book, therefore, the term “backup server” refers to the system that is performing the backups of FlashCopy snapshots to Tivoli Storage Manager.

3.2 Configuring the Tivoli Storage Manager server

Commands shown in this section are Tivoli Storage Manager administrative commands, which are run using the Tivoli Storage Manager administrative command line utility **dsmadmc**. These commands should be run on the system that is the Tivoli Storage Manager server. In our case, this is the backup server, uncletitus. However, it could be any system with suitable storage devices for backups. We assume that the basic Tivoli Storage Manager code is installed and configured with an administrative ID, and that the storage pools are available. For more information about planning and installing a Tivoli Storage Manager server, refer to the product documentation, or to the IBM Redbook, *IBM Tivoli Storage Manager Implementation Guide*, SG24-5416.

We recommend having a separate policy domain with policy set, management class, and copy group in Tivoli Storage Manager for each of the Tivoli Data Protection modules. We will define a separate policy domain and policy set for Data Protection for mySAP (DB2) as shown in Example 3-1.

Example 3-1 Defining policy domain, policy set

```
tsm: UNLCETITUS>define dom sapdom description="Policy Domain - SAP
ANR1500I Policy domain SAPDOM defined.

tsm: UNLCETITUS>define policy sapdom sapps description="Policy Set - SAP
ANR1510I Policy set SAPPS defined in policy domain SAPDOM.
```

Normally we will have different backup policy requirements for different instances of SAP. Also we would like to keep database and archive log backups in a separate storage pool. Even if we plan to control the backup versions through Data Protection for mySAP (DB2), and keep database, archive log backups in a single storage pool, we recommend that you plan and create as many management classes as required, so that later changes require less effort. Our SAP instance is called PR1, so we will create one management class for the database, one for archive logs pertaining to the PR1 instance, and one default management class, as shown in Example 3-2. The management class names are pr1dbs, pr1log, and sapmc, respectively.

Example 3-2 Defining management class

```
tsm: UNLCETITUS>define mgmtclass sapdom sapps pr1dbs description="Mgmt Class - PR1
Database"
ANR1520I Management class PR1DBS defined in policy domain SAPDOM, set SAPPS.

tsm: UNLCETITUS>define mgmtclass sapdom sapps pr1log description="Mgmt Class - PR1
Log"
ANR1520I Management class PR1LOG defined in policy domain SAPDOM, set SAPPS.

tsm: UNLCETITUS>define mgmtclass sapdom sapps sapmc description="Mgmt Class
(Default)"
ANR1520I Management class SAPMC defined in policy domain SAPDOM, set SAPPS.
```

Configure the SAPMC management class as the default management class as shown in Example 3-3.

Example 3-3 Assigning default management class

```
tsm: UNLCETITUS>assign defmgmtclass sapdom sapps sapmc
ANR1538I Default management class set to SAPMC for policy domain SAPDOM, set
SAPPS.
```

We are using an existing storage pool called TDPACS to store both database and log backups. However, if we later decide to send data to a different storage pool, this can be easily done, because we have already created two management classes for that purpose. We have decided to control the backup versions through Data Protection for mySAP (DB2), so we define the copy group with a retention period of “NOLIMIT” as shown in Example 3-4. We set the archive copy group for each of the three management classes with *TDPACS* as the destination storage pool.

Data Protection for mySAP does not require backup copy groups, because only the archive copy group is used.

Note: Here we are discussing only the use of Data Protection for mySAP, with its own nodename, which will protect the SAP software environment components — the database and logs. However, you should do backup of other parts of your system, such as SAP executables and configuration files, using the regular Tivoli Storage Manager Backup-Archive client. This should be done under a separate node name and policy.

Example 3-4 Defining archive copy group

```
tsm: UNLCETITUS>define copy sapdom sapps pr1dbs destination=tdpacs retver=nolimit
t=a
ANR1535I Archive copy group STANDARD defined in policy domain SAPDOM, set SAPPS,
management class PR1DBS.

tsm: UNLCETITUS>define copy sapdom sapps pr1log destination=tdpacs retver=nolimit
t=a
ANR1535I Archive copy group STANDARD defined in policy domain SAPDOM, set SAPPS,
management class PR1LOG.

tsm: UNLCETITUS>define copy sapdom sapps sapmc destination=tdpacs t=a
ANR1535I Archive copy group STANDARD defined in policy domain SAPDOM, set SAPPS,
management class SAPMC.
```

With the above configuration, Tivoli Storage Manager will not expire backups on its own, until they are deleted by Data Protection for mySAP (DB2). If you prefer to control the backup policy using Tivoli Storage Manager, configure the RETVER option to a value (in days) according to your backup policy requirements. In that case, you must disable version control in Data Protection for mySAP by setting MAX_VERSIONS to 0 (zero) in its utility file /db2/<*SID*>/dbs/init<*SID*>.utl. See 2.7, “Expiration considerations” on page 44 for more information about options for version control of SAP software backups.

Note: If you create a separate default management class, you must define an archive copy group in it, even if no objects are bound to the management class. Otherwise, even though the policy set will get activated, Data Protection for mySAP (DB2) backups will fail.

Validate and activate the policy set as shown in Example 3-5. You can ignore the warning that there is no backup copy group, because Data Protection for mySAP only requires archive copy groups.

Example 3-5 Validating, activating policy set

```
tsm: UNLCETITUS>validate policy sapdom sapps
ANR1515I Policy set SAPPS validated in domain SAPDOM (ready for activation).
tsm: UNLCETITUS>activate policy sapdom sapps
ANR1553W DEFAULT Management class SAPMC in policy set SAPDOM SAPPS does not have a
BACKUP copygroup:  files will not be backed up by default if this set is
activated.
Do you wish to proceed? (Yes (Y)/No (N)) y
ANR1553W DEFAULT Management class SAPMC in policy set SAPDOM SAPPS does not have a
BACKUP copygroup:  files will not be backed up by default if this set is
activated.
ANR1514I Policy set SAPPS activated in policy domain SAPDOM.
```

Tivoli Storage Manager associates and keeps the backup and archive objects with a specific configured node name. We recommend that you use a separate node name for backups done through each of the Tivoli Data Protection modules. We will register a node *auntmathilda_sap* for Data Protection for mySAP (DB2) using our policy domain, sapdom, as in Example 3-6.

Example 3-6 Registering node

```
tsm: UNLCETITUS>register node auntmathilda_sap redbook contact="TSM administrator"
domain=sapdom compress=no
ANR2060I Node AUNTMATHILDA_SAP registered in policy domain SAPDOM.
ANR2099I Administrative userid AUNTMATHILDA_SAP defined for OWNER access to node
AUNTMATHILDA_SAP.
```

The value `redbook` in the above command is the node's password, which will be used during configuration of Data Protection for mySAP.

3.3 Tivoli Storage Manager client configuration

The client configuration is performed on both the production and backup servers.

Install the required Tivoli Storage Manager client filesets according to the documentation, on each of the servers. We have installed the filesets as shown in Example 3-7.

Example 3-7 Tivoli Storage Manager client filesets

```
tivoli.tsm.client.api.64bit 5.3.0.0
tivoli.tsm.client.ba.32bit.base 5.3.0.0
tivoli.tsm.client.ba.32bit.common 5.3.0.0
tivoli.tsm.client.ba.32bit.image 5.3.0.0
tivoli.tsm.client.ba.32bit.nas 5.3.0.0
tivoli.tsm.client.ba.32bit.web 5.3.0.0
```

The highlighted API fileset is the only one designated for the 64-bit environment. The other packages, although they say 32-bit, will work on the 64-bit platform as well. In our environment the SAP and DB2 are 64-bit, so will be using the 64-bit Tivoli Storage Manager API. We also require the base and common packages for normal Tivoli Storage Manager client backup operations. The image, nas, and web packages are optional.

We set the basic required settings in the Tivoli Storage Manager client system options file dsm.sys and user options file dsm.opt for the API as shown in Example 3-8 and Example 3-9. We specify `SERVERNAME uncletitus` in these files, which will be used during installation of Data Protection for mySAP (DB2).

Example 3-8 API client system options file - /usr/tivoli/tsm/client/api/bin64/dsm.sys

```
SErvername  uncletitus
   COMMMethod         TCPip
   TCPPort            1500
   TCPServeraddress   9.152.10.57
   Errorlogname       /tmp/dsierror.log
```

Example 3-9 API client user options file - /usr/tivoli/tsm/client/api/bin64/dsm.opt

```
SErvername  uncletitus
```

3.4 Data Protection for mySAP (DB2) installation and configuration

Now we will install and configure Data Protection for mySAP (DB2).

3.4.1 Code installation on the production server

Before starting the installation of Data Protection for mySAP on the production system, you should collect the following information, which will be required during the installation process:

- DB2 UDB database SID:

  In our case, the SID name is *PR1*.

- Directory for Data Protection for mySAP (DB2) configuration files:

  Create a directory dbs in /db2/<SID> for configuration files. This will be mounted later on the backup server using NFS (see “NFS export of configuration directory” on page 69). Our configuration directory is /db2/PR1/dbs.

- Tivoli Storage Manager server:

  The name must already exist in the API dsm.sys file.

  This is the tag name used against SERVERNAME option in dsm.sys file. We used the name *uncletitus* in dsm.sys, as defined in Example 3-8.

- Tivoli Storage Manager node name:

  Our Tivoli Storage Manager node name for keeping Data Protection for mySAP (DB2) backups is *auntmathilda_sap*, as defined in Example 3-6 on page 55.

- Management class for database backups:

  Our management class for keeping PR1 instance database objects is pr1dbs, as defined in Example 3-2 on page 53.

- Management classes for log file backups:

  Our management class for keeping PR1 instance log objects is pr1log, as defined in Example 3-2 on page 53.

- Network address of Administration Assistant Server (Optional):

  If you have an administration assistant server in your environment, then the IP address of that server can be mentioned here.

- Port for Administration Assistant Server (Optional):

  If you have an Administration Assistant server in your environment, then the port number at which it is listening can be mentioned here.

Note: Before starting installation, ensure that /tmp has at least 64 MB of free space, which is used as a temporary space for code extraction.

The software comes as a single executable and by default requires X Windows to launch the graphical installation screen. If you have an XWindows environment, launch the executable as shown in Example 3-10.

Example 3-10 Launching installation in graphics mode

```
root@auntmathilda:/ ./install_tdpr3_db2_aix51_64bit.bin
```

Note: If you download the code from the Web, its name will be similar to web_tdpr3_db2_aix51_64bit.bin.

We used ASCII mode for installation as shown in Example 3-11. Notice the prompts to enter the configuration information just collected.

Example 3-11 Launching installation in ASCII mode

```
root@auntmathilda:/sw-install ./install_tdpr3_db2_aix51_64bit.bin -console

          Initializing InstallShield Wizard........
          Verifying JVM.
          Searching JVM..
          Extracting Bundled JRE.......
          Installing Bundled JRE.......
          Extracting Installation Archive.......
          Launching InstallShield Wizard........
-------------------------------------------------------------------------------
Welcome to ...

IBM Tivoli Storage Manager for ERP
Data Protection for mySAP (DB2)

This will install Data Protection for mySAP (DB2 UDB) on your computer. Please
visit our webpage:

www.ibm.com/software/tivoli

You will be asked some questions during installation. Be prepared with the
following information:

  - DB2 UDB database SID
  - Path for Data Protection for mySAP (DB2) configuration files
  - Connection and login information to TSM Server
  - Connection information to Administration Assistant Server (optional)

Press 1 for Next, 3 to Cancel or 5 to Redisplay [1] 1

-------------------------------------------------------------------------------
IBM Licence Acceptance Panel

    International Program License Agreement

.... <license text deleted> ...
Press Enter to continue viewing the license agreement, or, Enter "1" to accept
the agreement, "2" to decline it or "99" to go back to the previous screen, "3"
 Print, "4" Read non-IBM terms.

1

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

Please enter the required information
```

```
   Enter DB2 UDB database SID (max. 6 characters) [] PR1

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

Please enter the required information

   Enter directory for Data Protection for mySAP (DB2) configuration files
   (only directories without blanks are valid) [/db2/PR1/tdp_r3] /db2/PR1/dbs

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

To connect to the TSM server with basic settings the installer updates the
configuration files with the provided parameters. If you don't want the
parameters updated answer the next question with NO.


 [X]  1  -  Yes (recommended for first time installation)
 [ ]  2  -  No (recommended for update installation)

   To select an item enter its number, or 0 when you are finished [0]: 0

   Enter TSM server. The name must already exist in dsm.sys. [] uncletitus

   Enter TSM node name [] auntmathilda_sap

   Enter management class for database backups [] pr1db1s

   Enter management class(es) for log file backups [] pr1log

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

To enable Data Protection for mySAP (DB2) to connect to the Administration
Assistant Server the following information is needed. If you don't specify a
server, the connection will be disabled.

   Enter network address of Administration Assistant Server []

   Enter port for Administration Assistant Server [5126]

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

--------------------------------------------------------------------------------
Data Protection for mySAP (DB2) will be installed in the following location:

/usr/tivoli/tsm/tdp_r3/db264

with the following features:
```

```
Base Components
Samples
Documentation

for a total size:

 135.5 MB

NOTE: The following file systems will be expanded during the installation:

Press ENTER to read the text [Type q to quit]

/usr

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] q1

Installing Data Protection for mySAP (DB2). Please wait...

|-----------|-----------|-----------|------------|
0%         25%         50%         75%        100%
||||||||||||||||||||||||||||||||||||||||||||||||||

Updating the inventory ...

Creating uninstaller...
An instance of this product is installed at: /usr/tivoli/tsm/tdp_r3/db264

---------------------------------------------------------------------------
The InstallShield Wizard has successfully installed Data Protection for mySAP
(DB2). Choose Next to continue the wizard.
An instance of this product is installed at: /usr/tivoli/tsm/tdp_r3/db264

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

---------------------------------------------------------------------------
Please read the information below.

Important

After the installation of Data Protection for mySAP (DB2) ended successfully
the following steps must be done in order to use Data Protection for mySAP
(DB2):

  - Set the TSM password in the configuration file (backom).

Press 3 to Finish or 5 to Redisplay [3] 3

root@auntmathilda:/sw-install
```

The code gets installed in /usr/tivoli/tsm/tdp_r3/db264 directory, if it is 64bit code.

3.4.2 Code installation on the backup server

Follow the same procedure and use the same values as on the production server except for the following parameter.

Directory for Data Protection for mySAP (DB2) configuration files

Specify a dummy directory, because we will be using the same configuration files created on production server using NFS mount. We used /tmp/r3install as a dummy directory.

3.4.3 Customizing the DB2 environment

In this section we explain how to customize the DB2 environment.

On the production server

Environment variables are required in the login profile of the DB2 administrative user. In our case, the user was db2pr1 using the korn shell (ksh), so we updated .profile as shown in Example 3-12. Substitute the name of your SID in XINT_PROFILE and TDP_DIR environment variables. If you are in a 32-bit environment, the shared library is called libtdpdb2.a in directory /usr/tivoli/tsm/tdp_r3/db2.

Example 3-12 Environment variable in .profile file

```
export XINT_PROFILE=/db2/PR1/dbs/initPR1.utl
export TDP_DIR=/db2/PR1/dbs/tdplog
export DB2_VENDOR_LIB=/usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
```

The DB2 registry must be updated with the details of the vendor environment file as shown in Example 3-13.

Example 3-13 Updating DB2 registry

```
db2pr1@:/db2/PR1 db2set DB2_VENDOR_INI=/db2/PR1/dbs/vendor.env
```

3.4.4 Updating the Data Protection for mySAP utility file

Here we explain how to update this utility file.

On the production server

The Data Protection for mySAP utility file /db2/<*SID*>/dbs/init<*SID*>.utl will be populated with the values provided during code installation. Most of them are related to the interface with Tivoli Storage Manager; however, you can check in case you have to customize other parameters. In our case we have decided to do backup version control through Data Protection for mySAP, so we updated the parameter as shown in Example 3-14 to keep two versions. The default value of MAX_VERSIONS is 0, which means versioning is disabled.

Example 3-14 Version control values in Data Protection for mySAP utility file /db2/PR1/dbs/initPR1.utl

```
MAX_VERSIONS            2
```

3.4.5 Password handling methods

You can choose to have the node password handled by Data Protection for mySAP (DB2) or by the Tivoli Storage Manager client API. Based on the method you choose, a slightly different configuration will be required. If you choose to manage with Data Protection for mySAP utility files, configuration is only required on the production system only. However, if you decide to manage through client API, the system options file must be updated on both the production and backup server.

- Password handled by Data Protection for mySAP (DB2):

  In this method, the password is stored in the Data Protection for mySAP (DB2) binary configuration file, /db2/<*SID*>/dbs/init<*SID*>.bki, which takes the configuration information from the utility file init<*SID*>.utl. These files are shared between the production and backup server, so only the copy on the production server has to be updated. If the password expires in Tivoli Storage Manager, you must update the new password in Tivoli Storage Manager and configure the same in Data Protection for mySAP (DB2). We show how to do this in 3.4.6, “Updating the node password in Data Protection for mySAP (DB2)” on page 62. Entries required in the utility file for this method are shown in Example 3-15.

Example 3-15 Data Protection for mySAP (DB2) utility file /db2/PR1/dbs/initPR1.utl

```
PASSWORDREQUIRED     YES
ADSMNODE             auntmathilda_sap
```

  No additional options are required in the Tivoli storage Manager client API system options file (dsm.sys).

- Password handled by Tivoli Storage Manager client API:

  In this method, the password is stored by the Tivoli Storage Manager API. If the password expires in the Tivoli Storage Manager server, the client API updates the password and stores the same. You do not have to change any thing in Data Protection for mySAP (DB2). Entries required in the Tivoli Storage Manager client API system options file are shown in Example 3-16. Make sure to update this file on both the production and backup server.

Example 3-16 TSM client API system options file - /usr/tivoli/tsm/client/api/bin64/dsm.sys

```
passwordaccess      generate
nodename            auntmathilda_sap
```

  Example 3-17 shows the entries required in the Data Protection for mySAP (DB2) utility file (/db2/<*SID*>/dbs/init<*SID*>.utl).

Example 3-17 Data Protection for mySAP (DB2) utility file - /db2/PR1/dbs/initPR1.utl

```
PASSWORDREQUIRED     NO
# ADSMNODE             auntmathilda_sap
```

  The ADSMNODE line should be commented using the # symbol.

Note: We do not recommend password handling through Tivoli Storage Manager API because there are two physical servers (production, backup) in the Data Protection for FlashCopy environment. When the password expires in the Tivoli Storage Manager server, whichever physical server accesses the Tivoli Storage Manager server first will reset the password to a new one and save it in its local file. When the other physical server accesses the Tivoli Storage Manager server, it will fail because it still has the old password stored.

3.4.6 Updating the node password in Data Protection for mySAP (DB2)

In this section we explain how to update the node password.

On the production system

Log in with the DB2 administrative user ID db2<*SID*> (db2pr1 in our case) and update the node password in Data Protection for mySAP (DB2) as shown in Example 3-18.

Example 3-18 Updating the node password in Data Protection for mySAP (DB2)

```
db2pr1@:/db2/PR1 /usr/tivoli/tsm/tdp_r3/db264/backom -c password

================================================================================
              Data Protection for mySAP(R) - Backup Object Manager

        - Version 5, Release 3, Modification 2 Level 2 for AIX LF 64-bit -
                  Build: 278R compiled on Mar  3 2006
        (c) Copyright IBM Corporation, 1996, 2006, All Rights Reserved.
================================================================================

BKI8540I: Using ProLE at localhost:tdpr3db264
BKI8558I: Setting TSM password for partition 'NODE0000' on host 'AUNTMATHILDA'.
BKI2017I: Blocksize is set to 131072 bytes
BKI0049I: Please enter password for node  on server UNCLETITUS: xxxxx
BKI0051I: Password successfully verified for node  on server UNCLETITUS.
BKI8512I: Return code is:
0
```

In our case, the password entered is *redbook* as we defined for our node AUNTMATHILDA_SAP in Example 3-6 on page 55.

3.4.7 Testing the backup from Data Protection for mySAP (DB2)

Here we discuss our testing procedure for the backup.

On the production server

At this stage, we can test backup to ensure proper integration between Data Protection for mySAP (DB2), DB2, Tivoli Storage Manager API client and Tivoli Storage Manager server. We performed a backup of a single tablespace as shown in Example 3-19. The backup is done while logged in as the DB2 administrator user ID **db2pr1** directly from the production server to the Tivoli Storage Manager server.

Example 3-19 Testing backup from Data Protection for mySAP (DB2)

```
db2pr1@:/db2/PR1 /usr/tivoli/tsm/tdp_r3/db264/backom -c b_db -a PR1 -T SYSCATSPACE

================================================================================
              Data Protection for mySAP(R) - Backup Object Manager

        - Version 5, Release 3, Modification 2 Level 2 for AIX LF 64-bit -
                  Build: 278R compiled on Mar  3 2006
        (c) Copyright IBM Corporation, 1996, 2006, All Rights Reserved.
================================================================================

BKI8638I: Full online backup of tablespace(s) 'SYSCATSPACE' of 'PR1' started ...
```

```
BKI8665I: The backup timestamp is: 20060715023540
BKI8631I: Backup command completed successfully.
```

3.5 CIM software installation and configuration

In this section we explain how to install various CIM related software, which will be used for FlashCopy backup.

3.5.1 OpenSSL software requirements

Here we describe the requirements for OpenSSL software.

On the production and backup servers

The CIM client requires OpenSSL for correct operation, even though Data Protection for FlashCopy supports only non-SSL mode. Check whether openssl is installed or not, as shown in Example 3-20.

Example 3-20 Checking installation of openssl

```
root@auntmathilda:/ rpm -qa | grep openssl
openssl-0.9.7d-2
```

Our output shows that the package is already installed; however, if no entries are returned, this means that openSSL is not installed. You can find the rpm file on the AIX Linux ToolBox CD or can be downloaded from the AIX Toolbox for Linux Applications Web site:

http://www.ibm.com/servers/aix/products/aixos/linux/download.html

You have to access the AIX TOOLbox Cryptographic Content section of this Web site to access the OpenSSL package.

OpenSSL can be installed as shown in Example 3-21.

Example 3-21 Installing openssl

```
root@auntmathilda:/ rpm -ivh openssl-0.9.7d-2.rpm
```

The actual rpm name can vary depending on the version downloaded.

3.5.2 CIM (Pegasus) software installation

Here we describe the installation of the Pegasus CIM package on the servers.

On the production and backup servers

Pegasus CIM software has both a server and a client part. However, Data Protection for FlashCopy uses only the CIM client libraries to interface with the CIM agent for the respective storage system. The client libraries are referred to as the CIM client in the Data Protection for FlashCopy environment. The Pegasus package must be installed in each server where Data Protection for FlashCopy is going to be installed. The CIM client requires the libssl.a library, which is part of the OpenSSL package. However, SSL should be disabled for Data Protection for FlashCopy environment. We show this in the next section.

Pegasus software is available as part of the AIX Expansion pack with AIX 5.2 and 5.3. The required filesets are as follows:

- sysmgt.pegasus.cimserver.rte

  Pegasus CIM Server Runtime fileset. It installs in the /opt/freeware/cimom/pegasus directory. It includes both the client and server components. However, we do not actually use the server component.

- sysmgt.pegasus.osbaseproviders

  Base Providers for AIX OS fileset. It installs in the /usr/pegasus/provider directory.

The software is in installp format and can be installed using SMIT. No configuration is required on the CIM client.

3.5.3 DS Open API CIM agent installation and configuration

Next we discuss the installation of the CIM agent.

Installing the CIM agent

The DS Open API CIM agent installation is required only if an IBM ESS, DS8000, or DS6000 storage system is used. If the SAN Volume Controller (SVC) is used, the CIM agent is part of the SVC Master Console, so it does not have to be installed separately. The CIM agent can be installed on any server accessible by the production server, backup server, and the storage system. The CIM agent is a Java™ based application so we recommend not to run it on the production server because of the workload overhead. In many environments, the CIM agent will already be installed somewhere. If this is the case, you do not have to install it again, you can simply use the existing CIM agent. If the CIM agent is not already installed on an accessible system in your environment, you can install it on the backup server.

The CD image for the DS Open API CIM Agent, as well as updates and other information, can be obtained at the following URL:

http://www.ibm.com/servers/storage/support/software/cimdsoapi/installing.html

For ESS users: If your storage system is ESS, you must also install the *esscli* (Command-line interface for ESS) before installing the DS Open API CIM agent.

The default CIM agent installation is graphical, so it requires XWindows.

To avoid using XWindows, we used a silent installation with a response file. A sample response file called *responsefile* is available on the installation media. This can be copied to disk, modified and used during installation. Our response file is listed in Example 3-22. Note that we select a communication method of HTTP, not HTTPS, so that SSL is not used.

Example 3-22 Silent installation response file

```
root@uncletitus:/ cat /tmp/responsefile
-silent
-W cimObjectManagerPorts.port="5988"
-W cimObjectManagerPorts.serverCommunication="HTTP"
```

Note: Only HTTP is supported by Data Protection for FlashCopy.

The installation can be started in silent mode as shown in Example 3-23.

Example 3-23 DS Open API CIM agent installation in silent mode

```
root@uncletitus:/tmp/AIX ./setupaix -options /tmp/responsefile
InstallShield Wizard

Initializing InstallShield Wizard...

Preparing Java(tm) Virtual Machine...
.................................
............root@uncletitus:/tmp/AIX
```

The CIM agent installs in the /opt/IBM/cimagent directory. The installation process creates entries in /etc/inittab to start the Service Location Protocol (SLP) and CIM agent daemon (CIMOM) as shown in Example 3-24.

Example 3-24 Checking entries in /etc/inittab

```
root@uncletitus:/ cat /etc/inittab | egrep "slpd|cimom"
slpd:2:wait:/etc/rc.slpd > /dev/console 2>&1 # Autostart Service Location Protocol
Daemon
cimom:2:wait:/etc/rc.cimom > /dev/console 2>&1 # Autostart CIMOM Daemon
```

After installation, the SLP and CIMOM daemons are started automatically. However, we have to modify the CIMOM properties file (cimom.properties) as shown in Example 3-25.

Example 3-25 Changes required in /opt/IBM/cimagent/cimom.properties file

```
DigestAuthentication=false
```

The default value for the DigestAuthentication option is true, we have to change it to false. To make this change take effect, restart CIMOM as shown in Example 3-26.

Example 3-26 Starting / stopping CIM agent (CIMOM)

```
root@uncletitus:/opt/IBM/cimagent ./stopcimom

The IBM CIM Object Manager server is stopping...
The IBM CIM Object Manager server successfully stopped.
root@uncletitus:/opt/IBM/cimagent
root@uncletitus:/opt/IBM/cimagent ./startcimom

The IBM CIM Object Manager server is starting.
The IBM CIM Object Manager server successfully started.
Please see the log file /opt/IBM/cimagent/cimom.log
root@uncletitus:/opt/IBM/cimagent
```

Changing the CIM agent user password

The CIM agent comes with default user ID `superuser` with password set to “passw0rd”. If you want to change the password for the ID `superuser`, then you must first create another user and change the password through the newly created user ID as shown in Example 3-27.

Example 3-27 Changing CIM agent’s superuser password

```
root@uncletitus:/opt/IBM/cimagent ./setuser -u superuser -p passw0rd
Application setuser started in interactive mode
To terminate the application enter: exit
To get a help message enter: help
```

```
>>> adduser cimuser <password>
An account for user cimuser successfully created.
>>> exit

root@uncletitus:/opt/IBM/cimagent ./setuser -u cimuser -p <password>
Application setuser started in interactive mode
To terminate the application enter: exit
To get a help message enter: help
>>> chuser superuser <new password>
The password for user superuser successfully changed.
>>> exit
root@uncletitus:/opt/IBM/cimagent
```

The ID superuser will be used when configuring Data Protection for FlashCopy.

Configuring storage devices within the CIM agent

Storage devices like DS8000 or DS6000 used for doing FlashCopy must to be defined within the CIM agent as shown in Example 3-28. Specify the TCP/IP address of the DS[8/6]000, the DS[8/6]000 user and its password in the **addess** and **addessserver** commands.

Example 3-28 Defining storage devices in CIM agent

```
root@uncletitus:/opt/IBM/cimagent ./setdevice -u superuser -p <password>
Application setdevice started in interactive mode
To terminate the application enter: exit
To get a help message enter: help
>>>
>>> addess 172.31.1.41 tsmuser <password>
An ess provider entry for IP 172.31.1.41 successfully added
>>> addessserver 172.31.1.41 tsmuser <password>
An essserver entry for IP 172.31.1.41 successfully added
>>> exit
root@uncletitus:/opt/IBM/cimagent
```

Verifying the CIM agent configuration

Verify the CIM agent configuration with the **verifyconfig** command (Example 3-29).

Example 3-29 Verifying CIM agent configuration

```
root@uncletitus:/opt/IBM/cimagent ./verifyconfig -u superuser -p redbook
Tue Jul 18 22:10:29 GMT-06:00 2006
Verifying configuration of CIM agent for the IBM TotalStorage DS Open Application
Programming Interface...
Communicating with SLP to find WBEM services...
3 WBEM services found
   host=172.31.1.108, port=5988
   host=172.31.1.215, port=5988
   host=197.165.4.131, port=5988
Connecting to CIM agent, host=172.31.1.108, port=5988
Found 1 IBMTSESS_StorageSystem instances:
2107.7592481
Internal Server at 172.31.1.41 configured for 2107.92481
Verification Successful
root@uncletitus:/opt/IBM/cimagent
```

3.6 Data Protection for FlashCopy installation and configuration

Now we will install the Data Protection for FlashCopy code, then configure it.

3.6.1 Data Protection for FlashCopy code installation

In this section we describe the code installation process.

On production and backup server

The Data Protection for FlashCopy installation package is delivered as a single executable and by default requires XWindows for launching graphical installation. The executable name is install_tdphdwr3_db2.bin.

The installation must be done as root user. We used ASCII mode to do the installation as shown in Example 3-30.

Example 3-30 Data Protection for FlashCopy installation

```
root@auntmathilda:/sw-install/tdp/acs ./install_tdphdwr3_db2.bin -console

          Initializing InstallShield Wizard........
          Verifying JVM.
          Searching JVM..
          Extracting Bundled JRE.......
          Installing Bundled JRE.......
          Verifying JVM.......
          Extracting Installation Archive.......
          Launching InstallShield Wizard........

-------------------------------------------------------------------------------
Welcome to ...

IBM Tivoli Storage Manager for Hardware
Data Protection for DS and SVC for mySAP

This will install Data Protection for DS and SVC for mySAP on your computer.
 Version 5.3.1.2.
 Please visit our webpage:

 http://www.ibm.com/software/tivoli

Press 1 for Next, 3 to Cancel or 5 to Redisplay [1] 1

-------------------------------------------------------------------------------
IBM Licence Acceptance Panel

     International Program License Agreement

     ...<license text deleted>...
Press Enter to continue viewing the license agreement, or, Enter "1" to accept
the agreement, "2" to decline it or "99" to go back to the previous screen, "3"
 Print, "4" Read non-IBM terms.

1
```

```
Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

---------------------------------------------------------------------------
Data Protection for DS and SVC for mySAP will be installed in the following
location:

/usr/tivoli/tsm/tdpessr3/db2

with the following features:

DB2_AIX

for a total size:

 67.6 MB

NOTE: The following file systems will be expanded during the installation:

/usr

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

Expanding /usr ...

|-----------|-----------|-----------|-----------|
0%         25%         50%         75%        100%
||||||||||||||||||||||||||||||||||||||||||||||||||

Installing Data Protection for DS and SVC for mySAP. Please wait...

Updating the inventory ...

Creating uninstaller...

---------------------------------------------------------------------------
Please read the information below.

ATTENTION!
You have to execute the script ./setup.sh once for each user who will run Data
Protection for DS and SVC for mySAP.
You will find the script setup.sh in the installation directory
/usr/tivoli/tsm/tdpessr3/db2.

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

---------------------------------------------------------------------------
The InstallShield Wizard has successfully installed Data Protection for DS and
SVC for mySAP. Choose Finish to exit the wizard.

Press 3 to Finish or 5 to Redisplay [3] 3

root@auntmathilda:/sw-install/tdp/acs
```

The code gets installed in the directory /usr/tivoli/tsm/tdpessr3/db2.

3.6.2 Other prerequisites on the production server

In this section we describe various other requirements for the production server.

Environment file settings

Ensure that the /etc/environment file has ENV entry for the korn shell (ksh) (Example 3-31).

Example 3-31 Required setting in /etc/environment file

```
ENV=$HOME/.profile
```

Requirements of rsh and rexec

The rshd and rexecd daemons must be enabled on the production server. The inetd configuration file /etc/inetd.conf should have entries as shown in Example 3-32.

Example 3-32 Required entries in /etc/inetd.conf

```
shell   stream  tcp6    nowait  root    /usr/sbin/rshd        rshd
exec    stream  tcp6    nowait  root    /usr/sbin/rexecd      rexecd
```

If you have made changes to /etc/inetd.conf, refresh the inetd daemon as shown in Example 3-33.

Example 3-33 Refreshing inetd daemon

```
root@auntmathilda:/ refresh -s inetd
0513-095 The request for subsystem refresh was completed successfully.
```

Requirements of .rhosts file

Ensure that the .rhosts file is created in the home directory of the DB2 user ID (db2pr1 in our configuration) to enable the **rsh** command to work from the backup server to the production server. Our .rhosts file is shown in Example 3-34.

Example 3-34 Entries in /db2/PR1/.rhosts file

```
uncletitus db2pr1
uncletitus root
```

NFS export of configuration directory

We are using a common directory to keep all Data Protection for mySAP (DB2), Data Protection for FlashCopy configuration files, work directory, and log files so that the information is consistent across both the production and backup servers. For this reason, the configuration directory will be exported on the production server and NFS mounted on the backup server. Create an NFS export for /db2/PR1/dbs directory as shown in Example 3-35.

Example 3-35 NFS exporting /db2/PR1/dbs directory using smitty

```
root@auntmathilda:/ smitty mknfsexp

Add a Directory to Exports List

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

[TOP]                                                  [Entry Fields]
```

```
* Pathname of directory to export                    [/db2/PR1/dbs] /
  Anonymous UID                                      [-2]
  Public filesystem?                                  no +
* Export directory now, system restart or both       both +
  Pathname of alternate exports file                 []
  Allow access by NFS versions                       [] +
  External name of directory (NFS V4 access only)    []
  Referral locations (NFS V4 access only)            []
  Replica locations                                  []
  Ensure primary hostname in replica list             yes +
  Allow delegations?                                  no +
* Security method [sys,krb5p,krb5i,krb5,dh,none] +
*     Mode to export directory                        read-write +
      Hostname list. If exported read-mostly         []
      Hosts & netgroups allowed client access        []
      Hosts allowed root access                      [uncletitus]
  Security method                                    [] +
      Mode to export directory                       [] +
      Hostname list. If exported read-mostly         []
      Hosts & netgroups allowed client access        []
      Hosts allowed root access                      []
  Security method                                    [] +
      Mode to export directory                       [] +
      Hostname list. If exported read-mostly         []
      Hosts & netgroups allowed client access        []
      Hosts allowed root access                      []
  Security method                                    [] +
      Mode to export directory                       [] +
      Hostname list. If exported read-mostly         []
      Hosts & netgroups allowed client access        []
      Hosts allowed root access                      []
[MORE...5]

F1=Help                  F2=Refresh               F3=Cancel
F4=List
F5=Reset                 F6=Command               F7=Edit
F8=Image
F9=Shell                       F10=Exit                   Enter=Do
```

Environment variables required for DB2 administrative user

The profile of the DB2 administrative user db2pr1 must be updated with variables as shown in Example 3-36.

Example 3-36 Required environment variables in /db2/PR1/.profile

```
export DSMI_DIR=/usr/tivoli/tsm/client/api/bin64
export DSMI_CONFIG=/db2/PR1/sqllib/adsm/dsm.opt
export DSMI_LOG=/db2/PR1/errors

export DSM_DIR=/usr/tivoli/tsm/client/ba/bin
export DSM_CONFIG=/db2/PR1/sqllib/adsm/dsm.opt
export DSM_LOG=/db2/PR1/errors

export PATH=$PATH:.:
```

Note: The **tdphdwdb2** command requires that the PATH environment variable includes the /usr/sbin directory, which is usually set by default. However, you should check that the default has not been over-ridden. This is required for db2<SID> user (for example) db2pr1. Also, the current directory should be part of the PATH environment variable.

Information: Data Protection for FlashCopy also requires environment variables such as INSTHOME, DB2DBDFT, and DB2INSTANCE. However, these are normally set during SAP software installation and will be available.

The ulimit requirements

The ulimits of the db2<sid> user and root should be at least as follows:

```
data seg size (kbytes)=unlimited
max memory size (kbytes)=131000
stack size (kbytes)=131000
```

The current values can be checked using the **ulimit -a** command. If they are less than the required value, set them using the root user as shown in Example 3-37. The **chuser** command takes input value in 512 bytes. However, the **ulimit** command output is in kbytes.

Example 3-37 Setting ulimit

```
root@auntmathilda:/ chuser data=-1 root
root@auntmathilda:/ chuser stack=262000 root
root@auntmathilda:/ chuser rss=262000 root
root@auntmathilda:/ chuser data=-1 db2pr1
root@auntmathilda:/ chuser stack=262000 db2pr1
root@auntmathilda:/ chuser rss=262000 db2pr1
```

Tivoli Storage Manager client options file configuration

The script setupDB2BS (which will be executed later from the backup server) expects the Tivoli Storage Manager client options file to be available in the */*db2/*<SID>*/sqllib/adsm directory. We created a link to the actual option file as shown in Example 3-38.

Example 3-38 Create link to API client options file

```
root@auntmathilda:/ cd /db2/PR1/sqllib/adsm
root@auntmathilda:/db2/PR1/sqllib/adsm ln -sf \
> /usr/tivoli/tsm/client/api/bin64/dsm.opt dsm.opt
```

Note: All DB2 tablespaces must be database-managed tablespaces (DMS). All user/system temporary tablespaces such as PSAPTEMP can be system- managed tablespaces. This can be checked using command “db2 list tablespaces” as user db2pr1.

3.6.3 Customizing and initializing Data Protection for FlashCopy on production server

In this section we discuss how to customize and initialize this application.

Executing the setup.sh script

After the Data Protection for FlashCopy code installation, execute the *setup.sh* script, which copies the configuration files to the correct location and name, and creates links to the Data Protection for FlashCopy executables. Run the script as root user as shown in Example 3-39.

Example 3-39 Executing Data Protection for FlashCopy setup.sh script

```
root@auntmathilda:/ cd /usr/tivoli/tsm/tdpessr3/db2
root@auntmathilda:/usr/tivoli/tsm/tdpessr3/db2 ./setup.sh
Please enter the SID for the Production SAP System: [C21] PR1
 DB2 UDB V8 found on this machine
 checking DB2 Instance...OK

 DB2 instance db2pr1 is a DB2 V8 instance

 checking DB2 Instance Bit-Width...OK

 DB2 instance db2pr1 is a 64 bit instance

 checking DB2 Instance Type...OK

 DB2 instance db2pr1 is a EEE instance

 reading db2nodes.cfg...OK
   single EEE partition
   number of Servers      : 1
   list of Servers        : auntmathilda
   max # Nodes per Server : 1

Is auntmathilda your [P]roduction or [B]ackup server ? [P/B] P
 check/create directory /db2/PR1/dbs/auntmathilda ...
 creating directory /db2/PR1/dbs/auntmathilda...

 group dba exists with GID 302...
 user db2pr1 exists in group dba...
Directory /usr/tivoli/tsm/tdpessr3/db2/5.3.1.2 will be created

 checking DP for FC for mySAP socket server...

Setup successful.
root@auntmathilda:/usr/tivoli/tsm/tdpessr3/db2
```

Customizing Data Protection for FlashCopy profile

The Data Protection for FlashCopy profile */*db2/<*SID*>/dbs/<*productionserver*>/init<*SID*>.fcs has to be updated with values (values updated by us are highlighted) as shown in Example 3-40.

Values for PRIMARY_COPYSERVICES_SERVERNAME, COPYSERVICES_SERVERPORT, and COPYSERVICES_USERNAME should correspond to the CIM agent — either as installed or available in 3.5.3, “DS Open API CIM agent installation and configuration” for an ESS, DS6000, or DS8000, installation, or from the Master Console, if using a SAN Volume Controller. In all cases, make sure to use the http port, not the secure https port.

Example 3-40 Data Protection for FlashCopy profile /db2/PR1/dbs/auntmathilda/initPR1.fcs

```
>>> global
LOGON_HOST_PROD         auntmathilda db2pr1
LOGON_HOST_BACK         uncletitus
BACKUP_MAX              30
IDS_CONTROL_FILE        /db2/PR1/dbs/auntmathilda/save/idssave
CONFIG_FILE             /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                /db2/PR1/dbs/auntmathilda/work
TRACE                   YES
LOG_TRACE_DIR           /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE       /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT NO
COPYSERVICES_HARDWARE_TYPE     DS8000
<<< global
DB2_REMOTE_DBALIAS         R_PR1
DB2_RECOVERY_LOG           /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB              /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM            1
DB2_NUM_BUFFERS            2
DB2_BUFFER_SIZE            1024
<<< db2
>>> copyservices_data
PRIMARY_COPYSERVICES_SERVERNAME   9.152.10.57
COPYSERVICES_SERVERPORT    5988
COPYSERVICES_USERNAME      superuser
FLASHCOPY_TYPE             INCR
VOLUMES_FILE               /db2/PR1/dbs/auntmathilda/initPR1.fct
<<< copyservices_data
```

Customizing Data Protection for FlashCopy target volume file

The Data Protection for FlashCopy target volume file (/db2/*<SID>*/dbs/<production host>/init*<SID>*.fct) should be updated with details of the target LUNs that will be used to do FlashCopy. The target LUNs should match the number and size of the production LUNs. In our environment we had 9 LUNs of 10.2 GB on the production server for the database, so we updated the target volume file with 9 target LUNs of 10.2 GB size as shown in Example 3-41.

Example 3-41 Data Protection for FlashCopy target volume file /db2/PR1/dbs/auntmathilda/initPR1.fct

```
>>> volumes_set_1
TARGET_VOLUME 75924811291 - -
TARGET_VOLUME 75924811292 - -
TARGET_VOLUME 75924811293 - -
TARGET_VOLUME 75924811296 - -
TARGET_VOLUME 75924811299 - -
TARGET_VOLUME 7592481138D - -
TARGET_VOLUME 7592481138E - -
TARGET_VOLUME 7592481138F - -
TARGET_VOLUME 75924811390 - -
<<< volumes_set_1
```

In the TARGET_VOLUME lines, the highlighted number is the serial number of the target volume, the next two fields are for the serial number and size of the source volume. These two fields do not have to be specified, because they will be automatically populated when the **splitint** program runs for the first time to make the association between the target and source volumes.

A DS8000 volume serial number looks like xxxxxxxyyyy, in which xxxxxxx represents the 7 digit serial number of the DS8000, and yyyy represents the 4-digit LUN ID.

An ESS volume serial number looks like yyyxxxxx, in which xxxxx represents the last 5 digit serial number of the ESS and yyy represents the 3-digit LUN ID.

We used only one target set. If you require additional target sets, create an additional volumes_set_x stanzas (x should be replaced with the next numeric value, so the second target set stanza will be volumes_set_2), each with information about the same number of LUNs of the same size as the production database source LUNs.

Initializing Data Protection for FlashCopy

While initializing Data Protection for FlashCopy, the following information will be requested:

- TCP/IP service port for the socket server:

  This is the port on which the Data Protection for FlashCopy socket server will listen. Just press Enter to select the default port.

- Password for the user db2<*SID*>:

  This is the password of the DB2 instance owner ID — in our case, the password of user db2pr1.

- Password for the user superuser on the DS:

  This is the password of “superuser” user configured on the CIM agent.

Apart from requesting the above information and storing it in the file referred to by the CONFIG_FILE entry of the Data Protection for FlashCopy profile, the system also adds entries in /etc/services and /etc/inittab to automatically start the Data Protection for FlashCopy socket server.

We initialize Data Protection for FlashCopy using the **db2pr1** user ID (Example 3-42).

Example 3-42 Initializing Data Protection for FlashCopy

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs ./tdphdwdb2 -p ./auntmathilda/initPR1.fcs -f configure
IDS2310W The free space in the file system containing the directory / is only
17.59 MB (55 percent).

                IBM Tivoli Storage Manager for Hardware
            Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                              (TDPHDWDB2)

            FlashCopy Backup utility for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
              Build: 304 generated at 14:32:19 on Mar 14 2006
       (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'COPY'.
Profile                         ./auntmathilda/initPR1.fcs
Log file                        splitint_?_20060717215334.log
Trace file                      splitint_?_20060717215334.trace
Function                        configure
Log file                        tdphdwdb2_?_20060717215334.log
Trace file                      tdphdwdb2_?_20060717215334.trace

  -- Parameters of tdphdwdb2 profile --
```

```
LOGON_HOST_PROD                 auntmathilda    db2pr1
LOGON_HOST_BACK                 uncletitus
BACKUP_MAX                      30
IDS_CONTROL_FILE                /db2/PR1/dbs/auntmathilda/save/idssave
CONFIG_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                        /db2/PR1/dbs/auntmathilda/work
TRACE                           YES
LOG_TRACE_DIR                   /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE               /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
DB2_REMOTE_DBALIAS              R_PR1
DB2_RECOVERY_LOG                /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB                   /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM                 1
DB2_NUM_BUFFERS                 2
DB2_BUFFER_SIZE                 1024
PRIMARY_COPYSERVICES_SERVERNAME 9.152.10.57
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  COPY
VOLUMES_FILE                    /db2/PR1/dbs/auntmathilda/initPR1.fct
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2105I Start of tdphdwdb2 program at: 07/17/06-21:53:34 .
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Enter the TCPIP service port for the socket server []:
Function                        password
IDS2051I: Enter the password for the user 'db2pr1'      :
IDS2052I: Enter the password for the user 'db2pr1' again:
IDS2051I: Enter the password for the user 'superuser on the DS'      :
IDS2052I: Enter the password for the user 'superuser on the DS' again:
IDS2306I Issuing command 'rah "<>/db2/PR1/dbs/tdphdwdb2 -f configure -t EEE -P
57330 -p /db2/PR1/dbs/<>/initPR1.fcs -T 20060717215334"
echo hdwIntRC: $? ' ...
rah: omitting myself, auntmathilda
hdwIntRC: 0
IDS2306I Issuing command 'grep idscntlPR1 /etc/services | grep -w 57330
echo hdwIntRC: $? ' ...
hdwIntRC: 1
IDS2306I Issuing command 'grep -w 57330 /etc/services
echo hdwIntRC: $? ' ...
hdwIntRC: 1
IDS2306I Issuing command 'chservices -a -v idscntlPR1 -p tcp -n 57330
echo hdwIntRC: $? ' ...
hdwIntRC: 0
```

```
IDS2306I Issuing command 'mkitab "sockPR1:2:respawn:su - db2pr1 -c 'cd
/db2/PR1/dbs ; /db2/PR1/dbs/tdphdwdb2 -f initsocket -p ./auntmathilda/initPR1.fcs
'>/dev/null 2>&1"' ...
IDS2306I Issuing command 'grep idscntlPR1_0 /etc/services | grep -w 57331
echo hdwIntRC: $? ' ...
hdwIntRC: 1
IDS2306I Issuing command 'grep -w 57331 /etc/services
echo hdwIntRC: $? ' ...
hdwIntRC: 1
IDS2306I Issuing command 'chservices -a -v idscntlPR1_0 -p tcp -n 57331
echo hdwIntRC: $? ' ...
hdwIntRC: 0
IDS2306I Issuing command 'mkitab "sockPR1_0:2:respawn:su - db2pr1 -c 'cd
/db2/PR1/dbs ; /db2/PR1/dbs/tdphdwdb2 -f initsocket -p ./auntmathilda/initPR1.fcs
-s 0 '>/dev/null 2>&1"' ...
IDS2106I Exiting with return code 0.
db2pr1@:/db2/PR1/dbs
```

Testing backup from the production server

At this stage we can do an ordinary online or offline backup through Data Protection for FlashCopy. FlashCopy backup cannot be tested at this stage. The Data Protection for FlashCopy online backup can be initiated as shown in Example 3-43 using the db2pr1 user ID. Again, the backup is initiated from the production server to the Tivoli Storage Manager server.

Example 3-43 Testing Data Protection for FlashCopy backup from production server

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs ./tdphdwdb2 -p ./auntmathilda/initPR1.fcs -f backup -t online
IDS2310W The free space in the file system containing the directory / is only
17.59 MB (55 percent).

               IBM Tivoli Storage Manager for Hardware
            Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                              (TDPHDWDB2)

           FlashCopy Backup utility for IBM Tivoli Storage Manager
         - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
              Build: 304 generated at 14:32:19 on Mar 14 2006
       (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'COPY'.
Profile                         ./auntmathilda/initPR1.fcs
Log file                        splitint_?_20060718035820.log
Trace file                      splitint_?_20060718035820.trace
Function                        backup
Log file                        tdphdwdb2_?_20060718035820.log
Trace file                      tdphdwdb2_?_20060718035820.trace

  -- Parameters of tdphdwdb2 profile --

LOGON_HOST_PROD                 auntmathilda    db2pr1
LOGON_HOST_BACK                 uncletitus
BACKUP_MAX                      30
IDS_CONTROL_FILE                /db2/PR1/dbs/auntmathilda/save/idssave
```

```
CONFIG_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                        /db2/PR1/dbs/auntmathilda/work
TRACE                           YES
LOG_TRACE_DIR                   /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE               /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
DB2_REMOTE_DBALIAS              R_PR1
DB2_RECOVERY_LOG                /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB                   /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM                 1
DB2_NUM_BUFFERS                 2
DB2_BUFFER_SIZE                 1024
PRIMARY_COPYSERVICES_SERVERNAME 9.152.10.57
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  COPY
VOLUMES_FILE                    /db2/PR1/dbs/auntmathilda/initPR1.fct
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2105I Start of tdphdwdb2 program at: 07/18/06-03:58:20 .
Backup type                     online

Start the database manager db2pr1 ...
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Checking system database directory
Checking local database directory /db2/PR1
IDS1602I Waiting for SyncPoint 1 on all EEE nodes...
...
IDS1035I The IDS control file exists and a new backup cycle entry has been
created.

Get first active logfile for database PR1 NODE0000 ...
set client connection to Node 0

First active logfile for DB PR1 is: S0000015.LOG
IDS1602I Waiting for SyncPoint 2 on all EEE nodes...
...
IDS2307I Issuing DB2 command 'db2 backup db PR1 online load
/usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a OPEN 001 SESSIONS WITH 002 BUFFERS
BUFFER 01024 PARALLELISM 001
echo hdwIntRC: $?' ...

Backup successful. The timestamp for this backup image is : 20060718035839

hdwIntRC: 0
IDS2101I New assigned Backup Sequence Number    00002
set client to node 0
set client connection to Node 0
```

```
IDS0099I message_id = REQ_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS1602I Waiting for SyncPoint 3 on all EEE nodes...
...
IDS1602I Waiting for SyncPoint 4 on all EEE nodes...
...
BID                             20060718035839
UTL                             /db2/PR1/dbs/initPR1.utl
INF                             :0000:20060718035839
EBT                             -
EBB                             FULL_ONLINE
EBC                             :0000:/db2/PR1/log_dir/NODE0000/
EBR                             :0000:S0000015.LOG
IDS2033I Information from Data Protection for mySAP has been found with BACKUPID
20060718035839.
IDS1602I Waiting for SyncPoint 5 on all EEE nodes...
...
waiting for socket server to stop...
IDS2124I Exiting with return code 0.
```

The return code 0 indicates that the backup was successful.

3.6.4 Other prerequisites on backup server

Here we list some other prerequisites for the backup server.

File system for DB2 instance

We have to create a file system called /db2/*<SID>* of size 128 MB, which will be used for creating the DB2 instance home directory.

Checking required free user ID and group ID

Ensure the user ID (UID), group ID (GID) used by user db2pr1, group dbpr1adm, dba in production system are free in the backup server. These user and groups will be created by the **setupDB2BS.sh** script in backup server with the same UID, GID as on the production server.

Note: The **tdphdwdb2** command requires that the PATH environment variable includes the /usr/sbin directory which is an usually set by default. However, you should check this has not been over-ridden.

3.6.5 Customizing Data Protection for FlashCopy on the backup server

In this section we explain how to customize this feature on the backup server.

Executing setupDB2BS script

The setupDB2BS.sh script creates user, groups, mounts the NFS file system, catalogs the DB2 node and database, creates local directories, and copies various profiles. Execute the setupDB2BS.sh script as root as shown in Example 3-44.

Example 3-44 Executing script /usr/tivoli/tsm/tdpessr3/db2/setupDB2BS

```
root@uncletitus:/usr/tivoli/tsm/tdpessr3/db2 ./setupDB2BS PR1 auntmathilda
 checking rsh connection to auntmathilda...OK
 checking 'rsh' command output on auntmathilda...OK
 checking hostname on auntmathilda...OK
 hostname on auntmathilda = auntmathilda
 checking ENV-setting in /etc/environment on auntmathilda...OK
 DB2 UDB V8 found on the backup system
OK

 DB2 instance db2pr1 is a DB2 V8 instance

 checking DB2 Instance Bit-Width on auntmathilda... checking DB2 Instance Type on
auntmathilda...OK

 DB2 instance db2pr1 is a EEE instance

 reading db2nodes.cfg on auntmathilda...OK
   single EEE partition
   number of Servers     :  1
   list of Servers       :  auntmathilda
   max # Nodes per Server :  1
   list of Nodes         :  0
 checking sapdb2PR1 TCPIP service port on auntmathilda...OK
 creating TCPIP service port sapdb2PR1 5921/tcp...
   TCPIP service port ->sapdb2PR1      5921/tcp<- already exists
 checking DB2_db2pr1 TCPIP service port on auntmathilda...OK
 creating TCPIP service port DB2_db2pr1 60004/tcp...
   TCPIP service port ->DB2_db2pr1       60004/tcp<- already exists
 creating TCPIP service port DB2_db2pr1_END 60005/tcp...
   TCPIP service port ->DB2_db2pr1_END       60005/tcp<- already exists
 checking prole setup on auntmathilda...OK
 checking DP for FC socket server configuration for EEE instance:
 checking idscntlPR1 TCPIP service port on auntmathilda...OK
 creating TCPIP service port idscntlPR1 57330/tcp...
   TCPIP service port ->idscntlPR1       57330/tcp<- already exists
 checking sockPR1 setup on auntmathilda...OK
checking DP for FC socket server configuration for EEE node: 0
 checking idscntlPR1_0 TCPIP service port on auntmathilda...OK
 creating TCPIP service port idscntlPR1_0 57331/tcp...
   TCPIP service port ->idscntlPR1_0       57331/tcp<- already exists
 checking sockPR1_0 setup on auntmathilda...OK
 checking NFS Export /db2/PR1/dbs on auntmathilda...OK
 checking Filesystem /db2/PR1...OK
 checking Filesystem /db2/db2pr1...OK
 creating directories...
   /db2 exists/created
   /db2/db2pr1 exists/created
   /db2/PR1 exists/created
   /db2/PR1/db2pr1 exists/created
   /db2/PR1/sapdata1 exists/created
   /db2/PR1/sapdata2 exists/created
   /db2/PR1/sapdata3 exists/created
   /db2/PR1/sapdata4 exists/created
   /db2/PR1/sapdata5 exists/created
```

```
   /db2/PR1/sapdata6 exists/created
   /db2/PR1/log_dir/ exists/created
   /db2/PR1/log_archive exists/created
   /db2/PR1/log_retrieve exists/created
   /db2/PR1/db2dump exists/created
   /db2/PR1/errors exists/created
   /db2/PR1/dbs exists/created
 creating group dbpr1adm...
   group dbpr1adm exists with GID 701
 creating user db2pr1...
   user db2pr1 exists with UID 721
 changing login shell for user db2pr1 to /usr/bin/ksh...
 checking 'su' command output...OK
 creating group dba...
   group dba exists with GID 302
 adding user db2pr1 to group dba...
   user db2pr1 added successful to group dba
 changing owner for directories /db2/PR1...
   chown db2pr1.dbpr1adm for /db2/PR1 successful
 creating NFS mount /db2/PR1/dbs from auntmathilda...
   NFS mount for /db2/PR1/dbs exists
 mounting NFS mount /db2/PR1/dbs...
   mounting NFS mount /db2/PR1/dbs successful
 checking DP for FC (tdphdwdb2) symbolic link in /db2/PR1/dbs... checking DP for
FC (tdphdwdb2) file mode and owner...OK
 checking DP for FC (splitint) symbolic link in /db2/PR1/dbs... checking DP for FC
(splitint) file mode and owner...OK
 checking license for DP for FC for mySAP...OK
 checking license for Data Protection for mySAP...OK
 copying of db2pr1 user environment from auntmathilda to uncletitus...
   /db2/PR1/.dbenv_uncletitus.sh...
rm: Remove /db2/PR1/dbs/.dbenv_copy.sh? n
   /db2/PR1/.dbenv_uncletitus.csh...
rm: Remove /db2/PR1/dbs/.dbenv_copy.csh? n
   /db2/PR1/.profile...
rm: Remove /db2/PR1/dbs/.profile_copy? n
   /db2/PR1/.cshrc...
rm: Remove /db2/PR1/dbs/.cshrc_copy? n
   /db2/PR1/.login...
rm: Remove /db2/PR1/dbs/.login_copy? n
 creating DB2 instance db2pr1...
   DB2 instance db2pr1 exists
 checking tsm settings...
   DSM_CONFIG=/db2/PR1/sqllib/adsm/dsm.opt
   DSM_DIR=/usr/tivoli/tsm/client/ba/bin
   DSM_LOG=/db2/PR1/errors
   DSMI_CONFIG=/db2/PR1/sqllib/adsm/dsm.opt
   DSMI_DIR=/usr/tivoli/tsm/client/api/bin64
   DSMI_LOG=/db2/PR1/errors
 tsm settings...OK
 checking dsm.opt...rm: Remove /db2/PR1/dbs/dsm.opt.copy? n
OK
 checking dsm.sys...OK
 configuring DB2 instance...
   db2set DB2COMM=TCPIP...
```

```
   db2 update dbm cfg using SVCENAME sapdb2PR1...
DB20000I  The UPDATE DATABASE MANAGER CONFIGURATION command completed
successfully.
   db2 update dbm cfg using SYSADM_GROUP dbpr1adm...
DB20000I  The UPDATE DATABASE MANAGER CONFIGURATION command completed
successfully.
   db2 update dbm cfg using DFTDBPATH /db2/PR1...
DB20000I  The UPDATE DATABASE MANAGER CONFIGURATION command completed
successfully.
   db2 update dbm cfg using DIAGPATH /db2/PR1/db2dump...
DB20000I  The UPDATE DATABASE MANAGER CONFIGURATION command completed
successfully.
   db2 list node directory...

 Node Directory

 Number of entries in the directory = 1

Node 1 entry:

 Node name                    = REMPR1
 Comment                      =
 Directory entry type         = LOCAL
 Protocol                     = TCPIP
 Hostname                     = auntmathilda
 Service name                 = sapdb2PR1

 Node name                    = REMPR1
   tcpip node REMPR1 already cataloged
   db2 list database directory...

 System Database Directory

 Number of entries in the directory = 1

Database 1 entry:

 Database alias                       = R_PR1
 Database name                        = PR1
 Node name                            = REMPR1
 Database release level               = a.00
 Comment                              =
 Directory entry type                 = Remote
 Catalog database partition number    = -1
 Alternate server hostname            =
 Alternate server port number         =

 Database alias                       = R_PR1
   remote database PR1 on REMPR1 already cataloged as R_PR1
   db2start...
07/18/2006 03:28:56     0   0   SQL1026N  The database manager is already active.
SQL1026N  The database manager is already active.

 Installation completed successfully
```

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

 Please do the following step now on BS as user root:
  - start setup.sh script for Data Protection for mySAP < 3.3
     cd /usr/tivoli/tsm/tdp_r3/       (for TDP for R/3 < 3.2.0.10)
     cd /usr/tivoli/tsm/tdp_r3/db2    (for Data Protection for mySAP 32bit >=
3.2.0.10)
     cd /usr/tivoli/tsm/tdp_r3/db264  (for Data Protection for mySAP 64bit >=
3.2.0.10)
     ./setup.sh
  - start installer (update install) for Data Protection for mySAP >= 3.3

  - start setup.sh script for DP for FC for mySAP
     cd /usr/tivoli/tsm/tdpessr3/db2  (for 32bit and 64bit DB2 instances)
     ./setup.sh

root@uncletitus:/usr/tivoli/tsm/tdpessr3/db2
```

Executing setup.sh script

Now we have to execute the **setup.sh** script as **root** as shown in Example 3-45.

Example 3-45 Executing setup.sh script /usr/tivoli/tsm/tdpessr3/db2/setup.sh

```
root@uncletitus:/usr/tivoli/tsm/tdpessr3/db2 ./setup.sh
Please enter the SID for the Production SAP System: [C21] PR1
 DB2 UDB V8 found on this machine
 checking DB2 Instance...OK

 DB2 instance db2pr1 is a DB2 V8 instance

 checking DB2 Instance Bit-Width...OK

 DB2 instance db2pr1 is a 64 bit instance

 checking DB2 Instance Type...OK

 DB2 instance db2pr1 is a EEE instance

 reading db2nodes.cfg...OK
   single EEE partition
   number of Servers      : 1
   list of Servers        : uncletitus
   max # Nodes per Server : 1

Is uncletitus your [P]roduction or [B]ackup server ? [P/B] B

 group dba exists with GID 302...
 user db2pr1 exists in group dba...

 checking DP for FC for mySAP socket server...

/db2/PR1/dbs/splitint already exists. Rename ? [Y/N] n
Setup successful.
root@uncletitus:/usr/tivoli/tsm/tdpessr3/db2
```

DB2 registry setting on backup server

We have to update the vendor environment file details in the DB2 registry of the backup server. Log in as **db2pr1** and execute the **db2set** command as shown in Example 3-46.

Example 3-46 Updating db2 registry

```
db2pr1@:/db2/PR1 db2set DB2_VENDOR_INI=/db2/PR1/dbs/vendor.env
```

The ulimit requirements

The ulimits of the db2<*sid*> user and root should be at least the following values:

```
data seg size (kbytes)=unlimited
max memory size (kbytes)=131000
stack size (kbytes)=131000
```

The current values can be checked using the **ulimit -a** command. If they are less than the required value, set using the **root** user as shown in Example 3-47.

Example 3-47 Setting ulimit

```
root@auntmathilda:/ chuser data=-1 root
root@auntmathilda:/ chuser stack=262000 root
root@auntmathilda:/ chuser rss=262000 root
root@auntmathilda:/ chuser data=-1 db2pr1
root@auntmathilda:/ chuser stack=262000 db2pr1
root@auntmathilda:/ chuser rss=262000 db2pr1
```

Testing FlashCopy backup from the backup server

At this stage the FlashCopy backup can be tested from the backup server as shown in Example 3-48 using db2pr1 user ID. We show the full output here. However, see Chapter 5, “Backup and restore in DB2 environments” on page 119 for an explanation of what is happening.

Example 3-48 Testing FlashCopy backup

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs ./tdphdwdb2 -p /db2/PR1/dbs/auntmathilda/initPR1.fcs -f
flashcopy
IDS2310W The free space in the file system containing the directory / is only
16.93 MB (53 percent).

                IBM Tivoli Storage Manager for Hardware
          Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                             (TDPHDWDB2)

          FlashCopy Backup utility for IBM Tivoli Storage Manager
        - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
             Build: 304 generated at 14:32:19 on Mar 14 2006
      (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'COPY'.
Profile                         /db2/PR1/dbs/auntmathilda/initPR1.fcs
Log file                        splitint_?_20060719192714.log
Trace file                      splitint_?_20060719192714.trace
Function                        flashcopy
Log file                        tdphdwdb2_?_20060719192714.log
```

```
Trace file                      tdphdwdb2_?_20060719192714.trace

  -- Parameters of tdphdwdb2 profile --

LOGON_HOST_PROD                 auntmathilda    db2pr1
LOGON_HOST_BACK                 uncletitus
BACKUP_MAX                      30
IDS_CONTROL_FILE                /db2/PR1/dbs/auntmathilda/save/idssave
CONFIG_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                        /db2/PR1/dbs/auntmathilda/work
TRACE                           YES
LOG_TRACE_DIR                   /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE               /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
DB2_REMOTE_DBALIAS              R_PR1
DB2_RECOVERY_LOG                /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB                   /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM                 1
DB2_NUM_BUFFERS                 2
DB2_BUFFER_SIZE                 1024
PRIMARY_COPYSERVICES_SERVERNAME 9.152.10.57
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  COPY
VOLUMES_FILE                    /db2/PR1/dbs/auntmathilda/initPR1.fct
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2005I Start of tdphdwdb2 program at: 07/19/06-19:27:14 .
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1

Checking for the node directory entry REMPR1 ...
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Checking system database directory
IDS0099I message_id = REQ_DB_READ_DB2NODES_CFG
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_READ_DB2NODES_CFG
IDS0099I status     = MSG_OK
connect to Node 0
set client connection to Node 0

Checking for the node directory entry REMPR1_0 ...
Checking system database directory

Connecting to the database R_PR1_0 node 0 with user db2pr1 using ***** ...
TBS name=SYSCATSPACE     | ID=0 | Type=DMS | State=0 - Normal
TBS name=SYSTOOLSPACE    | ID=1 | Type=DMS | State=0 - Normal
```

```
TBS name=SYSTOOLSTMPSPACE        | ID=2 | Type=SMS user temp | State=0 - Normal
TBS name=PSAPTEMP        | ID=3 | Type=SMS system temp | State=0 - Normal
TBS name=PR1#STABD       | ID=4 | Type=DMS | State=0 - Normal
TBS name=PR1#STABI       | ID=5 | Type=DMS | State=0 - Normal
TBS name=PR1#BTABD       | ID=6 | Type=DMS | State=0 - Normal
TBS name=PR1#BTABI       | ID=7 | Type=DMS | State=0 - Normal
TBS name=PR1#CLUD        | ID=8 | Type=DMS | State=0 - Normal
TBS name=PR1#CLUI        | ID=9 | Type=DMS | State=0 - Normal
TBS name=PR1#POOLD       | ID=10 | Type=DMS | State=0 - Normal
TBS name=PR1#POOLI       | ID=11 | Type=DMS | State=0 - Normal
TBS name=PR1#DDICD       | ID=12 | Type=DMS | State=0 - Normal
TBS name=PR1#DDICI       | ID=13 | Type=DMS | State=0 - Normal
TBS name=PR1#DOCUD       | ID=14 | Type=DMS | State=0 - Normal
TBS name=PR1#DOCUI       | ID=15 | Type=DMS | State=0 - Normal
TBS name=PR1#EL620D      | ID=16 | Type=DMS | State=0 - Normal
TBS name=PR1#EL620I      | ID=17 | Type=DMS | State=0 - Normal
TBS name=PR1#LOADD       | ID=18 | Type=DMS | State=0 - Normal
TBS name=PR1#LOADI       | ID=19 | Type=DMS | State=0 - Normal
TBS name=PR1#PROTD       | ID=20 | Type=DMS | State=0 - Normal
TBS name=PR1#PROTI       | ID=21 | Type=DMS | State=0 - Normal
TBS name=PR1#ES620D      | ID=22 | Type=DMS | State=0 - Normal
TBS name=PR1#ES620I      | ID=23 | Type=DMS | State=0 - Normal
TBS name=PR1#SOURCED     | ID=24 | Type=DMS | State=0 - Normal
TBS name=PR1#SOURCEI     | ID=25 | Type=DMS | State=0 - Normal
TBS name=PR1#USER1D      | ID=26 | Type=DMS | State=0 - Normal
TBS name=PR1#USER1I      | ID=27 | Type=DMS | State=0 - Normal
TBS container name=/db2/PR1/sapdata1/NODE0000/SYSCATSPACE.container000
TBS container name=/db2/PR1/sapdata1/NODE0000/SYSTOOLSPACE.container000
TBS container name=/db2/PR1/saptemp1/NODE0000/temp4/SYSTOOLSTMPSPACE.000
TBS container name=/db2/PR1/saptemp1/NODE0000/temp4/PSAPTEMP.000
TBS container name=/db2/PR1/sapdata1/NODE0000/PR1#STABD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#STABI.container000
TBS container name=/db2/PR1/sapdata1/NODE0000/PR1#BTABD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#BTABI.container000
TBS container name=/db2/PR1/sapdata3/NODE0000/PR1#CLUD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#CLUI.container000
TBS container name=/db2/PR1/sapdata5/NODE0000/PR1#POOLD.container000
TBS container name=/db2/PR1/sapdata1/NODE0000/PR1#POOLI.container000
TBS container name=/db2/PR1/sapdata5/NODE0000/PR1#DDICD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#DDICI.container000
TBS container name=/db2/PR1/sapdata1/NODE0000/PR1#DOCUD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#DOCUI.container000
TBS container name=/db2/PR1/sapdata6/NODE0000/PR1#EL620D.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#EL620I.container000
TBS container name=/db2/PR1/sapdata3/NODE0000/PR1#LOADD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#LOADI.container000
TBS container name=/db2/PR1/sapdata3/NODE0000/PR1#PROTD.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#PROTI.container000
TBS container name=/db2/PR1/sapdata3/NODE0000/PR1#ES620D.container000
TBS container name=/db2/PR1/sapdata1/NODE0000/PR1#ES620I.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#SOURCED.container000
TBS container name=/db2/PR1/sapdata3/NODE0000/PR1#SOURCEI.container000
TBS container name=/db2/PR1/sapdata1/NODE0000/PR1#USER1D.container000
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#USER1I.container000
DB logretain status: RECOVERY
```

```
DB userexit status : ON

Verifying alias R_PR1_0 logpath: /db2/PR1/log_dir/NODE0000/
Database Path: /db2/PR1/db2pr1/NODE0000/SQL00001/
IDS0099I message_id = REQ_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS1035I The IDS control file exists and a new backup cycle entry has been
created.
IDS1101I New assigned Backup Sequence Number    00008
IDS1025I Time stamp: 07/19/06-19:27:23.
IDS1026I Start of splitint on the production system ...
IDS2310W The free space in the file system containing the directory / is only
17.57 MB (55 percent).

                IBM Tivoli Storage Manager for Hardware
             Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                           (TDPHDWDB2)

            FlashCopy Backup utility for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
               Build: 304 generated at 14:32:19 on Mar 14 2006
        (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'COPY'.
Profile                         /db2/PR1/dbs/auntmathilda/initPR1.fcs
Log file                        splitint_?_20060719192714.log
Trace file                      splitint_?_20060719192714.trace
Function                        flashcopy
Log file                        tdphdwdb2_?_20060719192714.log
Trace file                      tdphdwdb2_?_20060719192714.trace

  -- Parameters of tdphdwdb2 profile --

LOGON_HOST_PROD                 auntmathilda    db2pr1
LOGON_HOST_BACK                 uncletitus
BACKUP_MAX                      30
IDS_CONTROL_FILE                /db2/PR1/dbs/auntmathilda/save/idssave
CONFIG_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                        /db2/PR1/dbs/auntmathilda/work
TRACE                           YES
LOG_TRACE_DIR                   /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE               /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
DB2_REMOTE_DBALIAS              R_PR1
DB2_RECOVERY_LOG                /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB                   /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM                 1
DB2_NUM_BUFFERS                 2
DB2_BUFFER_SIZE                 1024
PRIMARY_COPYSERVICES_SERVERNAME 9.152.10.57
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
```

```
FLASHCOPY_TYPE                  COPY
VOLUMES_FILE                    /db2/PR1/dbs/auntmathilda/initPR1.fct
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2005I Start of tdphdwdb2 program at: 07/19/06-19:27:12 .
IDS2121I Getting the source volumes ...
Function                        getresources_prod
Subfunction                     performsplit
Backup list                     /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0156I Finding the serial numbers ...
IDS1404I The target set with ID '1' is selected for this run.
Matching pair tgt: <75924811390> src: <7592481137D> size: <10737418240_Bytes>
Matching pair tgt: <75924811291> src: <7592481137E> size: <10737418240_Bytes>
Matching pair tgt: <75924811292> src: <7592481137F> size: <10737418240_Bytes>
Matching pair tgt: <75924811293> src: <75924811380> size: <10737418240_Bytes>
Matching pair tgt: <75924811296> src: <75924811281> size: <10737418240_Bytes>
Matching pair tgt: <75924811299> src: <75924811282> size: <10737418240_Bytes>
Matching pair tgt: <7592481138D> src: <75924811283> size: <10737418240_Bytes>
Matching pair tgt: <7592481138E> src: <75924811286> size: <10737418240_Bytes>
Matching pair tgt: <7592481138F> src: <75924811289> size: <10737418240_Bytes>
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Checking system database directory
Checking local database directory /db2/PR1
IDS1602I Waiting for SyncPoint 1 on all EEE nodes...
...

Get first active logfile for database PR1 NODE0000 ...
set client connection to Node 0

First active logfile for DB PR1 is: S0000021.LOG
IDS1602I Waiting for SyncPoint 2 on all EEE nodes...
...
IDS1602I Waiting for SyncPoint 3 on all EEE nodes...
...
IDS2560I Suspend database PR1 NODE0000 write activities...
IDS0099I message_id = REQ_DB_SUSPEND
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_SUSPEND
IDS0099I status     = MSG_OK
IDS1602I Waiting for SyncPoint 4 on all EEE nodes...
.
.
IDS2122I Flashcopying the sources to the target volumes ...
Function                        flashcopy_prod
Subfunction                     performsplit
Backup list                     /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0272I Flushing the buffers to disk...
IDS1030I FlashCopy started ...
EEP1625I Number of volumes to be processed by Flashcopy: 9
```

```
EEP0354I Performing COPY FlashCopy of source volume 7592481137D to target volume
75924811390
EEP0354I Performing COPY FlashCopy of source volume 75924811289 to target volume
7592481138F
EEP0354I Performing COPY FlashCopy of source volume 75924811286 to target volume
7592481138E
EEP0354I Performing COPY FlashCopy of source volume 75924811283 to target volume
7592481138D
EEP0354I Performing COPY FlashCopy of source volume 75924811282 to target volume
75924811299
EEP0354I Performing COPY FlashCopy of source volume 75924811281 to target volume
75924811296
EEP0354I Performing COPY FlashCopy of source volume 75924811380 to target volume
75924811293
EEP0354I Performing COPY FlashCopy of source volume 7592481137F to target volume
75924811292
EEP0354I Performing COPY FlashCopy of source volume 7592481137E to target volume
75924811291
IDS1031I FlashCopy successful.
IDS1602I Waiting for SyncPoint 5 on all EEE nodes...
...
IDS2562I Resume database PR1 NODE0000 write activities...
IDS0099I message_id = REQ_DB_RESUME
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_RESUME
IDS0099I status     = MSG_OK
IDS1602I Waiting for SyncPoint 6 on all EEE nodes...
...
IDS1602I Waiting for SyncPoint 7 on all EEE nodes...
...
BID                             20060719192714
UTL                             /db2/PR1/dbs/initPR1.utl
INF                             -
EBT                             -
EBB                             FULL_ONLINE_DISK_ONLY
EBC                             :0000:/db2/PR1/log_dir/NODE0000/
EBR                             :0000:S0000021.LOG
IDS2033I Information from Data Protection for mySAP has been found with BACKUPID
20060719192714.
IDS1602I Waiting for SyncPoint 8 on all EEE nodes...
...
IDS2124I Exiting with return code 0.
#INFO remote shell terminated successfully
IDS1027I Splitint ended successfully on the production system.
IDS1025I Time stamp: 07/19/06-19:28:56.
IDS1540I Start of fcagent on the backup system ...
IDS2123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /db2/PR1/dbs/auntmathilda/save/tdpessdb2_lst
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EEP0126I Trying to find new devices to match the source device. This process will
take some time.......
EEP0148I Importing volume groups now...
```

```
EEP0149I Newly imported volume group: PR1_0tdp1
EEP0124I Mounting filesystem : /db2/PR1/db2pr1.
EEP0124I Mounting filesystem : /db2/PR1/sapdata1.
EEP0124I Mounting filesystem : /db2/PR1/sapdata2.
EEP0124I Mounting filesystem : /db2/PR1/sapdata3.
EEP0124I Mounting filesystem : /db2/PR1/sapdata5.
EEP0124I Mounting filesystem : /db2/PR1/sapdata6.
EEP0124I Mounting filesystem : /db2/PR1/saptemp1.
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 07/19/06-19:31:44.
IDS1602I Waiting for SyncPoint 1 on all EEE nodes...
...
waiting for socket server to stop...
IDS2124I Exiting with return code 0.
```

The return code 0 indicates that the backup was successful.

4

Installation for SAP software on Oracle

In this chapter we provide details regarding required customization on the Tivoli Storage Manager server, Tivoli Storage Manager client, and Oracle. We also supply detailed information about installation, configuration of Data Protection for mySAP (Oracle), CIM client (Pegasus), DS Open API CIM agent, and Data Protection for FlashCopy.

4.1 Overview of software components required on various servers

First we give you an overview of the required software components (see Table 4-1).

Table 4-1 Software components for servers

Software component	Required on
Tivoli Storage Manager server	Any server — recommended to be on a separate server or on the backup server.
Tivoli Storage Manager client (AIX)	Production and backup server.
CIM client (Pegasus)	Production and backup server.
OpenSSL	Production and backup server.
DS Open API CIM agent	Any server — recommended to be on a separate server or on the backup server. Required only for ESS, DS6000 or DS8000 storage. For SAN Volume Controller, this comes installed on the Master Console.
Data Protection for mySAP (Oracle)	Production and backup server.
Data Protection for FlashCopy (SAP software-Oracle)	Production and backup server.
Oracle server	Production server only.
Oracle client	Production server and backup server.
SAP application	Production server only.
BR*Tools	Production and backup server.

The production server is the server on which the production SAP application with Oracle database is running. In an HACMP cluster environment, any software on the production server must be installed also on the fallback server. In our configuration, the production server is auntmathilda, as shown in Figure 6-1 on page 173.

The backup server is the server on which the FlashCopy target volumes will be mounted and the backup initiated to the Tivoli Storage Manager server. In our configuration, the backup server is uncletitus, which also hosts the Tivoli Storage Manager server. The Tivoli Storage Manager server can also run on a completely separate system (but not recommended on the production server). In this book, therefore, the term “backup server” refers to the system which is performing the backups of FlashCopy snapshots to Tivoli Storage Manager.

4.2 Configuring the Tivoli Storage Manager server

Commands shown in this section are Tivoli Storage Manager administrative commands, which are run using the Tivoli Storage Manager administrative command line utility **dsmadmc**. These commands should be run on the system which is the Tivoli Storage Manager server. In our case, this is the backup server, uncletitus, however it could be any system with suitable storage devices for backups. We assume the basic Tivoli Storage Manager code is installed and configured with an administrative ID, and that the storage pools are available. For more information about planning and installing a Tivoli Storage Manager server, refer to the product documentation, or the IBM Redbook, *IBM Tivoli Storage Manager Implementation Guide*, SG24-5416.

We recommend having a separate policy domain with policy set, management class, copy group in Tivoli Storage Manager for each of the Tivoli Data Protection modules. We will define a separate policy domain, policy set for Data Protection for mySAP (Oracle) as in Example 4-1.

Example 4-1 Defining policy domain, policy set

```
tsm: UNLCETITUS>define dom osapdom description="Policy Domain - SAP
ANR1500I Policy domain OSAPDOM defined.

tsm: UNLCETITUS>define policy osapdom sapps description="Policy Set - SAP
ANR1510I Policy set SAPPS defined in policy domain OSAPDOM.
```

Normally we will have different backup policy requirements for different instance of SAP. Also we would like to keep database and archive log backups in a separate storage pool. Even if we plan to control backup version through Data Protection for mySAP (Oracle), and keep database and archive log backups in same storage pool, we recommend that you plan and create as many management classes as required, so that later changes require less effort. Our SAP instance is called R31, so we will create one management class for the database, one for archive logs pertaining to the R31 instance, and one default management class, as shown in Example 4-2. The management class names are r31dbs, r31log, and sapmc, respectively.

Example 4-2 Defining management class

```
tsm: UNLCETITUS>define mgmtclass osapdom sapps r31dbs description="Mgmt Class -
R31 Database"
ANR1520I Management class R31DBS defined in policy domain OSAPDOM, set SAPPS.

tsm: UNLCETITUS>define mgmtclass osapdom sapps r31log description="Mgmt Class -
R31 Log"
ANR1520I Management class R31LOG defined in policy domain OSAPDOM, set SAPPS.

tsm: UNLCETITUS>define mgmtclass osapdom sapps sapmc description="Mgmt Class
(Default)"
ANR1520I Management class SAPMC defined in policy domain OSAPDOM, set SAPPS.
```

Configure the SAPMC management class as the default management class as shown in Example 4-3.

Example 4-3 Assigning default management class

```
tsm: UNLCETITUS>assign defmgmtclass osapdom sapps sapmc
ANR1538I Default management class set to SAPMC for policy domain OSAPDOM, set
SAPPS.
```

We are using an existing storage pool called TDPACS to store both database and log backups. However, if we later decide to send data to different storage pools, it can be easily done, because we have already created two management classes for that purpose. We have decided to control the backup versions through Data Protection for mySAP (Oracle), so we define the copy group with a retention period of NOLIMIT as in Example 4-4. We set the archive copy group for each of the three management classes with *TDPACS* as the destination storage pool.

Data Protection for mySAP does not require backup copy groups, as only the archive copy group is used.

Note: Here we are discussing only the use of Data Protection for mySAP, with its own nodename, which will protect the SAP software components — the database and logs. However, you should also regularly backup the other parts of your system, such as SAP software executables, configuration files using the regular Tivoli Storage Manage Backup-Archive client. This should be done under a separate node name and policy.

Example 4-4 Defining archive copy group

```
tsm: UNLCETITUS>define copy osapdom sapps r31dbs destination=tdpacs retver=nolimit
t=a
ANR1535I Archive copy group STANDARD defined in policy domain OSAPDOM, set SAPPS,
management class R31DBS.

tsm: UNLCETITUS>define copy osapdom sapps r31log destination=tdpacs retver=nolimit
t=a
ANR1535I Archive copy group STANDARD defined in policy domain OSAPDOM, set SAPPS,
management class R31LOG.

tsm: UNLCETITUS>define copy osapdom sapps sapmc destination=tdpacs t=a
ANR1535I Archive copy group STANDARD defined in policy domain OSAPDOM, set SAPPS,
management class SAPMC.
```

With the above configuration, Tivoli Storage Manager will not expire backups on its own, until they are deleted by Data Protection for mySAP (Oracle). If you prefer to control the backup policy using Tivoli Storage Manager, configure the RETVER option to a value (in days) according to your backup policy requirements. In that case, you have to disable version control in Data Protection for mySAP by setting MAX_VERSIONS to 0 (zero) in its utility file /oracle/<*SID*>/920_64/dbs/init<*SID*>>.utl. See 2.7, “Expiration considerations” on page 44 for more information about options for version control of SAP software backups.

Note: If you create a separate default management class, you must define an archive copy group in it, even if no objects are bound to the management class. Otherwise, even though the policy set will get activated, Data Protection for mySAP (Oracle) backups will fail.

Validate and activate the policy set as shown in Example 4-5. You can ignore the warning that there is no backup copy group, because Data Protection for mySAP only requires archive copy groups.

Example 4-5 Validating, activating policy set

```
tsm: UNLCETITUS>validate policy osapdom sapps
ANR1515I Policy set SAPPS validated in domain OSAPDOM (ready for activation).
tsm: UNLCETITUS>activate policy osapdom sapps
ANR1553W DEFAULT Management class SAPMC in policy set OSAPDOM SAPPS does not have
a BACKUP copygroup:  files will not be backed up by default if this set is
activated.
Do you wish to proceed? (Yes (Y)/No (N)) y
ANR1553W DEFAULT Management class SAPMC in policy set OSAPDOM SAPPS does not have
a BACKUP copygroup:  files will not be backed up by default if this set is
activated.
ANR1514I Policy set SAPPS activated in policy domain OSAPDOM.
```

Tivoli Storage Manager associates and keeps the backup and archive objects with a specific configured node name. We recommend that you use a separate node name for backups done through each of the Tivoli Data Protection modules. We will register a node auntmathilda_r31 for Data Protection for mySAP (Oracle) as in Example 4-6, using our policy domain, osapdom.

Example 4-6 Registering node

```
tsm: UNLCETITUS>register node auntmathilda_r31 redbook contact="TSM administrator"
domain=osapdom compress=no
ANR2060I Node AUNTMATHILDA_R31 registered in policy domain OSAPDOM.
ANR2099I Administrative userid AUNTMATHILDA_R31 defined for OWNER access to node
AUNTMATHILDA_R31.
```

The value `redbook` in the above command is the node's password which will be used during configuration of Data Protection for mySAP.

4.3 Tivoli Storage Manager client configuration

The client configuration is performed on both the production and backup servers.

Install the required Tivoli Storage Manager client filesets according to the documentation, on each of the servers. We have installed the filesets as shown in Example 4-7.

Example 4-7 Tivoli Storage Manager client filesets

```
tivoli.tsm.client.api.64bit 5.3.0.0
tivoli.tsm.client.ba.32bit.base 5.3.0.0
tivoli.tsm.client.ba.32bit.common 5.3.0.0
tivoli.tsm.client.ba.32bit.image 5.3.0.0
tivoli.tsm.client.ba.32bit.nas 5.3.0.0
tivoli.tsm.client.ba.32bit.web 5.3.0.0
```

The highlighted API fileset is the only one designated for the 64-bit environment. The other packages, although they say 32-bit, will work on the 64-bit platform as well. In our environment the SAP and DB2 are 64-bit, so will be using the 64-bit Tivoli Storage Manager API. We also require the base and common packages for normal Tivoli Storage Manager client backup operations. The image, nas, and web packages are optional.

We set the basic required settings in the Tivoli Storage Manager client system options file dsm.sys and user options file dsm.opt for the API, as shown in Example 4-8 and Example 4-9. We specify `SERVERNAME uncletitus` in these files, which will be used during installation of Data Protection for mySAP (Oracle).

Example 4-8 API client system options file - /usr/tivoli/tsm/client/api/bin64/dsm.sys

```
SErvername  uncletitus
   COMMMethod         TCPip
   TCPPort            1500
   TCPServeraddress   9.152.10.57
   Errorlogname       /tmp/dsierror.log
```

Example 4-9 API client user options file - /usr/tivoli/tsm/client/api/bin64/dsm.opt

```
SErvername  uncletitus
```

4.4 Data Protection for mySAP (Oracle) installation and configuration

Now we will install and configure Data Protection for mySAP (Oracle).

4.4.1 Code installation on the production server

Before starting the installation of Data Protection for mySAP on the production system, you should collect the following information, which will be required during the installation process:

- Oracle SID:

  In our case the SID name is *R31*.

- Directory where the SAP BR*Tools are located:

  In our case, it is located in /usr/sap/*<SID>*/SYS/exe/run (/usr/sap/R31/SYS/exe/run), which is the SAP default structure.

- Directory where the SAP configuration file (initSID.sap) is located:

  Normally it will be in /oracle/*<SID>*/920_64/dbs. In our case, it translates to /oracle/R31/920_64/dbs. This will be mounted later on the backup server using NFS.

- Network address of Administration Assistant Server (optional):

  If you have an SAP administration assistant server in your environment, then the IP address of that server can be mentioned here.

- Port for Administration Assistant Server (optional):

  If you have an administration assistant server in your environment, then the port number at which it is listening can be mentioned here.

- Tivoli Storage Manager server:

  The name must already exist in dsm.sys.

  This is the tag name used against the SERVERNAME option in the dsm.sys file. We used the name *uncletitus* in dsm.sys, as shown in Example 4-8.

- Tivoli Storage Manager node name:

  Our Tivoli Storage Manager node name for keeping Data Protection for mySAP (Oracle) backups is *auntmathilda_r31*, as defined in Example 4-6.

- Backup management classes:

  Our management class for keeping R31 instance database objects is *r31dbs* as defined in Example 4-2.

- Archive management classes:

  Our management class for keeping R31 instance log objects is *r31log* as defined in Example 4-2.

Note: Before starting installation, ensure that /tmp has at least 64 MB of free space, which is used as a temporary space for code extraction.

The software comes as a single executable and by default requires X Windows to launch the graphical installation screen. If you have a working X Windows environment, launch the executable as shown in Example 4-10.

Example 4-10 Launching installation in graphics mode

```
root@auntmathilda:/ ./install_tdpr3_ora_aix51_64bit.bin
```

Note: If you download the code from the Web, its name will be similar to web_tdpr3_ora_aix51_64bit.bin.

We used ASCII mode for installation as shown in Example 4-11. Notice the prompts to enter in the configuration information just collected.

Example 4-11 Launching installation in ASCII mode

```
root@auntmathilda:/sw-install ./install_tdpr3_ora_aix51_64bit.bin -console

          Initializing InstallShield Wizard........
          Verifying JVM.
          Extracting Installation Archive.
          Launching InstallShield Wizard........

-------------------------------------------------------------------------------
Welcome to ...

IBM Tivoli Storage Manager for ERP
Data Protection for mySAP

This will install Data Protection for mySAP on your computer.
 Please visit our webpage:

www.ibm.com/software/tivoli/

You will be asked for some questions during installation. Be prepared with the
following information:

  - Oracle SID
  - Connection and login information to TSM Server
  - Connection information to Administration Assistant Server (optional)

Press 1 for Next, 3 to Cancel or 5 to Redisplay [1] 1

-------------------------------------------------------------------------------
IBM Licence Acceptance Panel

Software Licensing Agreement
Press Enter to display the license agreement on your screen. Please
read the agreement carefully before installing the Program. After
 reading the agreement, you will be given the opportunity to accept it
 or decline it. If you choose to decline the agreement, installation
 will not be completed and you will not be able to use the Program.

     International Program License Agreement

     Part 1 - General Terms

     BY DOWNLOADING, INSTALLING, COPYING, ACCESSING, OR USING
     THE PROGRAM YOU AGREE TO THE TERMS OF THIS AGREEMENT. IF YOU
      ARE ACCEPTING THESE TERMS ON BEHALF OF ANOTHER PERSON OR A
```

```
      COMPANY OR OTHER LEGAL ENTITY, YOU REPRESENT AND WARRANT
      THAT YOU HAVE FULL AUTHORITY TO BIND THAT PERSON, COMPANY,
      OR LEGAL ENTITY TO THESE TERMS. IF YOU DO NOT AGREE TO
      THESE TERMS,

- DO NOT DOWNLOAD, INSTALL, COPY, ACCESS, OR USE THE
      PROGRAM; AND

- PROMPTLY RETURN THE PROGRAM AND PROOF OF ENTITLEMENT TO
      THE PARTY FROM WHOM YOU ACQUIRED IT TO OBTAIN A REFUND OF
      THE AMOUNT YOU PAID. IF YOU DOWNLOADED THE PROGRAM, CONTACT
      THE PARTY FROM WHOM YOU ACQUIRED IT.

"IBM" is International Business Machines Corporation or one
      of its subsidiaries.

"License Information" ("LI") is a document that provides
      information specific to a Program. The Program's LI is
      available at http://www.ibm.com/software/sla/ . The LI may
      also be found in a file in the Program's directory, by the
      use of a system command, or as a booklet which accompanies
      the Program.

Press Enter to continue viewing the license agreement, or, Enter 1 to
accept the agreement, 2 to decline it or 99 to go back to the previous
 screen.

1

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

Please enter the required information

   Enter Oracle SID [SID] R31

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

Please enter the required information

   Enter directory where the SAP BR-Tools are located.
   [/usr/sap/R31/SYS/exe/run] /usr/sap/R31/SYS/exe/run

   Enter directory where the SAP configuration file (initSID.sap) is
   located. [/oracle/R31/dbs] /oracle/R31/920_64/dbs

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

--------------------------------------------------------------------------------
To connect to the Administration Assistant Server the following information is
needed. If you do not specify a server, the connection will be disabled.
```

```
Enter network address of Administration Assistant Server []

Enter port for Administration Assistant Server [5126]

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

To connect to the TSM server with basic settings the installer updates the
configuration files with the provided parameters. If you do not want the
parameters updated answer the next question with NO.

Should the installer update these settings?
 [X]  1  -  Yes (recommended for first time installation)
 [ ]  2  -  No (recommended for update installation)

   To select an item enter its number, or 0 when you are finished [0]: 0

   enter TSM server. The name must already exist in dsm.sys. [TSMSERV] uncletitus

   enter TSM node name [R3NODE] auntmathilda_r31

   enter backup management classes [MDB] r31dbs

   enter archive management classes [MLOG1 MLOG2] r31log

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

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

To support Oracle RMAN with Data Protection for mySAP a shared library must be
installed. In addition some action must be done to link the oracle executable
against this library. For more information read the installtion manual.

Do you want to install Oracle RMAN support?
 [ ]  1  -  Yes
 [X]  2  -  No

   To select an item enter its number, or 0 when you are finished [0]: 0

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

--------------------------------------------------------------------------------
Data Protection for mySAP will be installed in the following location:

/usr/tivoli/tsm/tdp_r3/ora64

with the following features:

Base Components
Samples
Documentation

for a total size:
```

```
 80.6 MB

NOTE: The following file systems will be expanded during the installation:

Press ENTER to read the text [Type q to quit]

/usr

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

Expanding /usr ...

|-----------|-----------|-----------|------------|
0%         25%         50%         75%        100%
||||||||||||||||||||||||||||||||||||||||||||||||||

Installing Data Protection for mySAP. Please wait...

Updating the inventory ...

Creating uninstaller...
An instance of this product is installed at: /usr/tivoli/tsm/tdp_r3/ora64
An instance of this product is installed at: /usr/tivoli/tsm/tdp_r3/ora64
pid file /var/tdp_r3/prole.tdpr3ora64.pid not found!

--------------------------------------------------------------------------------
The InstallShield Wizard has successfully installed Data Protection for mySAP.
Choose Finish to exit the wizard.

Press 3 to Finish or 5 to Redisplay [3] 3

root@auntmathilda:/sw-install
```

The code gets installed in /usr/tivoli/tsm/tdp_r3/ora64 directory, if it is 64bit code.

4.4.2 Code installation on the backup server

Follow the same procedure, and use the same values as on the production server except for the following parameters:

- Directory where the SAP BR*Tools are located:

  Specify a dummy directory, because we will be using /sapmnt/<SID> (i.e /sapmnt/R31) from the production server using NFS. Actually /usr/sap/*<SID>*/SYS/exe/run is just a link pointing to /sapmnt/*<SID>*/exe. We used /tmp/r3install as a dummy directory.

- Directory where the SAP configuration file (initSID.sap) is located:

  Specify a dummy directory, because we will be using same configuration files from /oracle/*<SID>*/920_64/dbs (for example, /oracle/R31/920_64/dbs) of the production server using NFS. We used /tmp/r3install as a dummy directory.

4.4.3 Updating Data Protection for mySAP utility file

Here we explain how to update this utility file.

On the production server

The Data Protection for mySAP utility file /oracle/<*SID*>/920_64/dbs/init<*SID*>.utl will be populated with the values provided during code installation. Most of the them are related to interface with Tivoli Storage Manager; however, you can check in case you have to customize any other parameters. In our case, we have decided to do backup version control through Data Protection for mySAP, so we updated the parameter as shown in Example 4-12 to keep two versions.

Example 4-12 Version control values in Data Protection for mySAP utility file /oracle/R31/920_64/dbs/initR31.utl

```
MAX_VERSIONS            2
```

4.4.4 Customizing SAP profile

The sap profile /oracle/<*SID*>/920_64/dbs/init<SID>.sap file must be customized for Data Protection for mySAP (Oracle). In our case we modified /oracle/R31/920_64/dbs/initR31.sap file with lines as shown in Example 4-13, only the modified lines are shown.

Example 4-13 SAP profile - /oracle/R31/920_64/dbs/initR31.sap

```
backup_type = online
backup_dev_type = util_file
util_par_file = initR31.utl
```

4.4.5 Password handling methods

You can choose to have the node password handled by Data Protection for mySAP (Oracle) or by the Tivoli Storage Manager client API. Based on the method you choose, a slightly different configuration will be required. If you choose to manage with Data Protection for mySAP utility files, configuration is only required on the production system only; however, if you decide to manage through client API, the Tivoli Storage Manager client system options file must be updated on both the production and backup server.

- Password handled by Data Protection for mySAP (Oracle):

  In this method, the password is stored in the Data Protection for mySAP (Oracle) binary configuration file, /oracle/<*SID*>/920_64/dbs/init<*SID*>.bki, which takes the configuration information from the utility file init<*SID*>.utl. These files are shared between the production and backup server, so only the copy on the production server has to be updated. If the password expires in Tivoli Storage Manager, you must update the new password in Tivoli Storage Manager and configure the same in Data Protection for mySAP (Oracle). We show how to do this in 4.4.6, “Updating the node password in Data Protection for mySAP” on page 102.

  Entries required in the utility file for this method are shown in Example 4-14.

Example 4-14 Entries required in Data Protection for mySAP (Oracle) utility file /oracle/R31/920_64/dbs/initR31.utl

```
PASSWORDREQUIRED    YES
ADSMNODE            auntmathilda_r31
```

No additional options are required in the Tivoli storage Manager client API system options file (dsm.sys).

- Password handled by Tivoli Storage Manager client API:

  In this method the password is stored by the Tivoli Storage Manager API. If the password expires in the Tivoli Storage Manager server, the client API updates the password and stores the same. You do not have to change anything in Data Protection for mySAP (Oracle). Entries required in the Tivoli Storage Manager client API system options file are shown in Example 4-15. Make sure to update this file on both the production and backup server.

Example 4-15 Tivoli Storage Manager client API system options file - /usr/tivoli/tsm/client/api/bin64/dsm.sys

```
passwordaccess      generate
nodename            auntmathilda_r31
```

Entries required in the Data Protection for mySAP (Oracle) utility file /oracle/<*SID*>/920_64/dbs/init<*SID*>.utl are shown in Example 4-16.

Example 4-16 Entries required in Data Protection for mySAP (Oracle) utility file - /oracle/R31/920_64/dbs/initR31.utl

```
PASSWORDREQUIRED    NO
# ADSMNODE            auntmathilda_r31
```

The ADSMNODE line should be commented using the # symbol.

Note: Password handling through the Tivoli Storage Manager client API is not recommended in a Data Protection for FlashCopy environment because in this environment we have two physical servers (that is, production server and backup server). Whichever server accesses the Tivoli Storage Manager server for the first time after the password expires will update it with the new password. The other server will not be aware of this new password and will fail, so it has to be set manually in this server.

4.4.6 Updating the node password in Data Protection for mySAP

In this section we explain how to update the node password.

On the production system

Log in with the Oracle administration ID (orar31 in our case) and update the node password in Data Protection for mySAP (Oracle) as shown in Example 4-17.

Example 4-17 Updating the node password in Data Protection for mySAP (Oracle)

```
orar31> backint -p /oracle/R31/920_64/dbs/initR31.utl -f password

                        Data Protection for mySAP(R)

             Interface between BR*Tools and Tivoli Storage Manager
             - Version 5, Release 3, Modification 2.0  for AIX LF 64-bit -
                   Build: 275  compiled on Nov 20 2005
          (c) Copyright IBM Corporation, 1996, 2005, All Rights Reserved.

BKI2027I: Using TSM-API version 5.3.0.0 (compiled with 5.3.0.0).
BKI2000I: Successfully connected to ProLE on port tdpr3ora64.
```

```
BKI0005I: Start of program at: Thu Jul 27 02:33:01 CDT 2006 .
BKI2017I: Blocksize is set to 131072 bytes
BKI0049I: Please enter password for node AUNTMATHILDA_R31 on server UNCLETITUS:
BKI0051I: Password successfully verified for node AUNTMATHILDA_R31 on server
UNCLETITUS.
BKI0020I: End of program at: Thu Jul 27 02:33:13 CDT 2006 .
BKI0021I: Elapsed time: 12 sec .
BKI0024I: Return code is: 0.
```

In our case, the password entered is *redbook* as we defined for our node AUNTMATHILDA_R31 in Example 4-6 on page 95. Data Protection for mySAP will save the password in its configuration file /oracle/<*SID*>/920_64/dbs/init<*SID*>.bki.

4.4.7 Testing the backup from Data Protection for mySAP

Here we discuss our testing procedure for the backup.

On the production server

At this stage, we can test backup to ensure proper integration between Data Protection for mySAP (Oracle), SAP, Tivoli Storage Manager API client and Tivoli Storage Manager server. We initiated a backup as shown in Example 4-18. The backup is done by the user ID ora*<SID>* (orar31 in our case) directly from the production server to the Tivoli Storage Manager server.

Example 4-18 Testing backup from Data Protection for mySAP (Oracle)

```
orar31> brbackup -c -u system/<password>
```

The password mentioned in brbackup command is for the Oracle user **system**.

4.5 CIM software installation and configuration

In this section we explain how to install various CIM related software, which will be required for FlashCopy backup.

4.5.1 OpenSSL software requirements

Here we describe the requirements for OpenSSL software.

On the production and backup servers

The CIM client requires OpenSSL for proper operation, even though Data Protection for FlashCopy supports only non-SSL mode. For details to check and install OpenSSL see 3.5.1, “OpenSSL software requirements” on page 63.

4.5.2 CIM (Pegasus) software requirements

Here we discuss the requirements for Pegasus CIM software.

On the production and backup servers

Pegasus CIM software has both a server and a client part. However, Data Protection for FlashCopy uses only the CIM client libraries to interface with the CIM agent for the respective

storage system. The client libraries are referred to as the CIM client in the Data Protection for FlashCopy environment. The Pegasus package must be installed in each server where Data Protection for FlashCopy is going to be installed. The CIM client requires the libssl.a library, which is part of the OpenSSL package; however, SSL should be disabled for Data Protection for FlashCopy environment. We show this in the next section. For details on the required Pegasus filesets, see 3.5.2, “CIM (Pegasus) software installation” on page 63.

4.5.3 DS Open API CIM agent requirements

The DS Open API CIM agent installation is required only if an IBM ESS, DS8000, or DS6000 storage system is used. If the SAN Volume Controller (SVC) is used, the CIM agent is part of the SVC Master Console, so they do not have to be installed separately. The CIM agent can be installed on any server accessible by the production server, backup server, and the storage system. The CIM agent is a Java based application so recommended not to run it on the production server because of the workload overhead. If the CIM agent is not already installed on an accessible system in your environment, you can install it on the backup server. See 3.5.3, “DS Open API CIM agent installation and configuration” on page 64 for installation and configuration of DS Open API CIM agent.

4.6 Data Protection for FlashCopy installation and configuration

Now we will install the Data Protection for FlashCopy code, then configure it.

4.6.1 Data Protection for FlashCopy code installation

Next we discuss an example of our installation procedure.

On production and backup server

The Data Protection for FlashCopy installation package is delivered as a single executable, and by default, requires X Windows for launching the graphical installation. The executable name is install_tdphdwr3_ora.bin.

The installation must be done as root user. We used ASCII mode to do the installation as shown in Example 4-19.

Example 4-19 Data Protection for FlashCopy installation

```
root@auntmathilda:/sw-install/tdp/acs ./install_tdpessr3_ora.bin -console

          Initializing InstallShield Wizard........
          Verifying JVM.
          Searching JVM..
          Verifying JVM..
          Extracting Bundled JRE.......
          Installing Bundled JRE.......
          Verifying JVM.......
          Extracting Installation Archive.......
          Launching InstallShield Wizard........

-------------------------------------------------------------------------------
Welcome to ...
```

```
IBM Tivoli Storage Manager for Hardware
Data Protection for DS and SVC for mySAP

This will install Data Protection for DS and SVC for mySAP on your computer.
 Version 5.3.1.2.
 Please visit our webpage:

http://www.ibm.com/software/tivoli

Press 1 for Next, 3 to Cancel or 5 to Redisplay [1] 1

--------------------------------------------------------------------------------
IBM Licence Acceptance Panel

     International Program License Agreement

     Part 1 - General Terms

     BY DOWNLOADING, INSTALLING, COPYING, ACCESSING, OR USING THE PROGRAM
     YOU AGREE TO THE TERMS OF THIS AGREEMENT. IF YOU ARE ACCEPTING THESE
      TERMS ON BEHALF OF ANOTHER PERSON OR A COMPANY OR OTHER LEGAL
      ENTITY, YOU REPRESENT AND WARRANT THAT YOU HAVE FULL AUTHORITY TO
      BIND THAT PERSON, COMPANY, OR LEGAL ENTITY TO THESE TERMS. IF YOU DO
      NOT AGREE TO THESE TERMS,

- DO NOT DOWNLOAD, INSTALL, COPY, ACCESS, OR USE THE PROGRAM; AND

- PROMPTLY RETURN THE PROGRAM AND PROOF OF ENTITLEMENT TO THE PARTY

Press Enter to continue viewing the license agreement, or, Enter "1" to accept
the agreement, "2" to decline it or "99" to go back to the previous screen, "3"
 Print, "4" Read non-IBM terms.

1

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

--------------------------------------------------------------------------------
Data Protection for DS and SVC for mySAP will be installed in the following
location:

/usr/tivoli/tsm/tdpessr3/oracle

for a total size:

 68.2 MB

NOTE: The following file systems will be expanded during the installation:

/usr

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

Expanding /usr ...
```

```
|-----------|-----------|-----------|------------|
0%         25%         50%         75%         100%
||||||||||||||||||||||||||||||||||||||||||||||||||

Installing Data Protection for DS and SVC for mySAP. Please wait...

Updating the inventory ...

Creating uninstaller...

--------------------------------------------------------------------------------
Please read the information below.

ATTENTION!
You have to execute the script ./setup.sh once for each user who will run Data
Protection for DS and SVC for mySAP.
You will find the script setup.sh in the installation directory
/usr/tivoli/tsm/tdpessr3/oracle.

Press 1 for Next, 2 for Previous, 3 to Cancel or 5 to Redisplay [1] 1

--------------------------------------------------------------------------------
The InstallShield Wizard has successfully installed Data Protection for DS and
SVC for mySAP. Choose Finish to exit the wizard.

Press 3 to Finish or 5 to Redisplay [3] 3

root@auntmathilda:/sw-install/tdp/acs
```

The code gets installed in the /usr/tivoli/tsm/tdpessr3/oracle directory.

4.6.2 Other prerequisites on the production server

Here we list some other prerequisites for you to keep in mind.

AIX environment file settings

Ensure that the /etc/environment file has the ENV entry for the korn shell (ksh), as shown in Example 4-20.

Example 4-20 Required setting in /etc/environment file

```
ENV=$HOME/.profile
```

Requirements of rexec

The rexecd daemon must be enabled on the production server. The inetd configuration file /etc/inetd.conf should have entries as shown in Example 4-21.

Example 4-21 Required entries in /etc/inetd.conf

```
exec    stream  tcp6    nowait  root    /usr/sbin/rexecd       rexecd
```

If you have made changes to /etc/inetd.conf, refresh the inetd daemon as shown in Example 4-22.

Example 4-22 Refreshing inetd daemon

```
root@auntmathilda:/ refresh -s inetd
0513-095 The request for subsystem refresh was completed successfully.
```

The ulimit requirements

The ulimits of the ora<*sid*> user (orar31) and root should be at least the following values:

```
data seg size (kbytes)=unlimited
max memory size (kbytes)=131000
stack size (kbytes)=131000
```

The current values can be checked using the **ulimit -a** command. If they are less than the required value, set them using the **root** user as shown in Example 4-23. The **chuser** command takes an input value in 512 bytes; however, the **ulimit** command output is in kbytes.

Example 4-23 Setting ulimit

```
root@auntmathilda:/ chuser data=-1 root
root@auntmathilda:/ chuser stack=262000 root
root@auntmathilda:/ chuser rss=262000 root
root@auntmathilda:/ chuser data=-1 orar31
root@auntmathilda:/ chuser stack=262000 orar31
root@auntmathilda:/ chuser rss=262000 orar31
```

Environment variable requirements for Oracle administrative user

Note: The **splitint** command requires that the PATH environment variable includes the /usr/sbin directory which is usually set by default. However you should check to ensure this has not been over-ridden. This is required for ora<*SID*> user (i.e) orar31.

NFS export of directories

We are using common directories for keeping the Data Protection for mySAP (Oracle), Data Protection for FlashCopy configuration files, work directory, and log files between the production and backup server, so that the information is consistent across both servers. For this reason, the configuration and log directories will be NFS exported from the production server and NFS mounted on the backup server. We also NFS export the SAP executable directory of the production server on the backup server so that BR*Tools do not have to be installed on backup server. The directories for NFS export are:

- /oracle/<SID>/920_64
- /oracle/<SID>/sapreorg
- /oracle/<SID>/sapbackup
- /sapmnt/<SID>

In our case these translate to the directories:

- /oracle/R31/920_64
- /oracle/R31/sapreorg
- /oracle/R31/sapbackup
- /sapmnt/R31

Create NFS exports as shown in Example 4-24. This is shown for one of the directories — follow the same steps to NFS export other directories.

Example 4-24 NFS exporting /oracle/R31/920_64 directory

```
root@auntmathilda:/ smitty mknfsexp

Add a Directory to Exports List

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

[TOP]                                                   [Entry Fields]
* Pathname of directory to export                      [/oracle/R31/920_64] /
  Anonymous UID                                        [-2]
  Public filesystem?                                    no +
* Export directory now, system restart or both         both +
  Pathname of alternate exports file                   []
  Allow access by NFS versions                         [] +
  External name of directory (NFS V4 access only)      []
  Referral locations (NFS V4 access only)              []
  Replica locations                                    []
  Ensure primary hostname in replica list               yes +
  Allow delegations?                                    no +
* Security method [sys,krb5p,krb5i,krb5,dh,none] +
*     Mode to export directory                          read-write +
      Hostname list. If exported read-mostly           []
      Hosts & netgroups allowed client access          []
      Hosts allowed root access                        [uncletitus]
  Security method                                      [] +
      Mode to export directory                         [] +
      Hostname list. If exported read-mostly           []
      Hosts & netgroups allowed client access          []
      Hosts allowed root access                        []
  Security method                                      [] +
      Mode to export directory                         [] +
      Hostname list. If exported read-mostly           []
      Hosts & netgroups allowed client access          []
      Hosts allowed root access                        []
  Security method                                      [] +
      Mode to export directory                         [] +
      Hostname list. If exported read-mostly           []
      Hosts & netgroups allowed client access          []
      Hosts allowed root access                        []
[MORE...5]

F1=Help                  F2=Refresh               F3=Cancel
F4=List
F5=Reset                 F6=Command               F7=Edit
F8=Image
F9=Shell                    F10=Exit                      Enter=Do
```

4.6.3 Customizing and initializing Data Protection for FlashCopy on production server

In this section we explain how to customize and initialize Data Protection for FlashCopy.

Executing the setup.sh script

After the Data Protection for FlashCopy code installation, execute the **setup.sh** script, which copies the configuration files to correct location, name and creates links to the Data Protection for FlashCopy executable. Run the script as root user as shown in Example 4-25.

Example 4-25 Executing Data Protection for FlashCopy setup.sh script

```
root@auntmathilda:/usr/tivoli/tsm/tdpessr3/oracle ./setup.sh
Please enter the SID for the Production SAP System: [C21] R31
 Oracle user orar31 found
Please enter the path for the executables: [/usr/sap/R31/SYS/exe/run]
Please enter the path for the configuration files: [/oracle/R31/920_64/dbs]

Directory /usr/tivoli/tsm/tdpessr3/oracle/5.3.1.2 will be created
Setup successful.
root@auntmathilda:/usr/tivoli/tsm/tdpessr3/oracle
```

Customizing Data Protection for FlashCopy profile

The Data Protection for FlashCopy profile /oracle/<*SID*>/920_64/dbs/init<*SID*>.fcs has to be updated with values (values updated by us are highlighted) as shown in Example 4-26. The values for PRIMARY_COPYSERVICES_SERVERNAME, COPYSERVICES_SERVERPORT, and COPYSERVICES_USERNAME should correspond to the CIM agent — either as installed or available as mentioned in 3.5.3, “DS Open API CIM agent installation and configuration” for an ESS, DS6000, or DS8000, installation, or from the Master Console, if using a SAN Volume Controller. In all cases, make sure to use the http port, not the secure https port.

Example 4-26 Data Protection for FlashCopy profile /oracle/R31/920_64/dbs/initR31.fcs

```
>>> global
LOGON_HOST_PROD         auntmathilda orar31
LOGON_HOST_BACK         uncletitus
BACKUP_MAX              30
IDS_CONTROL_FILE        /oracle/R31/sapbackup/idssave/idssave
CONFIG_FILE             /oracle/R31/920_64/dbs/initR31.fcp
WORK_DIR                /oracle/R31/sapbackup/work
TRACE                   YES
LOG_TRACE_DIR           /oracle/R31/sapbackup/logtraces
SUPPORT_ADMIN_ASSISTANT NO
COPYSERVICES_HARDWARE_TYPE     DS8000
<<< global
>>> copyservices_data
PRIMARY_COPYSERVICES_SERVERNAME   uncletitus
COPYSERVICES_SERVERPORT   5988
COPYSERVICES_USERNAME     superuser
FLASHCOPY_TYPE            INCR
VOLUMES_FILE              /oracle/R31/920_64/dbs/initR31.fct
<<< copyservices_data
```

Customizing Data Protection for FlashCopy target volume file

You should update the Data Protection for FlashCopy target volume file (/oracle/<*SID*>/920_64/dbs/init<*SID*>.fct) with details of the target LUNs that will be used to do FlashCopy. The target LUNs should match the number and size of the production source LUNs. In our environment we had 7 LUNs of 10.2 GB and 1 LUN of 5.1 GB for the production

database, and 1 LUN of 1.0GB for the redo log on the production server, so we updated the target volume file with target LUNs of 7 x 10.2 GB, 1 x 5.1 GB and 1 x 1.0 GB size as shown in Example 4-27. The target LUN for the redo log is required only in case of an offline_mirror backup.

Example 4-27 Data Protection for FlashCopy target volume file /oracle/R31/920_64/dbs/initR31.fct

```
>>> volumes_set_1
TARGET_VOLUME 75924811048 - -
TARGET_VOLUME 75924811049 - -
TARGET_VOLUME 7592481104A - -
TARGET_VOLUME 7592481104B - -
TARGET_VOLUME 7592481111C - -
TARGET_VOLUME 7592481111D - -
TARGET_VOLUME 75924811129 - -
TARGET_VOLUME 75924811127 - -
TARGET_VOLUME 7592481111F - -
<<< volumes_set_1
```

In the TARGET_VOLUME lines, the highlighted number is the serial number of the target volume; the next two fields are for the serial number and size of the source volume. These two fields do not have to be specified, because they will be automatically populated when the **splitint** program runs for the first time to make the association between the target and source volumes.

A DS8000 volume serial number has the format xxxxxxyyyy, where xxxxxxx represents the 7 digit serial number of the DS8000, and yyyy represents the 4 digit LUN ID.

An ESS volume serial number has the format yyyxxxxx, where xxxxx represents the last 5 digit serial number of the ESS and yyy represents the 3 digit LUN ID.

We used only one target set. If you require additional target sets, create additional *volumes_set_x* stanzas (replace x with the next numeric value, so the second target set stanza will be volumes_set_2), each with information about the same number of LUNs of the same size as the production database source LUNs.

Customizing Data Protection for mySAP utility file to enable FlashCopy

The Data Protection for mySAP utility file /oracle/*<SID>*/920_64/dbs/init*<SID>*.utl must be updated with the line shown in Example 4-28 for interfacing with Data Protection for FlashCopy.

Example 4-28 Updating Data Protection for mySAP (Oracle) utility file - /oracle/R31/920_64/dbs/initR31.utl

```
FCS_FILE                /oracle/R31/920_64/dbs/initR31.fcs
```

Customizing BR*Tools profile to enable FlashCopy

The BR*Tools profile /oracle/*<SID>*/920_64/dbs/init*<SID>*.sap file should be updated with lines shown in Example 4-29 for interfacing with Data Protection for FlashCopy.

*Example 4-29 Updating BR*Tools profile to enable FlashCopy - /oracle/R31/920_64/dbs/initR31.sap*

```
backup_type = online_mirror
split_options = "-p /oracle/R31/920_64/dbs/initR31.fcs"
split_resync = yes
primary_db = R31.WORLD
```

The parameter backup_type specifies the type of FlashCopy that **brbackup** will do as a default. In this case, it is an online_mirror. You can override this when you run **brbackup** by specifying the `-t option` on the command-line. split_options allows options to be passed on to **splitint**, split_resync will unmount the file system, export the volume group and potentially release the target volumes when the backup to Tivoli Storage Manager is complete on the backup server, and primary_db points to the Oracle instance string of the database as referred to in the tnsnames.ora Oracle file.

Initializing Data Protection for FlashCopy

While initializing the Data Protection for FlashCopy, the following information will be requested:

- Password for the user ora<*SID*>

  This is the password of the user referred by LOGON_HOST_PROD entry in Data Protection for FlashCopy profile which is basically the Oracle instance owner ID. In our case, it is the password of user orar31.

- Password for the user superuser on the DS

  This is the password of superuser user referred by COPYSERVICES_USERNAME entry in Data Protection for FlashCopy profile, which is basically the user configured on the CIM agent.

The above passwords are stored in the file referred to in the CONFIG_FILE entry of the Data Protection for FlashCopy profile. In our case, it is stored in the /oracle/R31/920_64/dbs/initR31.fcp file.

We initialize the Data Protection for FlashCopy using the orar31 (ora<*SID*>) user ID as shown in Example 4-30.

Example 4-30 Initializing Data Protection for FlashCopy

```
orar31@uncletitus:/oracle/R31> cd 920_64/dbs
orar31@uncletitus:/oracle/R31/920_64/dbs>splitint -f password -p initR31.fcs
IDS1310W The free space in the file system containing the directory
/oracle/R31/920_64 is only 35.09 MB (1 percent).
IDS1310W The free space in the file system containing the directory / is only
16.02 MB (50 percent).

                    IBM Tivoli Storage Manager for Hardware
               Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on
Oracle(R)

         BR*Tools Interface SPLITINT for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
               Build: 304 generated at 14:34:45 on Mar 14 2006
       (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'INCR'.
Profile                         ./initR31.fcs
Log file                        splitint_?_20062707223522.log
Trace file                      splitint_?_20062707223522.trace

  -- Parameters of splitint profile --

LOGON_HOST_PROD                 auntmathilda    orar31
LOGON_HOST_BACK                 uncletitus
```

```
BACKUP_MAX                      30
IDS_CONTROL_FILE                /oracle/R31/sapbackup/idssave/idssave
CONFIG_FILE                     /oracle/R31/920_64/dbs/initR31.fcp
WORK_DIR                        /oracle/R31/sapbackup/work
TRACE                           YES
LOG_TRACE_DIR                   /oracle/R31/sapbackup/logtraces
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
PRIMARY_COPYSERVICES_SERVERNAME uncletitus
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  INCR
VOLUMES_FILE                    /oracle/R31/920_64/dbs/initR31.fct
IDS1015I Start of splitint program at: 07/27/06-22:35:22 .
Function                        password
IDS1051I: Enter the password for the user 'orar31'      :
IDS1052I: Enter the password for the user 'orar31' again:
IDS1051I: Enter the password for the user 'superuser on the DS'     :
IDS1052I: Enter the password for the user 'superuser on the DS' again:
IDS1023I Exiting with return code 0.
```

Preparing for Oracle SQL*NET

We have to do the following tasks to establish the Oracle connection between the backup and production servers. The primary_db must be defined in the SAP profile /oracle/<*SID*>/920_64/dbs/init<*SID*>.sap, as we showed in “Customizing BR*Tools profile to enable FlashCopy” on page 110.

Create an Oracle password file using the user ID ora<*sid*> as shown in Example 4-31. In our example, the <password> is the password of the Oracle user sys.

Example 4-31 Creating Oracle password file

```
orar31@auntmathilda:/> orapwd file=/oracle/R31/920_64/dbs/orapwR31
password=<password> entries=100
```

The Oracle parameter file /oracle/<SID>/920_64/dbs/init<SID>.ora should to be updated with the entry as shown in Example 4-32. After the entry is made, Oracle must be restarted for parameter to take effect.

Example 4-32 Updating oracle parameter file - /oracle/R31/920_64/dbs/initR31.ora

```
remote_login_passwordfile = exclusive
```

We have to provide SYSOPER authority to the Oracle user system in the production database as shown in Example 4-33.

Example 4-33 Granting SYSOPER authority to Oracle user system

```
orar31> sqlplus /nolog
SQL*Plus: Release 9.2.0.1.0 - Production on Wed Aug 2 02:03:08 2006
Copyright (c) 1982, 2002, Oracle Corporation.  All rights reserved.
SQL> connect / as sysdba
Connected.
SQL> grant sysoper to system ;
Grant succeeded.
SQL> exit
```

```
Disconnected from Oracle9i Enterprise Edition Release 9.2.0.1.0 - 64bit Production
With the Partitioning option
JServer Release 9.2.0.1.0 - Production
orar31>
```

4.6.4 Other prerequisites on the backup server

Here we discuss other prerequisites for Data Protection for FlashCopy on the backup server.

File systems required for Oracle and SAP software

We have to create file systems called /oracle/<*SID*> of size 128 MB, which will be used for Oracle home, and /usr/sap/<*SID*> of size 128 MB, which will be used for creating the required directories, links to the SAP executables. After the file systems are created, mount them as shown in Example 4-34.

Example 4-34 Mounting file systems

```
root@uncletitus:/ mount /oracle/R31
root@uncletitus:/ mount /usr/sap/R31
```

Create required users and groups

Users ora<*SID*>, <*SID*>adm and groups dba, sapsys must be created on the backup server with the same UIDs, GIDs as on the production server.

Environment variables requirement for Oracle administrative user

Note: The **splitint** command requires that the PATH environment variable includes the /usr/sbin directory, which is usually set by default. Check to ensure that this has not been overridden. This is required for ora<*SID*> user (for example) orar31.

The ulimit requirements

The ulimits of the ora<*sid*> user (orar31) and 'root' should be at least the following values:

```
data seg size (kbytes)=unlimited
max memory size (kbytes)=131000
stack size (kbytes)=131000
```

The current values can be checked using the **ulimit -a** command. If they are less than the required value, set them using the **root** user as shown in Example 4-35. The **chuser** command takes input value in 512 bytes however the **ulimit** command output is in kbytes.

Example 4-35 Setting ulimit

```
root@auntmathilda:/ chuser data=-1 root
root@auntmathilda:/ chuser stack=262000 root
root@auntmathilda:/ chuser rss=262000 root
root@auntmathilda:/ chuser data=-1 orar31
root@auntmathilda:/ chuser stack=262000 orar31
root@auntmathilda:/ chuser rss=262000 orar31
```

Mounting NFS file systems

The following file systems have to be NFS mounted from the production server as shown in Example 4-36. We show the procedure to mount one of the file systems — you can repeat the procedure for the other file systems:

- /oracle/<SID>/920_64
- /oracle/<SID>/sapreorg
- /oracle/<SID>/sapbackup
- /sapmnt/<SID>

Example 4-36 Mounting NFS file system

```
root@uncletitus:/ smitty mknfsmnt
Add a File System for Mounting

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

[TOP]                                                  [Entry Fields]
* Pathname of mount point                             [/sapmnt/R31] /
* Pathname of remote directory                        [/sapmnt/R31]
* Host where remote directory resides                 [auntmathilda]
  Mount type name                                     []
* Security method                                     [sys] +
* Mount now, add entry to /etc/filesystems or both?   both +
* /etc/filesystems entry will mount the directory     yes +
   on system restart.
* Mode for this NFS file system                       read-write +
* Attempt mount in foreground or background          background +
  Number of times to attempt mount                    [] #
  Buffer size for read                                [] #
  Buffer size for writes                              [] #
  NFS timeout. In tenths of a second                  [] #
  NFS version for this NFS filesystem                 any +
  Transport protocol to use                           any +
  Internet port number for server                     [] #
* Allow execution of setuid and setgid programs       yes +
   in this file system?
* Allow device access via this mount?                 yes +
* Server supports long device numbers?                yes +
* Mount file system soft or hard                      soft +
  Minimum time, in seconds, for holding               [3] #
   attribute cache after file modification
  Allow keyboard interrupts on hard mounts?           yes +
  Maximum time, in seconds, for holding               [60] #
   attribute cache after file modification
  Minimum time, in seconds, for holding               [30] #
   attribute cache after directory modification
  Maximum time, in seconds, for holding               [60] #
   attribute cache after directory modification
[MORE...8]

F1=Help                  F2=Refresh               F3=Cancel
F4=List
F5=Reset                 F6=Command               F7=Edit
F8=Image
```

```
F9=Shell                    F10=Exit                    Enter=Do
```

Creating directories, links for SAP executables

We are accessing the SAP executables from the production server using NFS mount instead of installing the BR*Tools on the backup server. This requires certain directories and links to be created with the correct permissions as shown in Example 4-37. In our case the SID was R31 - replace the *<SID>* with your actual value.

Example 4-37 Creating directories, links for SAP executables

```
root@uncletitus:/ cd /usr/sap/R31
root@uncletitus:/ mkdir -p SYS/exe
root@uncletitus:/ chown -R r31adm:sapsys SYS
root@uncletitus:/ cd SYS/exe
root@uncletitus:/ ln -s /sapmnt/R31/exe dbg
root@uncletitus:/ ln -s dbg run
```

Setting up SAP environment for user ora<SID>

The SAP environment has to be set up for user ora*<SID>* (orar31) by copying the following files from the /oracle*/<SID>* directory of production server and renaming them:

- .sapenv_<hostname>.sh
- .sapenv_<hostname>.csh
- .dbenv_<hostname>.sh
- .dbenv_<hostname>.csh
- .profile
- .cshrc
- .login

In the production server, the files will be named with the production hostname, so after copying them to the backup server, rename them with the hostname of the backup server.

Oracle client

The Oracle client is required on the backup server, so it must be installed.

However, because we are accessing the /oracle/<SID>/920_64/dbs directory from the production server using NFS, we tried two alternative methods to have access to the required executables, without actually installing the Oracle client on the backup server. Both methods worked in our environment:

- Option 1: Put the following environment variable in /oracle/<SID>/.profile file of user ora<SID> - (orar31 in our case). The entry should be similar to Example 4-38.

Example 4-38 LIBPATH entry for Oracle client

```
export LIBPATH=$LIBPATH:/oracle/R31/920_64/lib
```

- Option 2: Create a structure for the Oracle client directories to match the production server as shown in Example 4-39.

Example 4-39 Structure required for Oracle client

```
root@uncletitus:/ mkdir -p /oracle/client/92x_64
root@uncletitus:/ chown -R orar31:dba /oracle/client
root@uncletitus:/ ln -s /oracle/R31/920_64/jdbc /oracle/client/92x_64/jdbc
root@uncletitus:/ ln -s /oracle/R31/920_64/lib /oracle/client/92x_64/lib
```

Note: The above methods are not documented and can vary for other releases of Oracle, so if you face problems with Oracle remote connectivity from the backup server, we recommend that you install the actual Oracle client.

Also, if you have multiple Oracle instances on the same server with different versions, Option 1 is preferred to Option 2, because it can be easily pointed to the correct Oracle version.

Checking Oracle remote connectivity

Oracle remote connectivity from the backup to production server can be tested using user ora*<SID>* as shown in Example 4-40. The password used with sqlplus is that of the Oracle user **system** and R31 is the SID in our instance.

Example 4-40 Checking Oracle remote connectivity

```
orar31@uncletitus:/oracle/R31> sqlplus 'system/<password>@R31 as SYSOPER'

SQL*Plus: Release 9.2.0.1.0 - Production on Thu Aug 10 19:30:33 2006

Copyright (c) 1982, 2002, Oracle Corporation.  All rights reserved.

Connected to:
Oracle9i Enterprise Edition Release 9.2.0.1.0 - 64bit Production
With the Partitioning option
JServer Release 9.2.0.1.0 - Production
SQL>
SQL> exit
Disconnected from Oracle9i Enterprise Edition Release 9.2.0.1.0 - 64bit Production
With the Partitioning option
JServer Release 9.2.0.1.0 - Production
orar31@uncletitus:/oracle/R31>
```

Note: In the above example, we have been checking only the connectivity part. However, if you want to check whether the authority for the Oracle user “system” is configured properly, you can do a startup / shutdown of the Oracle database from the SQL prompt.

4.6.5 Customizing Data Protection for FlashCopy on the backup server

In this section we explain how to customize Data Protection for FlashCopy.

Executing setup.sh script

We have to execute the setup.sh script as *root* user as shown in Example 4-41.

Example 4-41 Executing setup.sh script - /usr/tivoli/tsm/tdpessr3/oracle/setup.sh

```
root@uncletitus:/ cd /usr/tivoli/tsm/tdpessr3/oracle
root@uncletitus:/usr/tivoli/tsm/tdpessr3/oracle ./setup.sh
Please enter the SID for the Production SAP System: [C21] R31
 Oracle user orar31 found
Please enter the path for the executables: [/usr/sap/R31/SYS/exe/run]
/usr/sap/R31/SYS/exe/run
Please enter the path for the configuration files: [/oracle/R31/920_64/dbs]
/oracle/R31/920_64/dbs

/oracle/R31/920_64/dbs/initR31.fcs already exists. Old .fcs will be kept.
/oracle/R31/920_64/dbs/initR31.fct already exists. Old .fct will be kept.

/usr/sap/R31/SYS/exe/run/splitint already exists. Rename ? [Y/N] n
/usr/sap/R31/SYS/exe/run/PreRestore.sh already exists. Rename ? [Y/N] n
/usr/sap/R31/SYS/exe/run/PostRestore.sh already exists. Rename ? [Y/N] n
Setup successful.
root@uncletitus:/usr/tivoli/tsm/tdpessr3/oracle
```

Testing FlashCopy backup from the backup server

At this stage the FlashCopy backup can be tested from the backup server using **orar31** user ID as shown in Example 4-42. For full output and explanation, see Chapter 6, “Backup and restore in Oracle environments” on page 169.

Example 4-42 Testing FlashCopy backup

```
orar31@uncletitus:/oracle/R31>brbackup -c -u system/<password>
```

The <password> has to be replaced with the actual password of the Oracle user system.

5

Backup and restore in DB2 environments

In this chapter we describe the various backup and restore operations of Data Protection for FlashCopy performing with Data Protection for mySAP and FlashCopy.

We cover the following topics:

- Backup and restore concept
- Database backup and restore with FlashCopy backup disks
- Database backup and restore with FlashCopy NOCOPY option
- FlashCopy backup and FlashBack restore
- Database backup and restore without FlashCopy backup disks
- Backup of the offline log files
- Schedule considerations
- Monitoring backup and restore activity

5.1 Backup and restore concepts

In this section we describe some important points that you should understand before attempting real backup and restore operations.

5.1.1 FlashCopy type and Data Protection for FlashCopy backup

Data Protection for FlashCopy can issue three different types of FlashCopy operations:

- COPY: All physical blocks of the source are copied.
- NOCOPY: Only the data that changes in the source after the FlashCopy is established is copied. This is also known as copy-on-write.
- INCR: This is a FlashCopy that can be refreshed with updated information. Changes made to the volumes are tracked when the FlashCopy relationships are established, so that a LUN can be refreshed to the point-in-time content of the source or target, using only the changed data.

For more information about FlashCopy operations, refer to the IBM Redbook, *IBM TotalStorage DS8000 Series: Copy Services in Open Environments*, SG24-6788.

The copy type that will be used for the backup operation can be set using the variable FLASHCOPY_TYPE in the Data Protection for FlashCopy profile (initSID.fcs) or with the **-C** command-line parameter with the **tdphdwdb2** command. The copy type used will be determined as follows:

1. The Data Protection for FlashCopy profile (initSID.fcs) is examined first. If the FLASHCOPY_TYPE parameter is not specified, the default value COPY will be used.
2. If the **tdphdwdb2** command line parameter (-C <flashcopy_type>) is specified, this value will override the FLASHCOPY_TYPE value in the Data Protection for FlashCopy profile.
3. If the **-f flashcopy** option is used on the **tdphdwdb2** command, and based on rules 1 and 2, the FlashCopy type has been determined to be NOCOPY, it will be reset to COPY.

5.1.2 Backup and restore cycles

Data Protection for FlashCopy has to accomplish many tasks on both the production and backup servers. On the production server, Data Protection for FlashCopy runs the FlashCopy operation from the source to the target volumes. It then imports the volume group, mounts the file systems, and runs the backup job on the backup system. These operations must run in sequence — if there is a failure at some specific stage, the status has to be preserved for the next successful operation.

To facilitate this control, Data Protection for FlashCopy uses a progress status indicator (PSI), backup status indicator (BSI), and restore status indicator (RSI). Data Protection for FlashCopy will start a new backup or restore cycle only when these values are in an appropriate status. The IDS control file defined for Data Protection for FlashCopy contains these values.

Progress Status Indicator (PSI)

The PSI represents the status of the involved volumes and the AIX storage management environment after a Data Protection for FlashCopy function is complete. Another Data Protection for FlashCopy function can be started only when the PSI shows the correct state.

Here are the PSI values when no problem exists:

- PSI_MOUNT_DONE: This is the normal PSI value after completion of the **tdphdwdb2 -f flashcopy** command. If you want to run a new **tdphdwdb2 -f flashcopy** or **tdphdwdb2 -f backup,** you should first run **tdphdwdb2 -f unmount** or **tdphdwdb2 -f withdraw**.
- PSI_UNMOUNT_DONE: This is the normal PSI value after **tdphdwdb2 -f backup**. It means that all the file systems on the target volumes are unmounted successfully from the backup system.

Backup Status Indicator (BSI)

The BSI represents whether a FlashCopy or backup completed successfully and a restore can be initiated:

- BSI_START: This is the normal BSI value during the FlashCopy or backup operation.
- BSI_TAPEONLY: This is the normal BSI value when the backup to Tivoli Storage Manager is complete and the FlashCopy background process is not yet complete. At this time, we can only restore from Tivoli Storage Manager
- BSI_DISKONLY: This is the normal BSI value when the backup to Tivoli Storage Manager completed but the Tivoli Storage Manager backup is not yet complete. At this time, we can only restore from the FlashCopy.

Restore Status Indicator (RSI)

The RSI represents whether a restore or FlashBack restore completed successfully and a backup can be started with a new backup sequence number (BSN):

- RSI_START: This is the normal RSI value during the FlashCopy restore.
- RSI_DISKONLY: This is the normal RSI value after the completion of the FlashCopy background process.

For more information about these PSI, BSI, and RSI values, refer to Chapter 6, “Data Protection for FlashCopy Command” in *Data Protection for FlashCopy Devices for mySAP Installation and User’s Guide for DB2 UDB*, SC33-8208.

Example 5-1 illustrates some of these different indicators.

Example 5-1 The inquire function to list status indicators

```
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f inquire -p auntmathilda/initPR1.fcs

-- List of the IDS control Table --

IDS2014I 00042 BSI_DISKONLY PSI_UNMOUNT_DONE 20060731224824 1 20060731224824
07/31/06-22:48:39 20063107225413 exchange.00042 /db2/PR1/dbs/initPR1.utl - -
:0000:/db2/PR1/log_dir/NODE0000/ FULL_ONLINE_DISK_ONLY :0000:S0000061.LOG - - -
531304 COPY RSI_DISKONLY DISKONLY
IDS2014I 00043 BSI_DISKONLY PSI_WITHDRAW_DONE 20060801013152 1 20060801013152
07/31/06-22:48:24 20060108013844 exchange.00043 /db2/PR1/dbs/initPR1.utl - -
:0000:/db2/PR1/log_dir/NODE0000/ FULL_ONLINE_DISK_ONLY :0000:S0000068.LOG -
20060801034141 20060108034414 531304 COPY RSI_DISKONLY DISKONLY
IDS2014I 00044 BSI_DISKONLY PSI_MOUNT_DONE 20060801034541 1 20060801034541
08/01/06-03:47:36 20060108043539 exchange.00044 /db2/PR1/dbs/initPR1.utl - -
:0000:/db2/PR1/log_dir/NODE0000/ FULL_ONLINE_DISK_ONLY :0000:S0000070.LOG - - -
531304 COPY - DISKANDTSM
IDS2014I 00045 BSI_DISKANDTAPE PSI_MOUNT_DONE 20060801210047 1 20060801205219
08/01/06-20:52:17 20060108205747 exchange.00045 /db2/PR1/dbs/initPR1.utl
```

```
:0000:20060801210047 - :0000:/db2/PR1/log_dir/NODE0000/ FULL_ONLINE
:0000:S0000072.LOG - - - 531304 COPY - DISKANDTSM

IDS2106I Exiting with return code 0.
```

Checking the backup cycles

The **tdphdwdb2 -f inquire** command shows the results and details of all backup cycles. In Example 5-1, we show some of the backup cycles. The last line of the output represents the current backup cycle. Here you can see the BSI and PSI. The fields displayed are:

- Target set number
- Target set state
- Backup ID associated with the FlashCopy backup
- Backup sequence number
- Backup status
- Processing status
- Status of the backup cycle
- Time required for a FlashCopy

There is currently no detailed description available for certain fields, because they might be changed in a future product release.

We can, however, get some more detailed information about an individual action by using the option '**-b**' on the **tdphdwdb2 -f inquire** command. See Example 5-2.

Example 5-2 Detailed information about a specific backup ID

```
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f inquire -p auntmathilda/initPR1.fcs

Function                        inquire


-- Data content of the backup cycle with BSEQ_N/BID = 00045 --

IDS2014I 1  BACKUP_SEQUENCE_NO          00045
2  BACKUP_STATUS                BSI_DISKANDTAPE
3  PROCESSING_STATUS            PSI_UNMOUNT_DONE
4  BACKUP_ID                    20060801210047
5  VOL_TARGET_SET               1
6  DT_FLASHCOPY_START           20060801205219
7  DT_FLASHCOPY_END             08/01/06-20:52:17
8  DT_MOUNT_END                 20060108205747
9  EXCHANGE_FILE                exchange.00045
10 UTIL_FILE                    /db2/PR1/dbs/initPR1.utl
11 EEE_BACKUP_ID                :0000:20060801210047
12 RESERVED                     -
13 LOG_DIRECTORY                :0000:/db2/PR1/log_dir/NODE0000/
14 BACKUP_TYPE                  FULL_ONLINE
15 FIRST_ACTIVE_LOG             :0000:S0000072.LOG
16 DATABASE_FILE                -
17 DT_WITHDRAW_START            -
18 DT_WITHDRAW_END              -
19 VERSION                      531304
20 FLASHCOPY_TYPE               COPY
21 RSI                          -
22 BACKUP_DESTINATION           DISKANDTSM
```

```
.....................................................................
The remaining output we do not cover here.
```

BSI_DISKANDTAPE means that the FlashCopy backup process and the backup to the Tivoli Storage Manager server has finished successfully. PSI_UNMOUNT_DONE is the normal result of the “backup” function. The target volume set can now be used for a FlashBack restore or for another FlashCopy backup.

The first target volume set was used for this FlashCopy backup. The backup was done to DISKANDTSM (FlashCopy to the target volume set and a backup to the Tivoli Storage Manager server).

Because this is a backup operation, it does not show any RSI. RSI is shown when there is a restore.

5.1.3 Our lab environment

Figure 5-1 shows our lab environment, which is used for the tests in the rest of this chapter.

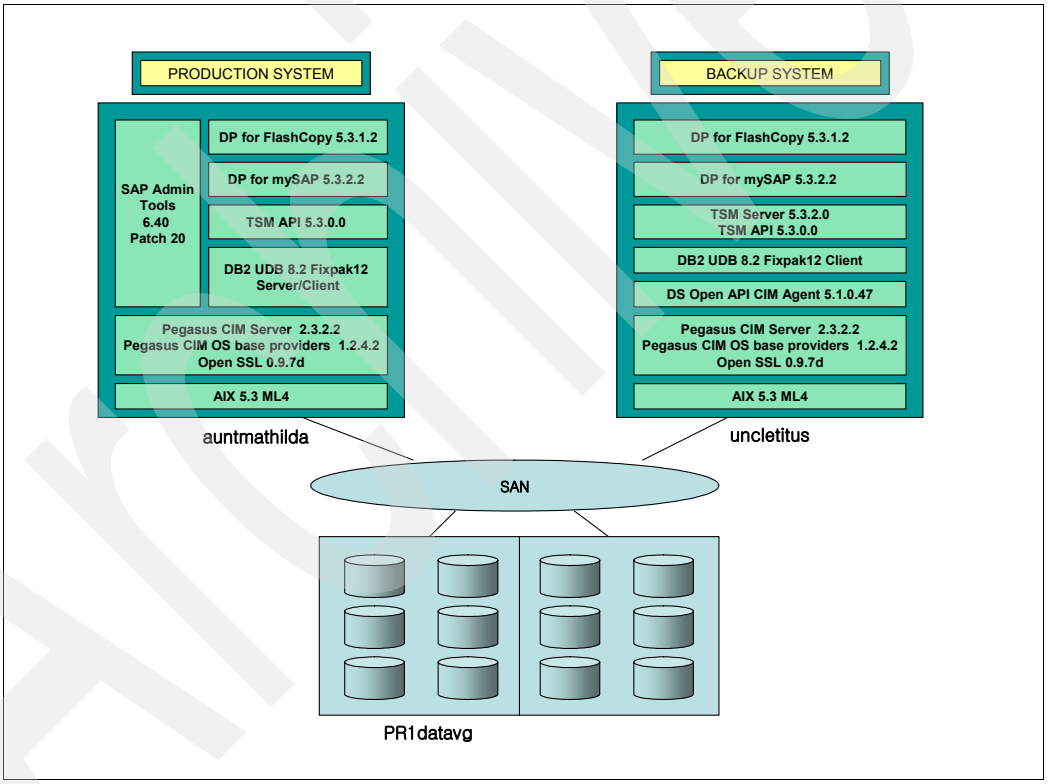


Figure 5-1 Lab environment -DB2

5.2 Database backup and restore with FlashCopy backup disks

In this section, we cover the normal Data Protection for FlashCopy backup and restore process. The backup creates two backup images: one FlashCopy image and one stored to Tivoli Storage Manager. The restore will be done from the Tivoli Storage Manager server media.

5.2.1 Database backup with FlashCopy backup disks

The Data Protection for FlashCopy command **tdphdwdb2 -f backup -p init<*SID*>.fcs** creates two sets of backup objects with different backup types; each one can be used for restore. The two backup types are FlashCopy and Tivoli Storage Manager:

- A FlashCopy backup resides as an image on the target volume specified on the FlashCopy.
- A Tivoli Storage Manager backup resides on the Tivoli Storage Manager server media (usually tape).

To create the two backups, the FLASHCOPY_TYPE must *not* be set as 'NOCOPY'. In our test, the FLASHCOPY_TYPE is set with 'INCR'.

Sample database backup procedure

Here is the procedure we followed:

1. Log in to the backup server (uncletitus) using the DB2 user id (db2pr1), as shown in Example 5-3.

Example 5-3 Log in as DB2 user id

```
root@uncletitus:/ su - db2pr1
db2pr1@:/db2/PR1
```

2. Issue the **tdphdwdb2 -f backup -p auntmathilda/initPR1.fcs** command to start the backup operation. It first checks the Data Protection for FlashCopy profile (initPR1.fcs) and displays the option set, as shown in Example 5-4.

> **Note:** This command, and other backup or restore operations, produce very lengthy output. We have broken the output into sections, in order to explain what is going on.

Example 5-4 Starting backup operation

```
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f backup -p auntmathilda/initPR1.fcs
                IBM Tivoli Storage Manager for Hardware
    Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                           (TDPHDWDB2)

            FlashCopy Backup utility for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
               Build: 304 generated at 14:32:19 on Mar 14 2006
       (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'INCR'.
Profile                         auntmathilda/initPR1.fcs
Log file                        splitint_?_20060724232756.log
Trace file                      splitint_?_20060724232756.trace
Function                        backup
Log file                        tdphdwdb2_?_20060724232756.log
Trace file                      tdphdwdb2_?_20060724232756.trace

  -- Parameters of tdphdwdb2 profile --

LOGON_HOST_PROD                 auntmathilda    db2pr1
LOGON_HOST_BACK                 uncletitus
```

```
BACKUP_MAX                      30
IDS_CONTROL_FILE                /db2/PR1/dbs/auntmathilda/save/idssave
CONFIG_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                        /db2/PR1/dbs/auntmathilda/work
TRACE                           YES
LOG_TRACE_DIR                   /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE               /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
DB2_REMOTE_DBALIAS              R_PR1
DB2_RECOVERY_LOG                /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB                   /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM                 1
DB2_NUM_BUFFERS                 2
DB2_BUFFER_SIZE                 1024
PRIMARY_COPYSERVICES_SERVERNAME 9.152.10.57
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  INCR
VOLUMES_FILE                    /db2/PR1/dbs/auntmathilda/initPR1.fc
```

3. Next, **tdphdwdb2** gets the DB2 information from the production system using a DB2 remote connection, as shown in Example 5-5.

Example 5-5 DB2 Information collection using remote connection

```
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2005I Start of tdphdwdb2 program at: 07/24/06-23:27:57 .
Backup type                     flashcopy
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1

Checking for the node directory entry REMPR1 ...
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Checking system database directory
IDS0099I message_id = REQ_DB_READ_DB2NODES_CFG
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_READ_DB2NODES_CFG
IDS0099I status     = MSG_OK
connect to Node 0
set client connection to Node 0

Checking for the node directory entry REMPR1_0 ...
Checking system database directory

Connecting to the database R_PR1_0 node 0 with user db2pr1 using ***** ...
TBS name=SYSCATSPACE     | ID=0 | Type=DMS | State=0 - Normal
.
```

```
.
.
TBS container name=/db2/PR1/sapdata2/NODE0000/PR1#USER1I.container000
DB logretain status: RECOVERY
DB userexit status : ON

Verifying alias R_PR1_0 logpath: /db2/PR1/log_dir/NODE0000/
Database Path: /db2/PR1/db2pr1/NODE0000/SQL00001/
IDS0099I message_id = REQ_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_SET_BACKUPID
IDS0099I status     = MSG_OK
```

4. In Example 5-6, **tdphdwdb2** checks the IDS control file and determines whether a new backup cycle can be started. If the PSI (Progress Status Indication) and RSI (Restore Status Indicator) are valid (as explained in 5.1.2, “Backup and restore cycles” on page 120), it starts a new backup cycle.

Example 5-6 Starts new backup cycle

```
IDS1035I The IDS control file exists and a new backup cycle entry has been
created.
IDS1101I New assigned Backup Sequence Number    00024
IDS1025I Time stamp: 07/24/06-23:28:34.
```

5. **splitint** starts from the production system with the parameters specified, as shown in Example 5-7.

Example 5-7 Start of splitint

```
IDS1026I Start of splitint on the production system ...
IDS2310W The free space in the file system containing the directory /db2/PR1 is
only 36.48 MB (23 percent).
.
.
.
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2005I Start of tdphdwdb2 program at: 07/24/06-23:28:23 .
```

6. **splitint** (LVM component) gathers information about the volumes from the production system (Example 5-8), and lists the matching target volumes for the FlashCopy. The list of target volumes that we can use is given in the Data Protection for FlashCopy target volume file (initPR1.fct).

Example 5-8 Gathering information about volumes

```
EEP0156I Finding the serial numbers ...
IDS1404I The target set with ID '1' is selected for this run.
Matching pair tgt: <75924811390> src: <7592481137D> size: <10737418240_Bytes>
Matching pair tgt: <75924811291> src: <7592481137E> size: <10737418240_Bytes>
Matching pair tgt: <75924811292> src: <7592481137F> size: <10737418240_Bytes>
Matching pair tgt: <75924811293> src: <75924811380> size: <10737418240_Bytes>
Matching pair tgt: <75924811296> src: <75924811281> size: <10737418240_Bytes>
Matching pair tgt: <75924811299> src: <75924811282> size: <10737418240_Bytes>
```

```
Matching pair tgt: <7592481138D> src: <75924811283> size: <10737418240_Bytes>
Matching pair tgt: <7592481138E> src: <75924811286> size: <10737418240_Bytes>
Matching pair tgt: <7592481138F> src: <75924811289> size: <10737418240_Bytes>
DB2 instance db2pr1 is a EEE instance.
```

7. **tdphdwdb2** suspends database write activities from the backup system (Example 5-9).

Example 5-9 Suspends database write activity

```
IDS2560I Suspend database PR1 NODE0000 write activities...
IDS0099I message_id = REQ_DB_SUSPEND
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_SUSPEND
IDS0099I status     = MSG_OK
IDS1602I Waiting for SyncPoint 4 on all EEE nodes...
```

8. **splitint** performs the FlashCopy operation from the production system using the FLASHCOPY_TYPE option (Example 5-10).

Example 5-10 Starts FlashCopy operation

```
IDS2122I Flashcopying the sources to the target volumes ...
Function                       flashcopy_prod
Subfunction                    performsplit
Backup list                    /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0272I Flushing the buffers to disk...
IDS1030I FlashCopy started ...
EEP1625I Number of volumes to be processed by Flashcopy: 9
EEP0354I Performing INCR FlashCopy of source volume 75924811390 to target volume
7592481137D
EEP0354I Performing INCR FlashCopy of source volume 7592481138F to target volume
75924811289
EEP0354I Performing INCR FlashCopy of source volume 7592481138E to target volume
75924811286
EEP0354I Performing INCR FlashCopy of source volume 7592481138D to target volume
75924811283
EEP0354I Performing INCR FlashCopy of source volume 75924811299 to target volume
75924811282
EEP0354I Performing INCR FlashCopy of source volume 75924811296 to target volume
75924811281
EEP0354I Performing INCR FlashCopy of source volume 75924811293 to target volume
75924811380
EEP0354I Performing INCR FlashCopy of source volume 75924811292 to target volume
7592481137F
EEP0354I Performing INCR FlashCopy of source volume 75924811291 to target volume
7592481137E
IDS1031I FlashCopy successful.
```

9. **tdphdwdb2** then puts the DB2 production database in “write resume” mode from the backup system (Example 5-11).

Example 5-11 Resume database write activities

```
IDS2562I Resume database PR1 NODE0000 write activities...
IDS0099I message_id = REQ_DB_RESUME
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_RESUME
```

```
IDS0099I status      = MSG_OK
```

10. Example 5-12 displays the information from Data Protection for mySAP after the successful backup and **splitint** operation from the production machine is finished.

Example 5-12 End of splitint on the production system

```
BID                             20060724232756
UTL                             /db2/PR1/dbs/initPR1.utl
INF                             -
EBT                             -
EBB                             FULL_ONLINE_DISK_ONLY
EBC                             :0000:/db2/PR1/log_dir/NODE0000/
EBR                             :0000:S0000037.LOG
IDS2033I Information from Data Protection for mySAP has been found with BACKUPID
20060724232756.
IDS1602I Waiting for SyncPoint 8 on all EEE nodes...
...
IDS2124I Exiting with return code 0.
IDS1027I Splitint ended successfully on the production system.
```

11. Now **fcagent** starts on the backup system to perform the FlashCopy (Example 5-13).

Example 5-13 Start of fcagent

```
IDS1540I Start of fcagent on the backup system ...
IDS2123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /db2/PR1/dbs/auntmathilda/save/tdpessdb2_lst
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
```

12. The file systems are imported and mounted on the backup system (Example 5-14).

Example 5-14 Volume group import and mount on the backup system

```
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EEP0126I Trying to find new devices to match the source device. This process will
take some time.......
EEP0148I Importing volume groups now...
EEP0149I Newly imported volume group: PR1_0tdp1
EEP0124I Mounting filesystem : /db2/PR1/db2pr1.
EEP0124I Mounting filesystem : /db2/PR1/sapdata1.
EEP0124I Mounting filesystem : /db2/PR1/sapdata2.
EEP0124I Mounting filesystem : /db2/PR1/sapdata3.
EEP0124I Mounting filesystem : /db2/PR1/sapdata5.
EEP0124I Mounting filesystem : /db2/PR1/sapdata6.
EEP0124I Mounting filesystem : /db2/PR1/saptemp1.
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 07/24/06-23:34:10.
```

13. After starting the database manager on the backup system, the FlashCopy'd version of the database (PR1) is initialized on the backup system with the **db2inidb PR1 as standby** command. This command puts the copy of the database in a rollforward pending mode, and creates a "hot standby" database. This is shown in Example 5-15.

Example 5-15 Database initialization on the backup system

```
Starting database manager...

Start the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 2 on all EEE nodes...
...
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Checking system database directory
Checking local database directory /db2/PR1
IDS1602I Waiting for SyncPoint 3 on all EEE nodes...
...

Initialize database PR1 on NODE0000...
set client connection to Node 0

Disconnecting from the database PR1 ...

Run db2inidb PR1 as standby
IDS2307I Issuing DB2 command 'db2inidb PR1 as standby
echo hdwIntRC: $?' ...
DBT1000I  The tool completed successfully.
```

14. Now the DB2 backup to Tivoli Storage Manager starts from the backup system, using the FlashCopy'd LUNs (Example 5-16).

Example 5-16 Starting database backup using Data Protection for mySAP library

```
IDS2307I Issuing DB2 command 'db2 backup db PR1 load
/usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a OPEN 001 SESSIONS WITH 002 BUFFERS
BUFFER 01024 PARALLELISM 001
echo hdwIntRC: $?' ...

A
Backup successful. The timestamp for this backup image is : 20060724233601

hdwIntRC: 0
set client to node 0
set client connection to Node 0
IDS0099I message_id = REQ_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_SET_BACKUPID
IDS0099I status     = MSG_OK
IDS1602I Waiting for SyncPoint 5 on all EEE nodes...
...
IDS1602I Waiting for SyncPoint 6 on all EEE nodes...
...
IDS2033I Information from Data Protection for mySAP has been found with BACKUPID
20060724233601.
```

15. The database manager is stopped after the backup is complete, Example 5-17.

Example 5-17 Stop the database manager on the backup system

```
Stopping database manager...
```

```
Stop the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 8 on all EEE nodes...
...
```

16. The backup server unmounts the file systems and exports the volume group - Example 5-18. This completes the operation.

Example 5-18 Unmounting file systems and exporting volume group

```
Function                        unmount
Backup list                     /db2/PR1/dbs/auntmathilda/save/tdpessdb2_lst
IDS1060I Start of listing of exported volume groups/unmounting file systems ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
EEPO273I Unmounting the file system /db2/PR1/saptemp1...
EEPO273I Unmounting the file system /db2/PR1/sapdata6...
EEPO273I Unmounting the file system /db2/PR1/sapdata5...
EEPO273I Unmounting the file system /db2/PR1/sapdata4...
EEPO273I Unmounting the file system /db2/PR1/sapdata3...
EEPO273I Unmounting the file system /db2/PR1/sapdata2...
EEPO273I Unmounting the file system /db2/PR1/sapdata1...
EEPO273I Unmounting the file system /db2/PR1/db2pr1...
EEPO152I Removing volume group PR1_Otdp1 ....
EEPO153I Varied off and exported volume group : PR1_Otdp1
EEPO140I Flashcopy type is set to COPY or INCR.
Leaving disk meta data intact for all target disks...
This backup is valid for a FlashCopy restore.
EEPO127I Removing device : hdisk61
EEPO127I Removing device : hdisk60
EEPO127I Removing device : hdisk59
EEPO127I Removing device : hdisk58
EEPO127I Removing device : hdisk57
EEPO127I Removing device : hdisk55
EEPO127I Removing device : hdisk52
EEPO127I Removing device : hdisk51
EEPO127I Removing device : hdisk50
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 07/25/06-00:18:51.
```

Checking the results of the backup

After the backup, we can check the backup status in three ways - these are:

- From Data Protection for FlashCopy
- From Data Protection for mySAP
- From DB2 itself

Checking the backup results from Data Protection for FlashCopy

The **tdphdwdb2 -f restore** command (issued from the production system) gives you the results of the backup in interactive mode. This command gets the information from the IDS control files. To check the current backup cycle, use **tdphdwdb2 -f inquire**.

1. Log in to the production system (auntmathilda) using the DB2 user id (db2pr1).
2. Start the **tdphdwdb2 -f restore** command (Example 5-19).

Example 5-19 Checking the backup results from the Data Protection for FlashCopy

```
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs
------------------------------------------------------------------------------

          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

------------------------------------------------------------------------------
      Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
------------------------------------------------------------------------------
 [1] - 24.07.2006 23:36:01  DB  online   ok  ok                  S0000037.LOG
 [2] - 24.07.2006 21:18:39  DB  offline  ok  invalid             S0000037.LOG
 [3] - 21.07.2006 21:55:09  DB  online   -   invalid             S0000036.LOG
 [4] - 21.07.2006 21:18:37  DB  online   -   invalid             S0000035.LOG
 [5] - 21.07.2006 21:24:48  DB  N/A      -   invalid

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2
```

This output displays the latest backup results. There are OK entries in both the TSM and FlashCopy column — indicating that the backup was sent to both, and is valid for a restore.

Example 5-20 shows the detailed output — to display this screen, select **d**.

Example 5-20 Checking the detailed backup results from the Data Protection for FlashCopy

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

          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

------------------------------------------------------------------------------
      Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
           BSN    HdwID   FCType  TargetID FlashBack RTime(min)
------------------------------------------------------------------------------
 [1] - 24.07.2006 23:36:01  DB  online   ok  ok                  S0000037.LOG
           00024  -       INCR     1
 [2] - 24.07.2006 21:18:39  DB  offline  ok  invalid             S0000037.LOG
 [3] - 21.07.2006 21:55:09  DB  online   -   invalid             S0000036.LOG
           00021  -       INCR     1                 0
 [4] - 21.07.2006 21:18:37  DB  online   -   invalid             S0000035.LOG
           00020  -       INCR     1
 [5] - 21.07.2006 21:24:48  DB  N/A      -   invalid

   [d] -  hide details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection:
```

Checking the backup results from Data Protection for mySAP

We can check the backup results from Data Protection for mySAP using the **backom** command on the production system and backup system, as shown in Example 5-21.

Example 5-21 Checking the backup results from the Data Protection for mySAP

```
db2pr1@:/usr/tivoli/tsm/tdp_r3/db264 backom -c q_all

================================================================================
              Data Protection for mySAP(R) - Backup Object Manager

        - Version 5, Release 3, Modification 2 Level 2 for AIX LF 64-bit -
                  Build: 278R compiled on Mar  3 2006
        (c) Copyright IBM Corporation, 1996, 2006, All Rights Reserved.
================================================================================

===> Backup images for database 'PR1' <===

    >> DATABASE BACKUP
        Time: 20060724211839   Node: 0000   Session(s): 1   TDI: no
        Time: 20060724233601   Node: 0000   Session(s): 1   TDI: no

    >> ARCHIVED LOGS
       -- Log Chain 'C0000002' --
            S0000037.LOG
```

Checking the backup results from DB2

We can check the backup status from DB2 using the **db2 list history** command, as shown in Example 5-22.

Example 5-22 Checking the detailed backup results from the DB

```
db2pr1@:/db2/PR1/dbs db2 list history backup all for pr1

                    List History File for pr1

Number of matching file entries = 17
.
.
.

 Op Obj Timestamp+Sequence Type Dev Earliest Log Current Log  Backup ID
 -- --- ------------------ ---- --- ------------ ------------ --------------
  B  D  20060724211839001   F    O  S0000037.LOG S0000037.LOG
 ----------------------------------------------------------------------------
  Contains 26 tablespace(s):

  00001 SYSCATSPACE
  00002 SYSTOOLSPACE
  00003 PR1#STABD
  00004 PR1#STABI
  00005 PR1#BTABD
  00006 PR1#BTABI
  00007 PR1#CLUD
  00008 PR1#CLUI
  00009 PR1#POOLD
```

```
 00010 PR1#POOLI
 00011 PR1#DDICD
 00012 PR1#DDICI
 00013 PR1#DOCUD
 00014 PR1#DOCUI
 00015 PR1#EL620D
 00016 PR1#EL620I
 00017 PR1#LOADD
 00018 PR1#LOADI
 00019 PR1#PROTD
 00020 PR1#PROTI
 00021 PR1#ES620D
 00022 PR1#ES620I
 00023 PR1#SOURCED
 00024 PR1#SOURCEI
 00025 PR1#USER1D
 00026 PR1#USER1I
--------------------------------------------------------------------------------
   Comment: DB2 BACKUP PR1 OFFLINE
Start Time: 20060724211839
  End Time: 20060724214057
    Status: A
--------------------------------------------------------------------------------
 EID: 95 Location: /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
```

5.2.2 Database restore from Tivoli Storage Manager

In this section we describe the database restore from the backup image stored in the Tivoli Storage Manager storage pool. The **tdphdwdb2 -f restore** command must be issued on the production system.

Note: If there have been no database transactions since the Tivoli Storage Manager backup and you are restoring from that backup image, you will see this error during the recovery process:

```
db2pr1@:/db2/PR1 db2 rollforward db pr1 to end of logs

SQL4970N Roll-forward recovery on database "PR1" cannot reach the specified stop point
(end-of-log or point-in-time) because of missing log file(s) on node(s) "0".
```

This is not typical for production systems, because usually databases are being continually updated. When testing the product, make sure to perform some database transactions on the production system before restoring it from the Tivoli Storage Manager backup.

Sample database restore procedure

Before starting the restore, make sure that the file system containing the DB2 logfiles has more than 55% of free space. The restore process creates the logsafe directory in this file system, and saves the old DB2 logfiles there. Proceed as follows:

1. Log in to the production system (auntmathilda) using the DB2 user id (db2pr1).
2. Start the restore with the command **tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs** It checks the Data Protection for FlashCopy profile (initPR1.fcs) and displays the option set and current environment. After that, the interactive menu shown in Example 5-23 is shown.

Example 5-23 Show the backup history

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs
------------------------------------------------------------------------------


          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

------------------------------------------------------------------------------
      Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
------------------------------------------------------------------------------
 [1] - 25.07.2006 21:26:50  DB  online   ok  ok                  S0000039.LOG
 [2] - 25.07.2006 18:47:13  DB  N/A      -   invalid
 [3] - 25.07.2006 18:28:55  DB  N/A      -   invalid
 [4] - 25.07.2006 18:23:01  DB  N/A      -   invalid
 [5] - 25.07.2006 18:20:42  DB  N/A      -   invalid

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection:
```

3. If we enter “d” for the detailed output, it shows the BSN (backup sequence number), HdwId (serial number, only in LVM mirrored environments), FCType (FlashCopy type), TargetID (ID of the target set), as in Example 5-24.

   We enter 1 to select the most recent backup.

Example 5-24 Show the detailed backup history

```


          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

------------------------------------------------------------------------------
      Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
           BSN    HdwID   FCType  TargetID FlashBack RTime(min)
------------------------------------------------------------------------------
 [1] - 25.07.2006 21:26:50  DB  online   ok  ok                  S0000039.LOG
           00025  -       INCR     1               0
 [2] - 25.07.2006 18:47:13  DB  N/A      -   invalid
 [3] - 25.07.2006 18:28:55  DB  N/A      -   invalid
 [4] - 25.07.2006 18:23:01  DB  N/A      -   invalid
 [5] - 25.07.2006 18:20:42  DB  N/A      -   invalid

   [d] -  hide details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
```

```
   [x] -  exit tdphdwdb2

 Enter your selection: 1
```

4. Our most recent backup was made to both FlashCopy and Tivoli Storage Manager. We can choose to restore from either one. We select to restore from the Tivoli Storage Manager backup — enter `r` as in Example 5-25.

Example 5-25 Selection of the backup type to restore

```
  [f]  -  FlashBack from FlashCopy run
  [r]  -  Restore from TSM

  [x]  -  exit tdphdwdb2

 Enter your selection: r
```

5. Choose what time to rollforward the database. We selected to rollforward our database to the end of the logs by entering `e` as in Example 5-26.

Example 5-26 Getting the rollforward recovery option

```
You select backup number 1 with BackupID 20060725212650
.
.
.
--------------------------------------------------------------------------------

           R o l l f o r w a r d   D a t a b a s e

--------------------------------------------------------------------------------
           Node       1st active Log      DB2 overflow Log path
--------------------------------------------------------------------------------
           0000        S0000039.LOG      /db2/PR1/log_dir/NODE0000/logsafe/
--------------------------------------------------------------------------------


 Enter the time to rollforward to


  [timestamp]  -  any timestamp with format YYYY-MM-DD-HH.MM.SS between
                  2006-07-25-22.12.07 and
                  2006-07-26-01.38.02 (Caution!! Use server time)

  [e]  -  to end of logs

  [x]  -  exit tdphdwdb2

 Enter your selection: e
```

6. You are prompted to confirm the section, in Example 5-27.

Example 5-27 Getting confirmation

```
 You want to restore the backup from
         25.07.2006  21:26:50 (server time)
         26.07.2006  02:26:50 (coordinated universal time (UTC))
 You want to rollforward the database to end of logs


 Is this correct [y/n] : y
```

7. Now the restore starts. In Example 5-28, the preparation stage copies the current log files to the logsafe directory.

Example 5-28 Preparing the restore

```
           P r e p a r i n g   t h e   R e s t o r e


Starting database manager...

Start the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 5 on all EEE nodes...
...
--------------------------------------------------------------------------------

             S t a r t i n g   t h e   R e s t o r e


Stopping database manager...

Force all applications for database PR1 ...
 waiting for all applications to be forced...

 all applications were forced...

Stop the database manager db2pr1 ...

Starting database manager...

Start the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 6 on all EEE nodes...
...
Checking system database directory
Checking local database directory /db2/PR1

     Checking freespace in PR1 logpath: /db2/PR1/log_dir/NODE0000/

Freespace in directory /db2/PR1/log_dir/NODE0000/ is 57 %  (1.94 GB)

 Saving old DB2 logfiles from /db2/PR1/log_dir/NODE0000/ to
/db2/PR1/log_dir/NODE0000/logsafe/
 This may take a few seconds...

IDS2306I Issuing command 'ls /db2/PR1/log_dir/NODE0000/S*.LOG > /dev/null 2>&1
echo hdwIntRC: $? ' ...
hdwIntRC: 0
```

```
IDS2306I Issuing command 'cp -p /db2/PR1/log_dir/NODE0000/S*.LOG
/db2/PR1/log_dir/NODE0000/logsafe/
echo hdwIntRC: $? ' ...
hdwIntRC: 0
```

8. This stage starts the database restore using Data Protection for mySAP command, as shown in Example 5-29.

Example 5-29 Starts database restore

```
           Restore of database PR1 node 0000 started

IDS2307I Issuing DB2 command 'db2 terminate ; export DB2NODE=0 ; db2 "restore db
PR1 load /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a OPEN 001 SESSIONS taken at
20060725212650 WITH 002 BUFFERS BUFFER 01024 PARALLELISM 001 without prompting"
echo hdwIntRC: $?' ...
DB20000I  The TERMINATE command completed successfully.
SQL2540W  Restore is successful, however a warning "2539" was encountered
during Database Restore while processing in No Interrupt mode.
hdwIntRC: 2
```

9. The message in Example 5-30 shows that the database restore was completed successfully.

Example 5-30 Successful database restore completion

```
           Restore of database PR1 finished successfully
```

10. Now the rollforward recovery starts. You will see the list of files required. If the log files required for the rollforward recovery are not ready in the log directory, you should restore them using **brrestore** at this stage. Note that Data Protection for FlashCopy does not backup the offline log files — you have to use **brarchive** for this. See the SAP manual, *BC R/3 Database Guide: DB2 Universal Database for UNIX & Windows,* or run **brarchive -help**. We also provide some more details on log archiving in 2.6.1, “DB2 logs” on page 43.

    After all the logs are available, press Enter to start rollforward recovery, as in Example 5-31.

Example 5-31 Prepare the log files for the rollforward recovery

```
          S t a r t i n g   t h e   E E E   R e c o v e r y

 You have to restore all DB2 logfiles beginning with

-------------------------------------------------------------------------------
          EEE Node    1st active Log      DB2 overflow Log path
-------------------------------------------------------------------------------
           0000        S0000039.LOG      /db2/PR1/log_dir/NODE0000/logsafe/
-------------------------------------------------------------------------------

 up to end of logs
```

```
 by using 'brrestore' or Data Protection for mySAP (backom).


IDS2522I Press [ENTER] when all logfiles are restored...
```

11. **tdphdwdb2** runs the rollforward process, as shown in Example 5-32.

Example 5-32 Running the rollforward recovery

```
IDS2307I Issuing DB2 command 'db2 terminate ; export DB2NODE=0 ; db2 "rollforward
db PR1 to end of logs overflow log path ( /db2/PR1/log_dir/overflow ,
/db2/PR1/log_dir/NODE0000/logsafe/ on node 0 )"
echo hdwIntRC: $?' ...
DB20000I  The TERMINATE command completed successfully.

                                Rollforward Status

 Input database alias                   = PR1
 Number of nodes have returned status   = 1

 Node number                            = 0
 Rollforward status                     = DB  working
 Next log file to be read               = S0000041.LOG
 Log files processed                    = S0000040.LOG - S0000040.LOG
 Last committed transaction             = 2006-07-26-06.35.55.000000

DB20000I  The ROLLFORWARD command completed successfully.
hdwIntRC: 0
```

12. The messages shown in Example 5-33 are displayed after the rollforward is complete.

Example 5-33 Request of the rollforward stop

```
          Recovery of database PR1 finished

  Use the command

     db2 rollforward database PR1 stop

  to stop the rollforward recovery.
```

13. To indicate that rollfoward is finished, so the database can be brought online, use the **stop** command as shown in Example 5-34, using the db2pr1 user id.

Example 5-34 Stop the rollforward recovery

```
db2pr1@:/db2/PR1/dbs db2 rollforward database PR1 stop

                                Rollforward Status

 Input database alias                   = PR1
 Number of nodes have returned status   = 1

 Node number                            = 0
 Rollforward status                     = not pending
 Next log file to be read               =
```

```
 Log files processed                  = S0000040.LOG - S0000040.LOG
 Last committed transaction           = 2006-07-26-06.35.55.000000

DB20000I  The ROLLFORWARD command completed successfully.
```

14. You can verify if the database is working correctly by using the **db2 connect** command, as shown in Example 5-35.

Example 5-35 Verify the database status after recovery

```
db2pr1@:/db2/PR1/dbs db2 connect to pr1

   Database Connection Information

 Database server        = DB2/AIX64 8.2.5
 SQL authorization ID   = DB2PR1
 Local database alias   = PR1
```

5.3 Database backup and restore with FlashCopy NOCOPY option

In this section, we test the exactly the same scenario as 5.2, “Database backup and restore with FlashCopy backup disks” on page 123, but FLASHCOPY_TYPE on the Data Protection for FlashCopy profile will be set to the NOCOPY value.

5.3.1 Database Backup with NOCOPY option

The Data Protection for FlashCopy command **tdphdwdb2 -f backup -p initSID.fcs** is used for this backup.

Sample database backup with NOCOPY Procedure

Because the output of this backup scenario is very similar to 5.2.1, “Database backup with FlashCopy backup disks” on page 124, we will only show the distinguishing output here.

1. The FlashCopy is running with NOCOPY option in Example 5-36.

Example 5-36 Performing NOCOPY FlashCopy

```
IDS1030I FlashCopy started ...
EEP1625I Number of volumes to be processed by Flashcopy: 9
EEP0354I Performing NOCOPY FlashCopy of source volume 7592481137D to target volume
75924811291
EEP0354I Performing NOCOPY FlashCopy of source volume 75924811289 to target volume
75924811390
EEP0354I Performing NOCOPY FlashCopy of source volume 75924811286 to target volume
7592481138F
EEP0354I Performing NOCOPY FlashCopy of source volume 75924811283 to target volume
7592481138E
EEP0354I Performing NOCOPY FlashCopy of source volume 75924811282 to target volume
7592481138D
EEP0354I Performing NOCOPY FlashCopy of source volume 75924811281 to target volume
75924811299
EEP0354I Performing NOCOPY FlashCopy of source volume 75924811380 to target volume
75924811296
```

```
EEP0354I Performing NOCOPY FlashCopy of source volume 7592481137F to target volume
75924811293
EEP0354I Performing NOCOPY FlashCopy of source volume 7592481137E to target volume
75924811292
IDS1031I FlashCopy successful.
```

2. The backup process now mounts the file system to the backup system and begins the backup, as shown in Example 5-37. Because this backup is using the NOCOPY option, the FlashCopy backup on disk cannot be used for the recovery. All the disks are deleted from the backup system, and the **withdraw** command is performed after finishing the backup to Tivoli Storage Manager. Note the output message that you cannot use the disk backup for restore, you can only restore from the Tivoli Storage Manager Server.

Example 5-37 Withdrawing the FlashCopy volumes

```
EEP0138I Flashcopy type is set to NOCOPY.
Removing disk meta data for all target disks...
This backup is NOT valid for a FlashCopy restore.
Please restore from TSM Server.
EEP0127I Removing device : hdisk61
EEP0127I Removing device : hdisk60
EEP0127I Removing device : hdisk59
EEP0127I Removing device : hdisk58
EEP0127I Removing device : hdisk57
EEP0127I Removing device : hdisk55
EEP0127I Removing device : hdisk52
EEP0127I Removing device : hdisk51
EEP0127I Removing device : hdisk50
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 07/28/06-00:12:03.
IDS1061I Start of withdraw of the target-source pairs ...
EEP0020I ====>Performing DP FOR FlashCopy WITHDRAW command.
EEP0357I Performing FlashCopy withdraw of source volume 7592481137D from target
volume 75924811291
EEP0357I Performing FlashCopy withdraw of source volume 7592481137E from target
volume 75924811292
EEP0357I Performing FlashCopy withdraw of source volume 7592481137F from target
volume 75924811293
EEP0357I Performing FlashCopy withdraw of source volume 75924811380 from target
volume 75924811296
EEP0357I Performing FlashCopy withdraw of source volume 75924811281 from target
volume 75924811299
EEP0357I Performing FlashCopy withdraw of source volume 75924811282 from target
volume 7592481138D
EEP0357I Performing FlashCopy withdraw of source volume 75924811283 from target
volume 7592481138E
EEP0357I Performing FlashCopy withdraw of source volume 75924811286 from target
volume 7592481138F
EEP0357I Performing FlashCopy withdraw of source volume 75924811289 from target
volume 75924811390
IDS1047I End of listing.
```

Checking the results of the backup with NOCOPY option

After the backup with NOCOPY option is complete, if we check the backup results with the **tdphdwdb2 -f restore** command, we can see that only the Tivoli Storage Manager backup is available for the restore -— the FlashCopy backup is invalid status for the restore. This is shown in Example 5-38.

Example 5-38 Checking the results of the backup with NOCOPY option

```
          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

--------------------------------------------------------------------------------
       Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
--------------------------------------------------------------------------------
 [1] - 27.07.2006 23:27:06  DB  online   ok  invalid              S0000051.LOG
 [2] - 27.07.2006 18:31:50  DB  online   -   invalid              S0000050.LOG
 [3] - 27.07.2006 17:57:50  DB  online   -   invalid              S0000048.LOG
 [4] - 26.07.2006 23:30:26  DB  online   -   invalid              S0000046.LOG
 [5] - 26.07.2006 19:36:26  DB  online   -   invalid              S0000045.LOG

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection:
```

5.3.2 Database restore from backup taken with NOCOPY option

The restore process from the Tivoli Storage Manager media is exactly the same as in 5.2.2, “Database restore from Tivoli Storage Manager” on page 133.

5.4 FlashCopy backup and FlashBack restore

In this section, we cover the FlashCopy disk backup and restore from the FlashCopy disk. In this case, there is no backup to Tivoli Storage Manager. At the end of this section, we discuss FlashCopy backup with multiple target volume sets.

5.4.1 FlashCopy backup

When you use the **-f flashcopy** parameter with the **tdphdwdb2** command, a disk-only FlashCopy of the SAP DB2 database is performed. The FlashCopy backup is performed exactly the same as in 5.2.1, “Database backup with FlashCopy backup disks”; however there is no backup to the Tivoli Storage Manager server media - no backup object on Tivoli Storage Manager is created. After the FlashCopy is successfully completed, you can use this point-in-time copy of the production database for testing or FlashBack restore using Data Protection for FlashCopy. The FlashCopy backup type used for this FlashCopy backup is defined by FLSAHCOPY_TYPE in the Data Protection for FlashCopy profile, but if this parameter is set to NOCOPY, it is overridden with COPY to make sure it is possible to recover from the FlashCopy. The backup operation must be started on the backup server.

Sample FlashCopy backup procedure

Here is the procedure we followed:

1. Log in to the backup server (uncletitus) using db2 user id(db2pr1).
2. Use the **tdphdwdb2 -f flashcopy -p auntmathilda/initPR1.fcs** command to start the FlashCopy only backup. It checks the Data Protection for FlashCopy profile (initPR1.fcs) and displays the option set, as in Example 5-39.

Example 5-39 Starting FlashCopy operation

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f flashcopy -p auntmathilda/initPR1.fcs


                IBM Tivoli Storage Manager for Hardware
            Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on DB2
                              (TDPHDWDB2)

            FlashCopy Backup utility for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
                Build: 304 generated at 14:32:19 on Mar 14 2006
       (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'COPY'.
Profile                          auntmathilda/initPR1.fcs
Log file                         splitint_?_20060731224824.log
Trace file                       splitint_?_20060731224824.trace
Function                         flashcopy
Log file                         tdphdwdb2_?_20060731224824.log
Trace file                       tdphdwdb2_?_20060731224824.trace

  -- Parameters of tdphdwdb2 profile --

LOGON_HOST_PROD                  auntmathilda    db2pr1
LOGON_HOST_BACK                  uncletitus
BACKUP_MAX                       30
IDS_CONTROL_FILE                 /db2/PR1/dbs/auntmathilda/save/idssave
CONFIG_FILE                      /db2/PR1/dbs/auntmathilda/initPR1.fcp
WORK_DIR                         /db2/PR1/dbs/auntmathilda/work
TRACE                            YES
LOG_TRACE_DIR                    /db2/PR1/dbs/auntmathilda/logtraces
TDPR3_CONFIG_FILE                /db2/PR1/dbs/initPR1.utl
SUPPORT_ADMIN_ASSISTANT          NO
COPYSERVICES_HARDWARE_TYPE       DS8000
DB2_REMOTE_DBALIAS               R_PR1
DB2_RECOVERY_LOG                 /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log
DB2_TDPR3_LIB                    /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a
DB2_PARALLELISM                  1
DB2_NUM_BUFFERS                  2
DB2_BUFFER_SIZE                  1024
PRIMARY_COPYSERVICES_SERVERNAME 9.152.10.57
COPYSERVICES_SERVERPORT          5988
COPYSERVICES_USERNAME            superuser
FLASHCOPY_TYPE                   COPY
VOLUMES_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fct
```

3. A DB2 remote connection retrieves the DB2 information from the production server, as in Example 5-40.

Example 5-40 DB2 Information collection using remote connection

```
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2005I Start of tdphdwdb2 program at: 07/31/06-22:48:24 .
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1

Checking for the node directory entry REMPR1 ...
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
Checking system database directory
IDS0099I message_id = REQ_DB_READ_DB2NODES_CFG
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_READ_DB2NODES_CFG
IDS0099I status     = MSG_OK
connect to Node 0
set client connection to Node 0

Checking for the node directory entry REMPR1_0 ...
Checking system database directory

Connecting to the database R_PR1_0 node 0 with user db2pr1 using ***** ...
TBS name=SYSCATSPACE     | ID=0 | Type=DMS | State=0 - Normal

TBS container name=/db2/PR1/sapdata4/NODE0000/SENTEST01.container000
.
.
.
DB logretain status: RECOVERY
DB userexit status : ON

Verifying alias R_PR1_0 logpath: /db2/PR1/log_dir/NODE0000/
Database Path: /db2/PR1/db2pr1/NODE0000/SQL00001/
```

4. The **tdphdwdb2** operation checks the IDS control file to determine whether a new backup cycle can be started. If the PSI (Progress Status Indicator) and RSI (Restore Status Indicator) of the previous restore cycle show consistent values (see 5.1.2, “Backup and restore cycles”), it starts a new backup cycle (Example 5-41). Here we will show what happens when the number of backup cycles has reached the value defined by BACKUP_MAX in the Data Protection for FlashCopy profile.

Note: As described in 2.7, “Expiration considerations” on page 44, the BACKUP_MAX option controls how much history will be displayed. Backups that are in use are not deleted. Also, if you set BACKUP_MAX to a lower value than the number of versions actually retained (VERSIONS parameter), the latter higher number overrides the value of BACKUP_MAX.

Example 5-41 Starts new backup cycle

```
IDS1035I The IDS control file exists and a new backup cycle entry has been
created.
IDS1101I New assigned Backup Sequence Number    00042
IDS1025I Time stamp: 07/31/06-22:48:50.
```

5. **splitint** from the production system starts with the specified parameters, as shown in Example 5-42.

Example 5-42 Start of splitint

```
IDS1026I Start of splitint on the production system ...
IDS2310W The free space in the file system containing the directory /db2/PR1 is
only 12.67 MB (8 percent).
.
.
.
VOLUMES_FILE                    /db2/PR1/dbs/auntmathilda/initPR1.fct
DB2 instance db2pr1 is using DB2 UDB Version 8.1.1.112
Checking DB2 Instance Bitwidth...
DB2 instance db2pr1 is running in 64 bit mode.
IDS2506I The DB2 instance db2pr1 is running in 64 bit mode. tdphdwdb2 is running
in compatibility mode.
Data Protection for mySAP Version 5.3.2. found
IDS2005I Start of tdphdwdb2 program at: 07/31/06-22:48:39 .
```

6. **splitint** (LVM component) gathers the information about the volumes from the production system, as in Example 5-43.

Example 5-43 Gathering information about volumes

```
IDS2121I Getting the source volumes ...
Function                        getresources_prod
Subfunction                     performsplit
Backup list                     /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0156I Finding the serial numbers ...
IDS1404I The target set with ID '1' is selected for this run.
Matching pair tgt: <75924811291> src: <7592481137D> size: <10737418240_Bytes>
Matching pair tgt: <75924811292> src: <7592481137E> size: <10737418240_Bytes>
Matching pair tgt: <75924811293> src: <7592481137F> size: <10737418240_Bytes>
Matching pair tgt: <75924811296> src: <75924811380> size: <10737418240_Bytes>
Matching pair tgt: <75924811299> src: <75924811281> size: <10737418240_Bytes>
Matching pair tgt: <7592481138D> src: <75924811282> size: <10737418240_Bytes>
Matching pair tgt: <7592481138E> src: <75924811283> size: <10737418240_Bytes>
Matching pair tgt: <7592481138F> src: <75924811286> size: <10737418240_Bytes>
Matching pair tgt: <75924811390> src: <75924811289> size: <10737418240_Bytes>
```

7. In Example 5-44, **tdphdwdb2** suspends database write activities from the backup system.

Example 5-44 Suspends database write activity

```
IDS2560I Suspend database PR1 NODE0000 write activities...
IDS0099I message_id = REQ_DB_SUSPEND
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_SUSPEND
IDS0099I status     = MSG_OK
IDS1602I Waiting for SyncPoint 4 on all EEE nodes...
```

8. **splitint** performs the FlashCopy operation from the production system using the FLASHCOPY_TYPE option, Example 5-45.

Example 5-45 Starts FlashCopy operation

```
IDS2122I Flashcopying the sources to the target volumes ...
Function                       flashcopy_prod
Subfunction                    performsplit
Backup list                    /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0272I Flushing the buffers to disk...
IDS1030I FlashCopy started ...
EEP1625I Number of volumes to be processed by Flashcopy: 9
EEP0354I Performing COPY FlashCopy of source volume 7592481137D to target volume
75924811291
EEP0354I Performing COPY FlashCopy of source volume 75924811289 to target volume
75924811390
EEP0354I Performing COPY FlashCopy of source volume 75924811286 to target volume
7592481138F
EEP0354I Performing COPY FlashCopy of source volume 75924811283 to target volume
7592481138E
EEP0354I Performing COPY FlashCopy of source volume 75924811282 to target volume
7592481138D
EEP0354I Performing COPY FlashCopy of source volume 75924811281 to target volume
75924811299
EEP0354I Performing COPY FlashCopy of source volume 75924811380 to target volume
75924811296
EEP0354I Performing COPY FlashCopy of source volume 7592481137F to target volume
75924811293
EEP0354I Performing COPY FlashCopy of source volume 7592481137E to target volume
75924811292
IDS1031I FlashCopy successful.
```

9. **tdphdwdb2** puts the DB2 production database in 'write resume' mode from the backup system, Example 5-46.

Example 5-46 Resume database write activities

```
IDS2562I Resume database PR1 NODE0000 write activities...
IDS0099I message_id = REQ_DB_RESUME
IDS0099I status     = MSG_OK
IDS0099I message_id = ANS_DB_RESUME
IDS0099I status     = MSG_OK
```

10. Example 5-47 shows the messages from Data Protection for mySAP after a successful backup and **splitint** operation from the production machine is complete.

Example 5-47 End of splitint on the production system

```
BID                             20060731224824
UTL                             /db2/PR1/dbs/initPR1.utl
INF                             -
EBT                             -
EBB                             FULL_ONLINE_DISK_ONLY
EBC                             :0000:/db2/PR1/log_dir/NODE0000/
EBR                             :0000:S0000061.LOG
IDS2033I Information from Data Protection for mySAP has been found with BACKUPID
20060731224824.
IDS1602I Waiting for SyncPoint 8 on all EEE nodes...
...
IDS2124I Exiting with return code 0.
#INFO remote shell terminated successfully
IDS1027I Splitint ended successfully on the production system.
IDS1025I Time stamp: 07/31/06-22:50:16.
```

11. Now **fcagent** starts on the backup system, Example 5-48.

Example 5-48 Start of fcagent

```
IDS1540I Start of fcagent on the backup system ...
IDS2123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /db2/PR1/dbs/auntmathilda/save/tdpessdb2_lst
```

12. The volume group imports and the file systems mount on the backup system, Example 5-49. The reason why we do the varyon and mount is to verify the consistency of the FlashCopied data and to allow cloning (see 2.10, “A service offering: FlashCopy cloning of SAP databases” on page 48 and Appendix B., “Installation and usage of the FlashCopy Cloning offering” on page 247.

Example 5-49 Volume group import and mount on the backup system

```
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EEPO126I Trying to find new devices to match the source device. This process will
take some time.......
EEPO314I Removing the logical device hdisk66 with the same PVID 0058926a737e75e6
in the ODM.
EEPO314I Removing the logical device hdisk59 with the same PVID 0058926a68324d5c
in the ODM.
EEPO314I Removing the logical device hdisk58 with the same PVID 0058926a683249c6
in the ODM.
EEPO314I Removing the logical device hdisk57 with the same PVID 0058926a68324817
in the ODM.
EEPO314I Removing the logical device hdisk55 with the same PVID 0058926a683245eb
in the ODM.
EEPO314I Removing the logical device hdisk53 with the same PVID 0058926a683243bc
in the ODM.
EEPO314I Removing the logical device hdisk52 with the same PVID 0058926a68324215
in the ODM.
EEPO314I Removing the logical device hdisk51 with the same PVID 0058926a68324066
in the ODM.
```

```
EEPO314I Removing the logical device hdisk50 with the same PVID 0058926a68323e35
in the ODM.
EEPO148I Importing volume groups now...
EEPO149I Newly imported volume group: PR1_Otdp1
EEPO124I Mounting filesystem : /db2/PR1/db2pr1.
EEPO124I Mounting filesystem : /db2/PR1/sapdata1.
EEPO124I Mounting filesystem : /db2/PR1/sapdata2.
EEPO124I Mounting filesystem : /db2/PR1/sapdata3.
EEPO124I Mounting filesystem : /db2/PR1/sapdata4.
EEPO124I Mounting filesystem : /db2/PR1/sapdata5.
EEPO124I Mounting filesystem : /db2/PR1/sapdata6.
EEPO124I Mounting filesystem : /db2/PR1/saptemp1.
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 07/31/06-22:54:13.
IDS1602I Waiting for SyncPoint 1 on all EEE nodes...
...
waiting for socket server to stop...
IDS2124I Exiting with return code 0.
```

Checking the results of the FlashCopy backup

After the FlashCopy backup, we can check the backup status and current backup cycle from the Data Protection for FlashCopy **tdphdwdb2** command.

Checking the FlashCopy Backup Result

The **tdphdwdb2 -f restore** command shows the previous backup result, as shown in Example 5-50.

Example 5-50 Checking the FlashCopy backup result

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs
------------------------------------------------------------------------------


          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                        SystemID: PR1

------------------------------------------------------------------------------
      Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
------------------------------------------------------------------------------
 [1] - 31.07.2006 22:48:24  DB  online   -   running   0.4        S0000061.LOG
 [2] - 31.07.2006 22:31:48  DB  online   -   invalid              S0000060.LOG
 [3] - 31.07.2006 22:20:59  DB  online   -   invalid              S0000059.LOG
 [4] - 31.07.2006 22:04:49  DB  online   -   invalid              S0000058.LOG
 [5] - 31.07.2006 21:40:10  DB  online   -   invalid              S0000057.LOG

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection: r
```

Although the output from the **tdphdwdb2 -f backup** command shows that the backup was complete, the physical FlashCopy job is still in a running status — blocks are still being copied (there is no entry in the TSM column, because no backup was done to Tivoli Storage Manager). At this moment, the FlashBack restore is not possible. If you wait for a moment, it will be completed as in Example 5-51, but if it has not completed for a long time, check the connectivity to the disk system. Sometimes, restarting the CIMOM will fix the problem.

Example 5-51 Checking the FlashCopy backup result

```
          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

--------------------------------------------------------------------------------
       Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
--------------------------------------------------------------------------------
 [1] - 31.07.2006 22:48:24  DB  online   -   ok                   S0000061.LOG
 [2] - 31.07.2006 22:31:48  DB  online   -   invalid              S0000060.LOG
 [3] - 31.07.2006 22:20:59  DB  online   -   invalid              S0000059.LOG
 [4] - 31.07.2006 22:04:49  DB  online   -   invalid              S0000058.LOG
 [5] - 31.07.2006 21:40:10  DB  online   -   invalid              S0000057.LOG

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection:
```

We check which file systems are mounted, in Example 5-52. All the SAP file systems that were mounted in Example 5-52 are still mounted on uncletitus, the backup server.

Example 5-52 File system mount status on the backup system after FlashCopy backup

```
root@uncletitus:/ df
Filesystem    512-blocks      Free %Used    Iused %Iused Mounted on
.
.
.
/dev/db2homelv     262144    219304   17%      211     1% /db2/PR1
auntmathilda:/db2/PR1/dbs     327680     90488   73%     3298    25% /db2/PR1/dbs
/dev/lvPR1pr1      786432    566752   28%      594     1% /db2/PR1/db2pr1
/dev/lvPR1data1   73400320   5521208   93%       14     1% /db2/PR1/sapdata1
/dev/lvPR1data2   23068672   2215808   91%       16     1% /db2/PR1/sapdata2
/dev/lvPR1data3   41943040   2614344   94%       11     1% /db2/PR1/sapdata3
/dev/lvPR1data5   18874368   3510800   82%        8     1% /db2/PR1/sapdata5
/dev/lvPR1data6    1310720    900232   32%        7     1% /db2/PR1/sapdata6
/dev/lvPR1datat    2097152   2096056    1%       12     1% /db2/PR1/saptemp1
```

Because all the FlashCopy backup volumes are in a mounted status on the backup system after the FlashCopy backup, the mounted volume should be unmounted from the backup system using **tdphdwdb2 -f unmount** or **tdphdwdb2 -f withdraw** before the next backup operation (**-f backup** or **-f flashcopy** on the **tdphdwdb2** command).

Note: When the FLASHCOPY_TYPE is set to INCR, it will take more time for the next backup operation if you withdraw the relationship between source and target volume with the **`tdphdwdb2 -f withdraw`** command. This is because a full FlashCopy backup is required in this instance.

5.4.2 FlashBack restore

FlashBack restore uses the FlashCopy reverse copy to restore a database directly from the backup disk volumes (target volumes) to the original location (source volumes) of the production system. FlashBack restore can restore FlashCopy images created by **`tdphdwdb2 -f backup`** and **`tdphdwdb2 -f flashcopy`**.

FlashBack restore offers the following benefits. You can:

- Do a quick restore in the event of database failure.
- Restore the operating system storage structure (file system, volume group, tablespaces.)
- Make multiple FlashCopy backups at different times, depending on how much disk you want to use for FlashCopies. This means you can restore the database to different points in time, by selecting which target to FlashBack.

There are a number of situations where FlashBack restore must not be used. We list some here, but it is very important to read carefully the sections “When Not to Use FlashBack Restore” and “FlashBack Restore Limitations” in the manual, *Data Protection for FlashCopy Devices for mySAP Installation and User’s Guide for DB2,* UDB SC33-8208. Special attention is required when making any change to the production server’s hardware configuration, to make sure proper maintenance procedures are observed. We recommend thorough testing of FlashBack restore procedures. Also, the integrity of the FlashCopy target volumes must be maintained — there must be no updates to them after the FlashCopy is complete.

FlashBack restore is not possible in these circumstances, among others:

- If the Data Protection for FlashCopy target volume file (.fct) for the FlashBack Restore is different from the target volume files used for the FlashCopy backup.
- If you are unsure of what backup images you have on the target volumes that you plan to restore using FlashBack Restore
- If the source volume configuration on the production system differs from the source volume configuration during the FlashCopy backup, and you want to preserve the new source volume configuration (for example, if a volume has been added or deleted on the production system since the FlashCopy backup).
- If the backup of the database was performed using Data Protection for FlashCopy with the FLASHCOPY_TYPE parameter specified as NOCOPY.
- If the FlashCopy agent process is not physically completed.
- If there are logical volumes or file systems that belong to other applications in the database volume group, this can cause integrity problem. We recommend having only file systems and logical volumes that are part of the SAP database in the database volume group.
- FlashBack Restore cannot restore a database that was backed up with a version of Data Protection for ESS earlier than V5.3
- The database copy on the target set to be restored must not have been brought online on the backup system at any time after the Data Protection for FlashCopy backup, because in this case, the integrity of the FlashCopy target volumes cannot be guaranteed. You can

maintain the database copy as a standby database using **db2inidb <dbname> as standby** (which is how the Tivoli Storage Manager backup, if made, is done).

- If you run the withdraw command for the target volumes, the integrity of the FlashCopy target volumes cannot be guaranteed — FlashBack restore is not possible.
- A FlashCopy backup from ESS volumes cannot be restored directly to DS volumes.

Sample FlashBack restore scenarios

In this section, we test the FlashBack restore operation in these scenarios:

- No change made after FlashCopy backup
- File system added after FlashCopy backup
- File system removed after FlashCopy backup
- Source volume added after FlashCopy backup

FlashBack restore scenario 1: No change made after FlashCopy backup

Before you start the restore, make sure that the file system containing the DB2 logfiles has more than 55% of free space. The restore process creates a directory called logsafe there, and saves the old DB2 logfiles there. Proceed as follows:

1. Log in to the production server (auntmathilda) using the DB2 user id db2pr1.
2. We use the **tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs** command to start the restore operation. It checks the Data Protection for FlashCopy profile (initPR1.fcs) and displays the option set and current environment. Then the interactive menu (Example 5-53) is displayed. We select to restore the backup numbered 1.

Example 5-53 Show the backup history

```
db2pr1@:/db2/PR1 cd dbs
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs
------------------------------------------------------------------------------


          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                          SystemID: PR1

------------------------------------------------------------------------------
      Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
------------------------------------------------------------------------------
 [1] - 31.07.2006 22:48:24  DB  online   -   ok                  S0000061.LOG
 [2] - 31.07.2006 22:31:48  DB  online   -   invalid             S0000060.LOG
 [3] - 31.07.2006 22:20:59  DB  online   -   invalid             S0000059.LOG
 [4] - 31.07.2006 22:04:49  DB  online   -   invalid             S0000058.LOG
 [5] - 31.07.2006 21:40:10  DB  online   -   invalid             S0000057.LOG

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection: 1
```

3. Because this backup is only on FlashCopy, our only possibility is to do a FlashBack restore. Hence, we do not see the restore type choices which were displayed in Example 5-53.

   We can decide whether to save the active logfiles to the logsafe directory or not. We choose to save, as in Example 5-54.

Example 5-54 Option to save active logfiles during restore process

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

          R e c o v e r y   o f   D a t a b a s e

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

 Do you want to save all active logfiles to logsafe directory?
 !! This step may take several minutes and needs double space in the Log path !!

  [s]  -  save to logsafe directory   (this may take several minutes)

  [n]  -  do not save logfiles


  [x]  -  exit tdphdwdb2

 Enter your selection: s
```

4. Choose the point to rollforward the database. We select to rollforward our database to the end of the logs by entering e, as in Example 5-55.

Example 5-55 Set the rollforward recovery option

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

          R o l l f o r w a r d   D a t a b a s e

--------------------------------------------------------------------------------
          Node       1st active Log      DB2 overflow Log path
--------------------------------------------------------------------------------
          0000        S0000061.LOG      /db2/PR1/log_dir/NODE0000/logsafe/
--------------------------------------------------------------------------------


 Enter the time to rollforward to


  [timestamp]  -  any timestamp with format YYYY-MM-DD-HH.MM.SS between
                  2006-07-31-22.50.04 and
                  2006-08-01-00.27.24 (Caution!! Use server time)

  [e]  -  to end of logs

  [x]  -  exit tdphdwdb2

 Enter your selection: e
```

5. In Example 5-56, we confirm our selection.

Example 5-56 Getting confirmation

```
You want to FlashBack the FlashCopy run from
        31.07.2006  22:48:24 (server time)
        01.08.2006  03:48:24 (coordinated universal time (UTC))
You want to rollforward the database to end of logs


Is this correct [y/n] : y
```

6. When we confirm, the restore starts. The database is now offline. First the current log files are copied to the logsafe directory, as in Example 5-57.

Example 5-57 Prepare the restore

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

         P r e p a r i n g   t h e   F l a s h B a c k


Starting database manager...

Start the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 5 on all EEE nodes...
...



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

           S t a r t i n g   t h e   F l a s h B a c k

Checking system database directory
Checking local database directory /db2/PR1
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1
IDS1602I Waiting for SyncPoint 6 on all EEE nodes...
...

Stopping database manager...

Force all applications for database PR1 ...
 waiting for all applications to be forced...

 all applications were forced...

Stop the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 7 on all EEE nodes...
...

     Checking freespace in PR1 logpath: /db2/PR1/log_dir/NODE0000/
```

```
Freespace in directory /db2/PR1/log_dir/NODE0000/ is 61 %  (2.06 GB)

 Saving old DB2 logfiles from /db2/PR1/log_dir/NODE0000/ to
/db2/PR1/log_dir/NODE0000/logsafe/
 This may take a few seconds...

IDS2306I Issuing command 'ls /db2/PR1/log_dir/NODE0000/S*.LOG > /dev/null 2>&1
echo hdwIntRC: $? ' ...
hdwIntRC: 0
IDS2306I Issuing command 'cp -p /db2/PR1/log_dir/NODE0000/S*.LOG
/db2/PR1/log_dir/NODE0000/logsafe/
echo hdwIntRC: $? ' ...
hdwIntRC: 0
```

7. **splitint** starts the database restore, as in Example 5-58.

Example 5-58 Start FlashBack restore

```
IDS2306I Issuing command '/db2/PR1/dbs/splitint -f flashback -p
auntmathilda/initPR1.fcs -T 20060801002712 -b 20060731224824
```

8. **splitint** now checks the availability of the source volumes and checks the file system list on the volume group, as shown in Example 5-59.

Example 5-59 Checking the file system and volumes on the production system

```
EEP0156I Finding the serial numbers ...
PR1datavg:
LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT POINT
lvPR1pr1            jfs2       3     3     1    open/syncd    /db2/PR1/db2pr1
loglv34             jfs2log    1     1     1    open/syncd    N/A
lvPR1data1          jfs2       280   280   4    open/syncd    /db2/PR1/sapdata1
lvPR1data2          jfs2       88    88    2    open/syncd    /db2/PR1/sapdata2
lvPR1data3          jfs2       160   160   4    open/syncd    /db2/PR1/sapdata3
lvPR1data4          jfs2       48    48    2    open/syncd    /db2/PR1/sapdata4
lvPR1data5          jfs2       72    72    2    open/syncd    /db2/PR1/sapdata5
lvPR1data6          jfs2       5     5     1    open/syncd    /db2/PR1/sapdata6
lvPR1datat          jfs2       8     8     2    open/syncd    /db2/PR1/saptemp1
PR1datavg:
PV_NAME           PV STATE          TOTAL PPs   FREE PPs    FREE DISTRIBUTION
hdisk36           active            79          0           00..00..00..00..00
hdisk37           active            79          0           00..00..00..00..00
hdisk38           active            79          0           00..00..00..00..00
hdisk39           active            79          0           00..00..00..00..00
hdisk27           active            79          0           00..00..00..00..00
hdisk28           active            79          19          00..00..00..03..16
hdisk29           active            79          27          00..00..00..11..16
hdisk32           active            79          0           00..00..00..00..00
hdisk35           active            79          0           00..00..00..00..00
```

9. If the volumes are still assigned correctly, it displays the summary of the file systems as in Example 5-60. It includes their sizes on the backed up volumes and the file systems which will be restored. It only lists the file systems required for the SAP data recovery (any empty file system will not be listed here — see “Special case: Where a file system was empty when the FlashCopy was made” on page 157).

Because this is our last chance to either stop here, or continue the FlashBack, we must:

- Note any changes to the production system made since the FlashCopy backup - because these will be lost.
- Make notes of any manual steps to be performed after the FlashBack. For example, if we had created a new file system on the database volume group after the FlashCopy, it will no longer exist after the FlashBack restore. Therefore we must note here its name/size and other details, and back up its contents (for example, to Tivoli Storage Manager or **tar** command) so that we can re-define, mount it, and restore after the FlashBack.

Enter `c` to continue the restore (or enter `s` to halt the process).

Example 5-60 Show the summary of the file systems

```
EEPO293I List of the current file systems on the backed up volume groups ...
Name            Nodename   Mount Pt               VFS   Size    Options    Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw         yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw        yes
no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw        yes
no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw        yes
no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw        yes
no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw        yes
no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw         yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw         yes  no

EEPO294I List of file systems which will be restored...
Name            Nodename   Mount Pt               VFS   Size    Options   Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw        yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw        yes  no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw        yes  no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw        yes  no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw        yes  no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw        yes  no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw        yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw        yes  no
IDS1084I This is your last chance to stop the FlashBack Restore. Enter 'c[ont]' to
continue, 's[top]' to cancel.
c
```

10. All the listed file systems and the volume group are now deleted on the production server.

Example 5-61 Delete the source volumes and file systems

```
IDS1441I Checking the FlashCopy relations, please wait ...
IDS1134I Disabling the volumes and filesystems ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
#UNMOUNTING_FS
EEPO273I Unmounting the file system /db2/PR1/saptemp1...
```

```
EEP0402I rmfs -r /db2/PR1/saptemp1
EEP0273I Unmounting the file system /db2/PR1/sapdata6...
EEP0402I rmfs -r /db2/PR1/sapdata6
EEP0273I Unmounting the file system /db2/PR1/sapdata5...
EEP0402I rmfs -r /db2/PR1/sapdata5
EEP0273I Unmounting the file system /db2/PR1/sapdata4...
EEP0402I rmfs -r /db2/PR1/sapdata4
EEP0273I Unmounting the file system /db2/PR1/sapdata3...
EEP0402I rmfs -r /db2/PR1/sapdata3
EEP0273I Unmounting the file system /db2/PR1/sapdata2...
EEP0402I rmfs -r /db2/PR1/sapdata2
EEP0273I Unmounting the file system /db2/PR1/sapdata1...
EEP0402I rmfs -r /db2/PR1/sapdata1
EEP0273I Unmounting the file system /db2/PR1/db2pr1...
EEP0402I rmfs -r /db2/PR1/db2pr1
EEP0402I rmlv -f loglv34
EEP0152I Removing volume group PR1datavg ....
EEP0153I Varied off and exported volume group : PR1datavg
```

11. The FlashBack starts from the target to the source volumes, as in Example 5-62.

Example 5-62 Reverse FlashCopy (FlashBack)

```
IDS1135I FlashCopying the target to the source volumes ...
IDS1030I FlashCopy started ...
EEP1625I Number of volumes to be processed by Flashcopy: 9
EEP0354I Performing COPY FlashCopy of source volume 75924811291 to target volume
7592481137D
EEP0354I Performing COPY FlashCopy of source volume 75924811390 to target volume
75924811289
EEP0354I Performing COPY FlashCopy of source volume 7592481138F to target volume
75924811286
EEP0354I Performing COPY FlashCopy of source volume 7592481138E to target volume
75924811283
EEP0354I Performing COPY FlashCopy of source volume 7592481138D to target volume
75924811282
EEP0354I Performing COPY FlashCopy of source volume 75924811299 to target volume
75924811281
EEP0354I Performing COPY FlashCopy of source volume 75924811296 to target volume
75924811380
EEP0354I Performing COPY FlashCopy of source volume 75924811293 to target volume
7592481137F
EEP0354I Performing COPY FlashCopy of source volume 75924811292 to target volume
7592481137E
IDS1031I FlashCopy successful.
```

12. After finishing the FlashBack restore, the volume group is imported and file systems are mounted on the production system, as in Example 5-63. File systems that are not used by the database itself will not be mounted automatically.

Example 5-63 Enable volumes and file systems

```
IDS1545I Start of fcagent on the production system ...
IDS1123I Enabling the volumes and filesystems ...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EEP0402I importvg -V 47 -y PR1datavg -n hdisk36
```

```
EEP0274I Bringing up the volume groups...
EEP0124I Mounting filesystem : /db2/PR1/db2pr1.
EEP0124I Mounting filesystem : /db2/PR1/sapdata1.
EEP0124I Mounting filesystem : /db2/PR1/sapdata2.
EEP0124I Mounting filesystem : /db2/PR1/sapdata3.
EEP0124I Mounting filesystem : /db2/PR1/sapdata4.
EEP0124I Mounting filesystem : /db2/PR1/sapdata5.
EEP0124I Mounting filesystem : /db2/PR1/sapdata6.
EEP0124I Mounting filesystem : /db2/PR1/saptemp1.
IDS1077I Semaphore released.
IDS1047I End of listing.
#FS_MOUNTED
IDS1025I Time stamp: 08/01/06-00:32:00.
IDS1024I Exiting with return code 0.
```

13. The database manager and the database are initialized as a mirror copy, as in Example 5-64.

Example 5-64 Initialize the database

```
Starting database manager...

Start the database manager db2pr1 ...
IDS1602I Waiting for SyncPoint 9 on all EEE nodes...
...
Checking system database directory
Checking local database directory /db2/PR1
DB2 instance db2pr1 is a EEE instance.
Default database path: /db2/PR1
TCPIP service name: sapdb2PR1

Initialize database PR1 on NODE0000...
set client connection to Node 0

Run db2inidb PR1 as mirror
IDS2307I Issuing DB2 command 'db2inidb PR1 as mirror
echo hdwIntRC: $?' ...
DBT1000I  The tool completed successfully.
```

14. All the DB2 log files should be restored at this point to the production server, if they are not already available, by using **brrestore**. These will be used for the rollforward recovery. Press Enter when all the logs are available (Example 5-65).

Example 5-65 Prepare the log files for rollforward recovery

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

        S t a r t i n g   t h e   E E E   R e c o v e r y


 You have to restore all DB2 logfiles beginning with

--------------------------------------------------------------------------------
          EEE Node    1st active Log      DB2 overflow Log path
--------------------------------------------------------------------------------
```

```
          0000        S0000061.LOG      /db2/PR1/log_dir/NODE0000/logsafe/
------------------------------------------------------------------------------

 up to end of logs

 by using 'brrestore' or Data Protection for mySAP (backom).


IDS2522I Press [ENTER] when all logfiles are restored...
```

15. Example 5-66 shows that the rollforward command completed successfully.

Example 5-66 Performing rollforward recovery

```
IDS2307I Issuing DB2 command 'db2 terminate ; export DB2NODE=0 ; db2 "rollforward
db PR1 to end of logs overflow log path ( /db2/PR1/log_dir/overflow ,
/db2/PR1/log_dir/NODE0000/logsafe/ on node 0 )"
echo hdwIntRC: $?' ...
DB20000I  The TERMINATE command completed successfully.

                                Rollforward Status

 Input database alias                   = PR1
 Number of nodes have returned status   = 1

 Node number                            = 0
 Rollforward status                     = DB  working
 Next log file to be read               = S0000064.LOG
 Log files processed                    = S0000062.LOG - S0000063.LOG
 Last committed transaction             = 2006-08-01-04.15.20.000000

DB20000I  The ROLLFORWARD command completed successfully.
hdwIntRC: 0
```

16. The message in Example 5-67 displays after the rollforward. To indicate that the rollforward is complete, and start the database, use the **db2 rollforward database PR1 stop** command from the command line.

Example 5-67 Request of the rollforward stop

```
          Recovery of database PR1 finished

  Use the command

     db2 rollforward database PR1 stop

  to stop the rollforward recovery.
```

Special case: Where a file system was empty when the FlashCopy was made

A special case exists if you have any SAP file systems that do not contain any data, but that existed at the time of the FlashCopy. After the FlashBack restore, the file system will not be mounted.

For example, suppose that file system /db2/PR1/sapdata4 existed, but was empty at the time of the FlashCopy backup. If you FlashBack this target set, you will see, as in Example 5-68, that the file system sapdata4 is listed in the current file systems on the backed up volume groups, but not in the list of file systems to be restored. After the FlashBack, you can mount the (empty) file system. Any data stored in the file system after the FlashCopy will be lost, because it has reverted to its empty state.

Example 5-68 Show the summary of the file systems

```
EEPO293I List of the current file systems on the backed up volume groups ...
Name            Nodename   Mount Pt               VFS   Size    Options    Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw         yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw         yes
no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw         yes
no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw         yes
no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw         yes
no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw         yes
no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw         yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw         yes  no

EEPO294I List of file systems which will be restored...
Name            Nodename   Mount Pt               VFS   Size    Options   Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw        yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw        yes  no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw        yes  no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw        yes  no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw        yes  no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw        yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw        yes  no
IDS1084I This is your last chance to stop the FlashBack Restore. Enter 'c[ont]' to
continue, 's[top]' to cancel.
c
```

FlashBack restore scenario 2: File system added since the FlashCopy backup

If a file system is created on the production system after the FlashCopy Backup, the restore process is exactly the same as “FlashBack restore scenario 1: No change made after FlashCopy backup” on page 150 up until the step where the source volume status is displayed (which is Example 5-59 on page 153 in that scenario). It is different from this point here, because we have created another file system that was not included in the original FlashCopy backup. In this scenario, we created a new file system called /Added after the original FlashCopy backup.

We initiate the FlashBack restore as in the previous scenario:

1. Because the file system /Added was created after the FlashCopy backup, the warning message in Example 5-69 displays. The new file system is displayed as part of the PR1datavg volume group on the production system source volume.

Example 5-69 Checking the availability of the source volumes

```
EEP0156I Finding the serial numbers ...
PR1datavg:
LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT POINT
lvPR1pr1            jfs2       3     3     1    open/syncd    /db2/PR1/db2pr1
loglv34             jfs2log    1     1     1    open/syncd    N/A
lvPR1data1          jfs2       280   280   4    open/syncd    /db2/PR1/sapdata1
lvPR1data2          jfs2       88    88    2    open/syncd    /db2/PR1/sapdata2
lvPR1data3          jfs2       160   160   4    open/syncd    /db2/PR1/sapdata3
lvPR1data4          jfs2       48    48    2    open/syncd    /db2/PR1/sapdata4
lvPR1data5          jfs2       72    72    2    open/syncd    /db2/PR1/sapdata5
lvPR1data6          jfs2       5     5     1    open/syncd    /db2/PR1/sapdata6
lvPR1datat          jfs2       8     8     2    open/syncd    /db2/PR1/saptemp1
lvAdded             jfs2       2     2     1    open/syncd    /Added
PR1datavg:
PV_NAME           PV STATE          TOTAL PPs   FREE PPs    FREE DISTRIBUTION
hdisk36           active            79          0           00..00..00..00..00
hdisk37           active            79          0           00..00..00..00..00
hdisk38           active            79          0           00..00..00..00..00
hdisk39           active            79          0           00..00..00..00..00
hdisk27           active            79          0           00..00..00..00..00
hdisk28           active            79          19          00..00..00..03..16
hdisk29           active            79          25          00..00..00..09..16
hdisk32           active            79          0           00..00..00..00..00
hdisk35           active            79          0           00..00..00..00..00
EEP0292W The logical volume lvAdded on the mount point /Added was renamed or newly
added.
 (rc=115 HdwVm::checkLogicalVolume
```

2. Example 5-70 lists the current file systems on the backed up volume and the file systems that will be restored. The current file system list includes the /Added file system, but it is not listed for restore, because it does not exist on the FlashCopy. Because this is our last chance to back out, we must:

   – Note any changes to the production system made since the FlashCopy backup — because these changes will be lost.

   – Make notes of any manual steps to be performed after the FlashBack. For example, because we created a new file system on the database volume group after the FlashCopy (/Added), it will no longer exist after the FlashBack restore. Therefore, we record here its name/size and other details, and back up its contents (for example, to Tivoli Storage Manager or with a **tar** command) so that we can re-define, mount it, and restore after the FlashBack.

   Enter `c` to continue the restore (or `s` to halt the process).

Example 5-70 Show the summary of the file systems

```
EEP0293I List of the current file systems on the backed up volume groups ...
Name            Nodename   Mount Pt               VFS   Size    Options    Auto
Accounting
/dev/lvAdded    --         /Added                 jfs2  524288  rw         no   no
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw         yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw        yes
no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw        yes
no
```

```
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw         yes
no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw         yes
no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw         yes
no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw         yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw         yes  no

EEPO294I List of file systems which will be restored...
Name            Nodename   Mount Pt               VFS   Size    Options   Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw        yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw        yes  no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw        yes  no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw        yes  no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw        yes  no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw        yes  no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw        yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw        yes  no
IDS1084I This is your last chance to stop the FlashBack Restore. Enter 'c[ont]' to
continue, 's[top]' to cancel.
c
```

3. The FlashBack restore disables all the source volumes and file systems, including the newly added /Added file system, as shown in Example 5-71. Because this file system is removed at this stage and the FlashCopy backup had no information about this file system, the new file system will be deleted after FlashBack restore.

Example 5-71 Disable the source volumes and file systems

```
IDS1441I Checking the FlashCopy relations, please wait ...
IDS1134I Disabling the volumes and filesystems ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
#UNMOUNTING_FS
EEPO273I Unmounting the file system /db2/PR1/saptemp1...
EEPO402I rmfs -r /db2/PR1/saptemp1
EEPO273I Unmounting the file system /db2/PR1/sapdata6...
EEPO402I rmfs -r /db2/PR1/sapdata6
EEPO273I Unmounting the file system /db2/PR1/sapdata5...
EEPO402I rmfs -r /db2/PR1/sapdata5
EEPO273I Unmounting the file system /db2/PR1/sapdata4...
EEPO402I rmfs -r /db2/PR1/sapdata4
EEPO273I Unmounting the file system /db2/PR1/sapdata3...
EEPO402I rmfs -r /db2/PR1/sapdata3
EEPO273I Unmounting the file system /db2/PR1/sapdata2...
EEPO402I rmfs -r /db2/PR1/sapdata2
EEPO273I Unmounting the file system /db2/PR1/sapdata1...
EEPO402I rmfs -r /db2/PR1/sapdata1
EEPO273I Unmounting the file system /db2/PR1/db2pr1...
EEPO402I rmfs -r /db2/PR1/db2pr1
EEPO273I Unmounting the file system /Added...
EEPO402I rmfs -r /Added
EEPO402I rmlv -f loglv34
EEPO152I Removing volume group PR1datavg ....
```

```
EEPO153I Varied off and exported volume group : PR1datavg
```

4. The FlashCopy starts from the target to the source volumes - FlashBack restore, as in Example 5-72.

Example 5-72 Reverse FlashCopy (FlashBack)

```
IDS1030I FlashCopy started ...
EEP1625I Number of volumes to be processed by Flashcopy: 9
EEPO354I Performing COPY FlashCopy of source volume 75924811291 to target volume
7592481137D
EEPO354I Performing COPY FlashCopy of source volume 75924811390 to target volume
75924811289
EEPO354I Performing COPY FlashCopy of source volume 7592481138F to target volume
75924811286
EEPO354I Performing COPY FlashCopy of source volume 7592481138E to target volume
75924811283
EEPO354I Performing COPY FlashCopy of source volume 7592481138D to target volume
75924811282
EEPO354I Performing COPY FlashCopy of source volume 75924811299 to target volume
75924811281
EEPO354I Performing COPY FlashCopy of source volume 75924811296 to target volume
75924811380
EEPO354I Performing COPY FlashCopy of source volume 75924811293 to target volume
7592481137F
EEPO354I Performing COPY FlashCopy of source volume 75924811292 to target volume
7592481137E
IDS1031I FlashCopy successful.
```

5. The volume group is imported and the file systems required for the database recovery are mounted (Example 5-73). As expected, the file system /Added is not present!

Example 5-73 Importing and mounting the file systems

```
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EEPO402I importvg -V 47 -y PR1datavg -n hdisk36
EEPO274I Bringing up the volume groups...
EEPO124I Mounting filesystem : /db2/PR1/db2pr1.
EEPO124I Mounting filesystem : /db2/PR1/sapdata1.
EEPO124I Mounting filesystem : /db2/PR1/sapdata2.
EEPO124I Mounting filesystem : /db2/PR1/sapdata3.
EEPO124I Mounting filesystem : /db2/PR1/sapdata5.
EEPO124I Mounting filesystem : /db2/PR1/sapdata6.
EEPO124I Mounting filesystem : /db2/PR1/saptemp1.
IDS1077I Semaphore released.
IDS1047I End of listing.
```

6. After the FlashBack is completed, we check the file systems on the production server. We can see the /Added file system was deleted because it was not included in the FlashCopy backup image (Example 5-74).

Example 5-74 Checking the file system's existence

```
db2pr1@:/db2/PR1/dbs lsvg -l PR1datavg
PR1datavg:
LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT POINT
lvPR1pr1            jfs2       3     3     1    open/syncd    /db2/PR1/db2pr1
```

```
loglv34             jfs2log     1     1     1    open/syncd    N/A
lvPR1data1          jfs2        280   280   4    open/syncd    /db2/PR1/sapdata1
lvPR1data2          jfs2        88    88    2    open/syncd    /db2/PR1/sapdata2
lvPR1data3          jfs2        160   160   4    open/syncd    /db2/PR1/sapdata3
lvPR1data4          jfs2        48    48    2    open/syncd    /db2/PR1/sapdata4
lvPR1data5          jfs2        72    72    2    open/syncd    /db2/PR1/sapdata5
lvPR1data6          jfs2        5     5     1    open/syncd    /db2/PR1/sapdata6
lvPR1datat          jfs2        8     8     2    open/syncd    /db2/PR1/saptemp1
```

Note: Because the file system that was created after the FlashCopy backup is deleted after the FlashBack restore, we must first back up the new file system to Tivoli Storage Manager before performing the FlashBack restore. If the file system is not related to the database, we can create the file system and restore the contents after the rollforward recovery. But if the new file system *is* a part of the database, we must restore the file system after the FlashCopy reverse copy but *before* the database rollforward recovery.

In general, we do not recommend creating non-database file systems on the source volumes.

FlashBack restore scenario 3: File system removed since FlashCopy backup

If you remove a file system that was present when the FlashCopy backup was made, the file system will be present again, after the FlashBack restore. To demonstrate this, we added a file system (called /Added), then made a FlashCopy backup. We then deleted the /Added file system. We will now FlashBack the image. Because the process is similar to the previous scenarios, we will show here only the parts which are different. We initiate the restore as in the previous scenarios.

1. Example 5-75 shows the command output, which shows the volume status listing on the production system. Because the file system /Added has been deleted, it does not appear.

Example 5-75 Listing the file systems and source volumes on the production server

```
EEPO156I Finding the serial numbers ...
PR1datavg:
LV NAME             TYPE      LPs   PPs   PVs  LV STATE      MOUNT POINT
lvPR1pr1            jfs2      3     3     1    open/syncd    /db2/PR1/db2pr1
loglv34             jfs2log   1     1     1    open/syncd    N/A
lvPR1data1          jfs2      280   280   4    open/syncd    /db2/PR1/sapdata1
lvPR1data2          jfs2      88    88    2    open/syncd    /db2/PR1/sapdata2
lvPR1data3          jfs2      160   160   4    open/syncd    /db2/PR1/sapdata3
lvPR1data4          jfs2      48    48    2    open/syncd    /db2/PR1/sapdata4
lvPR1data5          jfs2      72    72    2    open/syncd    /db2/PR1/sapdata5
lvPR1data6          jfs2      5     5     1    open/syncd    /db2/PR1/sapdata6
lvPR1datat          jfs2      8     8     2    open/syncd    /db2/PR1/saptemp1
PR1datavg:
PV_NAME           PV STATE          TOTAL PPs   FREE PPs    FREE DISTRIBUTION
hdisk36           active            79          0           00..00..00..00..00
hdisk37           active            79          0           00..00..00..00..00
hdisk38           active            79          0           00..00..00..00..00
hdisk39           active            79          0           00..00..00..00..00
hdisk27           active            79          0           00..00..00..00..00
hdisk28           active            79          19          00..00..00..03..16
hdisk29           active            79          27          00..00..00..11..16
hdisk32           active            79          0           00..00..00..00..00
hdisk35           active            79          0           00..00..00..00..00
```

2. Example 5-76 shows the file systems on the current production server and the file systems that will be restored which are used by database. Although the deleted file system /Added was included in the FlashCopy backup, it does not display here, because this file system is not required for database recovery. However, it will be restored by the FlashBack, but will not be automatically mounted.

Example 5-76 List of the file systems on the production systems that will be restored

```
EEPO293I List of the current file systems on the backed up volume groups ...
Name            Nodename   Mount Pt               VFS   Size    Options    Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw         yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw         yes
no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw         yes
no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw         yes
no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw         yes
no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw         yes
no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw         yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw         yes  no

EEPO294I List of file systems which will be restored...
Name            Nodename   Mount Pt               VFS   Size    Options   Auto
Accounting
/dev/lvPR1pr1   --         /db2/PR1/db2pr1        jfs2  786432  rw        yes  no
/dev/lvPR1data1 --         /db2/PR1/sapdata1      jfs2  73400320 rw        yes  no
/dev/lvPR1data2 --         /db2/PR1/sapdata2      jfs2  23068672 rw        yes  no
/dev/lvPR1data3 --         /db2/PR1/sapdata3      jfs2  41943040 rw        yes  no
/dev/lvPR1data4 --         /db2/PR1/sapdata4      jfs2  12582912 rw        yes  no
/dev/lvPR1data5 --         /db2/PR1/sapdata5      jfs2  18874368 rw        yes  no
/dev/lvPR1data6 --         /db2/PR1/sapdata6      jfs2  1310720 rw        yes  no
/dev/lvPR1datat --         /db2/PR1/saptemp1      jfs2  2097152 rw        yes  no
IDS1084I This is your last chance to stop the FlashBack Restore. Enter 'c[ont]' to
continue, 's[top]' to cancel.
c
```

3. After the FlashBack restore completion, we can see that the /Added file system exists on the volume group. Because it was not automatically mounted, we mount it now and display the contents as shown in Example 5-77.

Example 5-77 Checking the file systems with the operating system command

```
root@auntmathilda:/ lsvg -l PR1datavg
PR1datavg:
LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT POINT
lvPR1pr1            jfs2       3     3     1    open/syncd    /db2/PR1/db2pr1
loglv34             jfs2log    1     1     1    open/syncd    N/A
lvPR1data1          jfs2       280   280   4    open/syncd    /db2/PR1/sapdata1
lvPR1data2          jfs2       88    88    2    open/syncd    /db2/PR1/sapdata2
lvPR1data3          jfs2       160   160   4    open/syncd    /db2/PR1/sapdata3
lvPR1data4          jfs2       48    48    2    open/syncd    /db2/PR1/sapdata4
lvPR1data5          jfs2       72    72    2    open/syncd    /db2/PR1/sapdata5
```

```
lvPR1data6          jfs2       5     5     1    open/syncd    /db2/PR1/sapdata6
lvPR1datat          jfs2       8     8     2    open/syncd    /db2/PR1/saptemp1
lvAdded             jfs2       2     2     1    closed/syncd  /Added
root@auntmathilda:/ mount /Added
root@auntmathilda:/ ls -l /Added
total 56
-rwxr-xr-x   1 root     system        21429 Aug 01 01:28 hdwmap.sh
drwxr-xr-x   2 root     system          256 Aug 01 01:27 lost+found
-rwxr-xr-x   1 root     system         3983 Aug 01 01:28 reImportVG.sh
root@auntmathilda:/ cat /Added/reImportVG.sh
#!/bin/ksh
SETOPTS="+x"
set ${SETOPTS}
.
.
.
```

FlashBack restore Scenario 4: Source volume added

In this test, we added a volume to the source volume group (that is, a new LUN), but did not create any logical volume or file system on the added volume. If we then do a FlashBack restore, the volume will be deleted from the volume group. During the restore process we see the message shown in Example 5-78.

Example 5-78 Newly added volume will be deleted after FlashBack restore

```
EEPO156I Finding the serial numbers ...
PR1datavg:
LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT POINT
lvPR1pr1            jfs2       3     3     1    open/syncd    /db2/PR1/db2pr1
loglv34             jfs2log    1     1     1    open/syncd    N/A
lvPR1data1          jfs2       280   280   4    open/syncd    /db2/PR1/sapdata1
lvPR1data2          jfs2       88    88    2    open/syncd    /db2/PR1/sapdata2
lvPR1data3          jfs2       160   160   4    open/syncd    /db2/PR1/sapdata3
lvPR1data4          jfs2       48    48    2    open/syncd    /db2/PR1/sapdata4
lvPR1data5          jfs2       72    72    2    open/syncd    /db2/PR1/sapdata5
lvPR1data6          jfs2       5     5     1    open/syncd    /db2/PR1/sapdata6
lvPR1datat          jfs2       8     8     2    open/syncd    /db2/PR1/saptemp1
PR1datavg:
PV_NAME           PV STATE          TOTAL PPs   FREE PPs    FREE DISTRIBUTION
hdisk36           active            79          0           00..00..00..00..00
hdisk37           active            79          0           00..00..00..00..00
hdisk38           active            79          0           00..00..00..00..00
hdisk39           active            79          0           00..00..00..00..00
hdisk27           active            79          0           00..00..00..00..00
hdisk28           active            79          19          00..00..00..03..16
hdisk29           active            79          27          00..00..00..11..16
hdisk32           active            79          0           00..00..00..00..00
hdisk35           active            79          0           00..00..00..00..00
hdisk9            active            15          15          03..03..03..03..03
EEPO297W The newly added volume hdisk9 will be deleted from the database volume
group PR1datavg.
```

4. After the FlashBack restore, we have to manually re-add the LUN back to the volume group to preserve the configuration.

5.4.3 FlashBack restore rerun

It is possible to restart a FlashBack restore that did not complete successfully.

If a FlashCopy running in the background has not yet finished for the latest FlashBack restore, Data Protection for FlashCopy allows the FlashBack restore to be rerun with the same Backup ID. This capability is very useful if the rollforward recovery went beyond the desired point, or if the FlashBack was interrupted for some reason.

5.4.4 FlashCopy backup with multiple target volume sets

In certain situations you might want to restore an older backup version, for example, if a database corruption occurred before the last backup was done. Previous releases of Data Protection for FlashCopy supported only one target volume set (or two if using LVM mirroring), so a restore from a previous backup could only be done from the Tivoli Storage Manager server. V5.3.1 of Data Protection for FlashCopy now supports multiple target volume sets.

For our testing we had two target volume sets available. Example 5-79 shows the definition of a second target volume set in the target volumes file initPR1.fct.

Example 5-79 Sample of the target volumes file initPR1.fct

```
>>> volumes_set_1
#                 target     source           size
TARGET_VOLUME 75924811291 7592481137D 10737418240_Bytes
.....
TARGET_VOLUME 75924811390 75924811289 10737418240_Bytes
<<< volumes_set_1

>>> volumes_set_3
TARGET_VOLUME 75924811177 - -
.....
TARGET_VOLUME 75924811294 - -
<<< volumes_set_3
```

We chose to name the second target volume set 'volumes_set_3'. The manual for Data Protection for FlashCopy always uses 'volumes_set_1' and 'volumes_set_2' in the examples. Different names are valid and so multiple target volume sets (not only two per DS system) are supported.

We assume we have already made the first FlashCopy backup to the original target set. We start the backup on the second target volume set with:

```
tdphdwdb2 -f flashcopy -p auntmathilda/initPR1.fcs -n 3
```

After the backup is complete, we can check the results with **tdphdwdb2 -f restore** command. As shown in Example 5-80, two FlashCopy backup versions are available.

Example 5-80 Check the results of backup with multiple target volume set

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

          B a c k u p   H i s t o r y   f o r   D a t a b a s e
                        SystemID: PR1

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

```
       Backup timestamp(ID) Type         TSM FlashCopy RTime(min) 1st active Log
------------------------------------------------------------------------------
[1] - 02.08.2006 03:16:16  DB  online   -   ok                   S0000064.LOG
[2] - 01.08.2006 21:00:47  DB  online   -   ok                   S0000063.LOG
[3] - 01.08.2006 01:31:52  DB  online   -   invalid              S0000062.LOG
[4] - 31.07.2006 22:48:24  DB  online   -   invalid              S0000061.LOG
[5] - 31.07.2006 22:31:48  DB  online   -   invalid              S0000060.LOG

   [d] -  show details
   [r] -  refresh display
   [o] -  choose from older backups
   [#] -  restore the database with line number #
   [f] -  show FlashCopy backups only (target set state IN_USE)
   [x] -  exit tdphdwdb2

 Enter your selection:
```

The output from **tdphdwdb2 -f inquire** shows the two backups - Example 5-81.

Example 5-81 Output from inquire command after a DISKONLY backup to a second target volume set

```
db2pr1@:/db2/PR1/dbs tdphdwdb2 -f inquire -p auntmathilda/initPR1.fcs

Function                          inquire

-- List of the IDS control Table --

IDS2014I 00045 BSI_DISKANDTAPE PSI_UNMOUNT_DONE 20060801210047 1 20060801205219
08/01/06-20:52:17 20060108205747 exchange.00045 /db2/PR1/dbs/initPR1.utl
:0000:20060801210047 - :0000:/db2/PR1/log_dir/NODE0000/ FULL_ONLINE
:0000:S0000072.LOG - - - 531304 COPY - DISKANDTSM
IDS2014I 00046 BSI_START PSI_FLASHCOPY_QUERY XXXXXXYYMMDDHHMM ????? 20060802021058
- - exchange.00046 - - - - flashcopy - - - - 531304 COPY - DISKANDTSM
IDS2014I 00047 BSI_START PSI_FLASHCOPY_QUERY XXXXXXYYMMDDHHMM 3 20060802025708 - -
exchange.00047 - - - - flashcopy - - - - 531304 COPY - DISKONLY
IDS2014I 00048 BSI_DISKONLY PSI_MOUNT_DONE 20060802031616 3 20060802031616
08/02/06-03:17:14 20060208032243 exchange.00048 /db2/PR1/dbs/initPR1.utl - -
:0000:/db2/PR1/log_dir/NODE0000/ FULL_ONLINE_DISK_ONLY :0000:S0000074.LOG - - -
531304 COPY - DISKONLY

IDS2106I Exiting with return code 0.
```

Now we can have independent backup types of FlashCopy operation at different times during the day.

For example, we make an initial backup each day to DISKANDTAPE. Subsequently, several backups of the offline logs were done automatically by DB2. Then at lunchtime, we do a DISKONLY backup to the second target volume set. In the afternoon we could choose to run a FlashBack restore from either of the two target volume sets, depending to what point in time we want to recover the database. In case of a hardware error, we can also restore from Tivoli Storage Manager because the offline logs were continuously written to the Tivoli Storage Manager server.

5.5 Database backup and restore without FlashCopy backup

We can back up and restore to and from Tivoli Storage Manager, using the Data Protection for mySAP function from the production server. In this case, there will be no FlashCopy made. The backup can be done at the tablespace level, as opposed to FlashCopy, which is always at the database level. For more information, refer to the *Data Protection for mySAP* manual.

5.6 Backup of the offline log files

Clearly, backup of log files is critical for rollforward recovery. We do not cover this in detail here, because it is not automatically performed by Data Protection for FlashCopy. It is intended to provide this functionality in the future.

There are many backup methods available for backing up DB2 offline logs. For example, BR*Tools includes the **brarchive** tool for this purpose, which performs offline log backup operation with Data Protection for mySAP. For more information about **brarchive**, refer to the BR*Tools documentation.

Note: Each time you run an online or FlashCopy backup of the SAP database, you should also run a **brarchive** to back up the offline log files. You will require the offline log files in order to restore an online backup.

5.7 Schedule considerations

Typically backups will be automatically scheduled to make sure they execute regularly.

Scheduling backups on the backup server

For the backups using FlashCopy, you cannot define the backup schedule on the CCMS (Computer Center Management System) in SAP software. That is because the backup operation has to be initiated from the backup system and it does not use BR*Tools in the DB2 environment. From the backup system, the backup schedule can be scheduled using the operating system crontab or Tivoli Storage Manager scheduler, or another external scheduler product like IBM Tivoli Workload Scheduler.

Scheduling DB2 offline log backup on the production system

Data Protection for FlashCopy does not handle the DB2 offline log file that is required for the complete database recovery, so **brarchive** should be scheduled on the production system. We recommend sending the log files to a Tivoli Storage Manager disk storage pool rather than to tape, to eliminate wait periods for a mount point, as well as tape mount times.

5.8 Monitoring backup and restore activity

For the daily monitoring of the scheduled backup operations and problem determination purposes, there are many various hardware and software logs available in our environment.

5.8.1 Log file management

Log file management involves regular monitoring of the various hardware and software logs.

5.8.2 Logs and traces to check

Here we describe logs and traces that can help you in troubleshooting problems.

Data Protection for FlashCopy logs and traces

Data Protection for FlashCopy logs are located in the directory that is specified by LOG_TRACE_DIR of the Data Protection for FlashCopy profile (init<*SID*>.fcs). If this value is not specified, the logs and traces will be placed in the directory as specified by WORK_DIR of the Data Protection for FlashCopy profile. The directory must be shared by NFS between the production and backup servers.

The Data Protection for FlashCopy **tdphdwdb2** and **splitint** commands creates a log file as below when running the various function like split, resync, withdraw, ts_inquire, runagent (except for inquire and password) and others. A trace file below can be requested by specifying the TRACE parameter in the Data Protection for FlashCopy profile. You can leave this parameter set permanently, as it does not create much overhead, and it will help IBM service to more readily isolate a problem.

- tdphdwdb2_b_<tdphdwdb2 function>_<date time stamp>.log — log file for tdphdwdb2 functions running on the backup server
- tdphdwdb2_b_<tdphdwdb2 function>_<date time stamp>.trace — trace file for tdphdwdb2 functions running on the backup server
- tdphdwdb2_p_<tdphdwdb2 function>_<date time stamp>.log — log file for tdphdwdb2 functions running on the production server
- tdphdwdb2_p_<tdphdwdb2 function>_<date time stamp>.trace — trace file for tdphdwdb2 functions running on the production server
- splitint_b_<splitint function>_<date time stamp>.log — log file for **splitint** functions running on the backup server
- splitint_b_<splitint function>_<date time stamp>.trace — trace file for **splitint** functions running on the backup server
- splitint_p_<splitint function>_<date time stamp>.log — log file for **splitint** functions running on the production server
- splitint_p_<splitint function>_<date time stamp>.trace — trace file for **splitint** functions running on the production server

CIM logs and traces

For the DS Open API CIM Agent installed on our environment, we can check the cimom.log in the directory where you installed the CIM agent to verify the CIMOM processing status. For more information for logging and tracing information for the CIM Server (Pegasus), DS Open API CIM Agent, and CIM Agent for SVC, refer to the related documents.

Storage system logs and traces

For storage system logs and traces, consult the documentation for the storage system which you are using.

AIX logs and traces

Information about disk problems can be displayed using the AIX error reporting command:

```
errpt -a
```

6

Backup and restore in Oracle environments

In this chapter we describe the various backup and restore operations of Data Protection for FlashCopy performing with Data Protection for mySAP and FlashCopy with Oracle Database.

We cover the following topics:

- Backup and restore concepts
- Online database backup and restore with FlashCopy backup disks
- Offline database backup and restore with FlashCopy backup disks
- Database backup and restore with FlashCopy NOCOPY option
- FlashCopy backup and FlashBack restore
- Database backup and restore without FlashCopy backup disks
- Backup of the offline redo log files
- Schedule considerations
- Monitoring backup and restore activity

6.1 Backup and restore concepts

In this section we describe some important points that you should understand before attempting real backup and restore operations.

6.1.1 FlashCopy type and Data Protection for FlashCopy backup

Data Protection for FlashCopy can issue three different types of FlashCopy operations

- COPY: All physical blocks of the source are copied.
- NOCOPY: Only the data that changes in the source after the FlashCopy is established is copied. This is also known as copy-on-write.
- INCR: This is a FlashCopy which can be refreshed with updated information. Changes made to the volumes are tracked when the FlashCopy relationships are established, so that a LUN can be refreshed to the source or target's point in time content using only the changed data.

For more information about FlashCopy operations in supported hardware, refer to the IBM Redbooks, *IBM TotalStorage DS8000 Series: Copy Services in Open Environments*, SG24-6788; *IBM System Storage DS6000 Series: Copy Services in Open Environments*, SG24-6783; and *IBM System Storage SAN Volume Controller*, SG24-6423.

The copy type that will be used for the backup operation can be set using the variable FLASHCOPY_TYPE in the Data Protection for FlashCopy profile (init<*SID*>.fcs). The copy type used will be determined as follows:

1. The Data Protection for FlashCopy profile (init<*SID*>.fcs) is examined first. If the FLASHCOPY_TYPE parameter is not specified, the default value COPY will be used.
2. If the FLASHCOPY_TYPE value of the copy type parameter (-C <flashcopy_type>) is specified in the split_options statement in the SAP software profile (init<*SID*>.sap), this value will override the FLASHCOPY_TYPE value in the Data Protection for FlashCopy profile
3. The disk-only backup parameter (‘-d’), if specified in the split_options statement in the SAP software profile (init<*SID*>.sap), will reset the FLASHCOPY_TYPE parameter value to COPY if the intended FLASHCOPY_TYPE in 1, and 2. is NOCOPY.

6.1.2 Backup and restore cycles

Data Protection for FlashCopy has to accomplish many tasks on both the production and backup servers. On the production server, Data Protection for FlashCopy runs the FlashCopy operation from the source to the target volumes. It then imports the volume group, mounts the file systems and runs the backup job on the backup system. These operations must run in sequence — if there is a failure at some specific stage, the status has to be preserved for the next successful operation.To facilitate this control, Data Protection for FlashCopy uses a progress status indicator (PSI), backup status indicator (BSI), and restore status indicator (RSI). Data Protection for FlashCopy will start a new backup or restore cycle only when these values are in an appropriate status. The IDS control file defined for Data Protection for FlashCopy contains these values.

Progress Status Indicator (PSI)

The PSI represents the status of the involved volumes and the AIX storage management environment after a Data Protection for FlashCopy function is complete. Another Data Protection for FlashCopy function can be started only when the PSI shows the correct state.

Here are the PSI values when no problem exists::

- PSI_MOUNT_DONE: This is set on the backup system once all the mounts have been done. It is the normal result when using the split function. The **splitint -f withdraw** has to be run before the next **brbackup** request.
- PSI_UNMOUNT_DONE: This is the normal PSI value after **splitint -f withdraw** or a new **brbackup**. It means that all the file systems on the target volumes are unmounted successfully from the backup system.

Backup Status Indicator (BSI)

The BSI represents whether a FlashCopy or backup completed successfully and a restore can be initiated:

- BSI_START: This is the normal BSI value during the FlashCopy or backup operation.
- BSI_DISKONLY: This is the normal BSI value when the backup to Tivoli Storage Manager completed but the Tivoli Storage Manager backup is not yet complete. At this time, we can only restore from the FlashCopy.

Restore Status Indicator (RSI)

The RSI represents whether a restore or FlashBack restore completed successfully and a backup can be started with a new backup sequence number (BSN):

- RSI_START: This is the normal RSI value during the FlashCopy restore.
- RSI_DISKONLY: This is the normal RSI value after the completion of the FlashCopy background process.

For more information about these PSI, BSI, and RSI values, refer to Chapter 6, “Data Protection for FlashCopy Command” in *Data Protection for FlashCopy Devices for mySAP Installation and User’s Guide for Oracle*, SC33-9207.

Example 6-1 illustrates some of these different indicators.

Example 6-1 List of the IDS Control Table

```
orar31> splitint -f inquire -p /oracle/R31/920_64/dbs/initR31.fcs
IDS1015I Start of splitint program at: 08/09/06-00:31:47 .
Function                        inquire


-- List of the IDS control Table --

IDS1014I 00027 BSI_DISKONLY PSI_UNMOUNT_DONE R31___AOEQEUR6RW 1 20060308030545
08/03/06-03:06:24 20060308031314 exchange.00027 /oracle/R31/920_64/dbs/initR31.utl
/oracle/R31/sapbackup/.bdtepkvb.lst file BRBACKUP FULL NEW - - - 531304 INCR -
DISKANDTSM
IDS1014I 00028 BSI_DISKONLY PSI_UNMOUNT_DONE R31___AOEQEVEMA4 1 20060308032412
08/03/06-03:24:07 20060308033111 exchange.00028 /oracle/R31/920_64/dbs/initR31.utl
/oracle/R31/sapbackup/.bdtepmmj.lst file BRBACKUP FULL NEW - - - 531304 INCR
RSI_DISKONLY DISKONLY
IDS1014I 00029 BSI_DISKONLY PSI_UNMOUNT_DONE R31___AOEQH5XEQ3 1 20060408175257
08/04/06-17:53:50 20060408180127 exchange.00029 /oracle/R31/920_64/dbs/initR31.utl
/oracle/R31/sapbackup/.bdtexjjh.lst file BRBACKUP FULL NEW - - - 531304 INCR
RSI_DISKONLY DISKANDTSM

IDS1023I Exiting with return code 0.
```

Checking the backup cycles

The **splitint -f inquire** command shows the results and details of all backup cycles. In Example 6-1, we show some of the backup cycles. The last line of the output represents the current backup cycle. Here you can see the BSI, RSI, and PSI. The fields displayed are:

- Target set number
- Target set state
- Backup ID associated with the FlashCopy backup
- Backup sequence number
- Backup status
- Processing status
- Status of the backup cycle
- Time required for a FlashCopy

There is currently no detailed description available for individual fields, because they might be changed in a future product release.

We can, however, get some more detailed information about an individual action by using the option '**-b**'. See Example 6-2 for an illustration.

Example 6-2 Show detailed information about a specific backup ID

```
orar31> splitint -f inquire -p /oracle/R31/920_64/dbs/initR31.fcs -b
R31___AOEQH5XEQ3
IDS1014I 1  BACKUP_SEQUENCE_NO          00029
2  BACKUP_STATUS                BSI_DISKONLY
3  PROCESSING_STATUS            PSI_UNMOUNT_DONE
4  BACKUP_ID                    R31___AOEQH5XEQ3
5  VOL_TARGET_SET               1
6  DT_FLASHCOPY_START           20060408175257
7  DT_FLASHCOPY_END             08/04/06-17:53:50
8  DT_MOUNT_END                 20060408180127
9  EXCHANGE_FILE                exchange.00029
10 UTIL_FILE                    /oracle/R31/920_64/dbs/initR31.utl
11 INPUT_FILE                   /oracle/R31/sapbackup/.bdtexjjh.lst
12 BACKINT_OPT_T                file
13 BI_CALLER                    BRBACKUP
14 BI_BACKUP                    FULL
15 BI_REQUEST                   NEW
16 DATABASE_FILE                -
17 DT_WITHDRAW_START            -
18 DT_WITHDRAW_END              -
19 VERSION                      531304
20 FLASHCOPY_TYPE               INCR
21 RSI                          RSI_DISKONLY
22 BACKUP_DESTINATION           DISKANDTSM
```

BSI_DISKONLY means that the FlashCopy backup process has finished successfully and PSI_UNMOUNT_DONE is the normal result of the “backup” function. The target volume set can now be used for a FlashBack restore or for another FlashCopy backup. The RSI_DISKONLY indicates that the FlashBack restore has finished successfully.

The first target volume set was used for this FlashCopy backup. The backup was done to DISKANDTSM (FlashCopy to the target volume set and a backup to the TSM server).

6.1.3 Our lab environment

Figure 6-1 shows our lab environment, which will be used for the tests in the rest of this chapter.

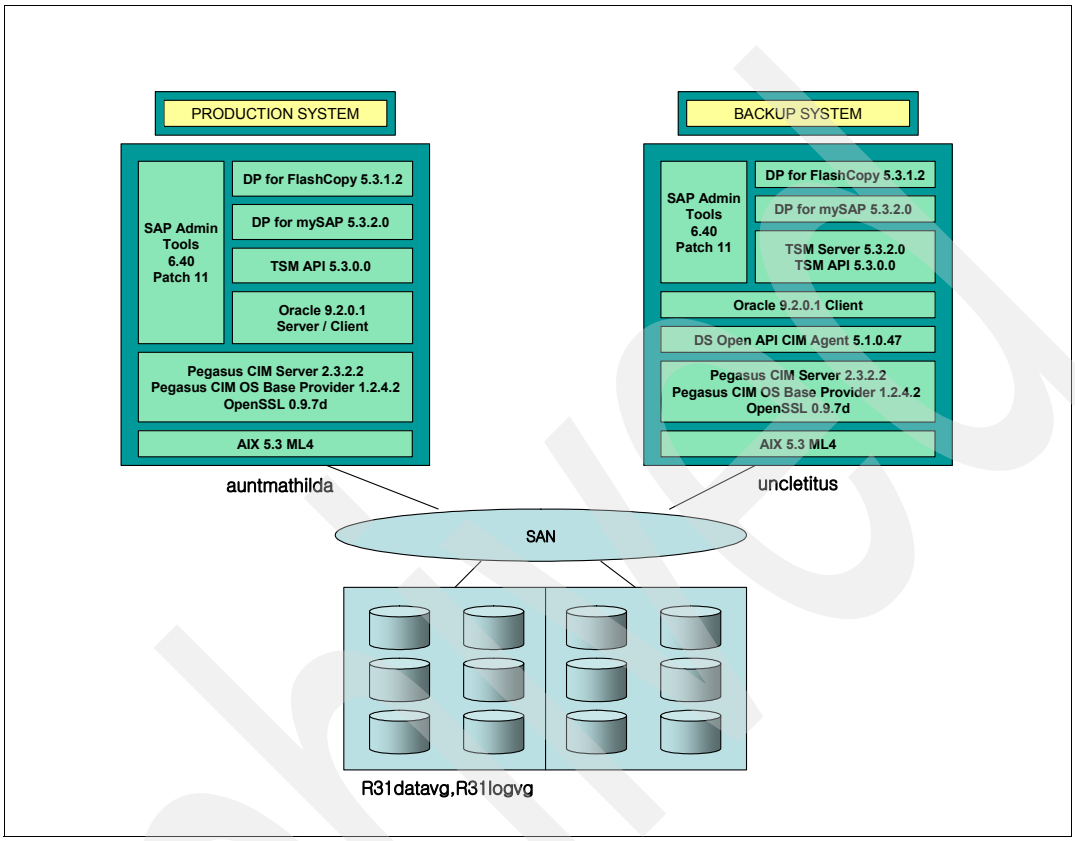


Figure 6-1 Lab environment -Oracle

6.2 Online backup and restore with FlashCopy disks

The Data Protection for FlashCopy for Oracle operation is fully integrated with the BR*Tools command. In this section, we cover the normal Data Protection for FlashCopy backup and restore process. Backup must be started on the backup server, and restore must be started on the production server. The backup creates two backup images — one FlashCopy image and one stored to Tivoli Storage Manager. Each backup can be restored separately; in this section, we will restore from the Tivoli Storage Manager backup image. We will show how to restore from the FlashCopy in 6.5.2, “FlashBack restore” on page 211.

The backup can be initiated only by BR*Tools (**brbackup**), whereas for restore, we have the choice of using BR*Tools (**brrestore**), Data Protection for mySAP (**backfm, backint**), or Data Protection for FlashCopy (**tdphdwora**).

Figure 6-2 shows the files that constitute a complete online_mirror database backup. For the online_mirror backup, the complete database backup is augmented by an NFS file, which will be backed up in each case to the Tivoli Storage Manager. This type of complete database backup is recorded at the file level in the **brbackup** run log and is identified with one backup ID. It can be requested as an entity for a restore process.

For the online_mirror backup, **brbackup** causes a FlashCopy process to be initiated via Data Protection for FlashCopy for all volumes containing the following files:

- All tablespace files
- The database control file(s):
  - For SAP R/3 4.5B, only the first file specified in the control_files section of $ORACLE_HOME/dbs/init<*SID*>.ora
  - For higher releases (4.6D and following), all files specified in the control_files section

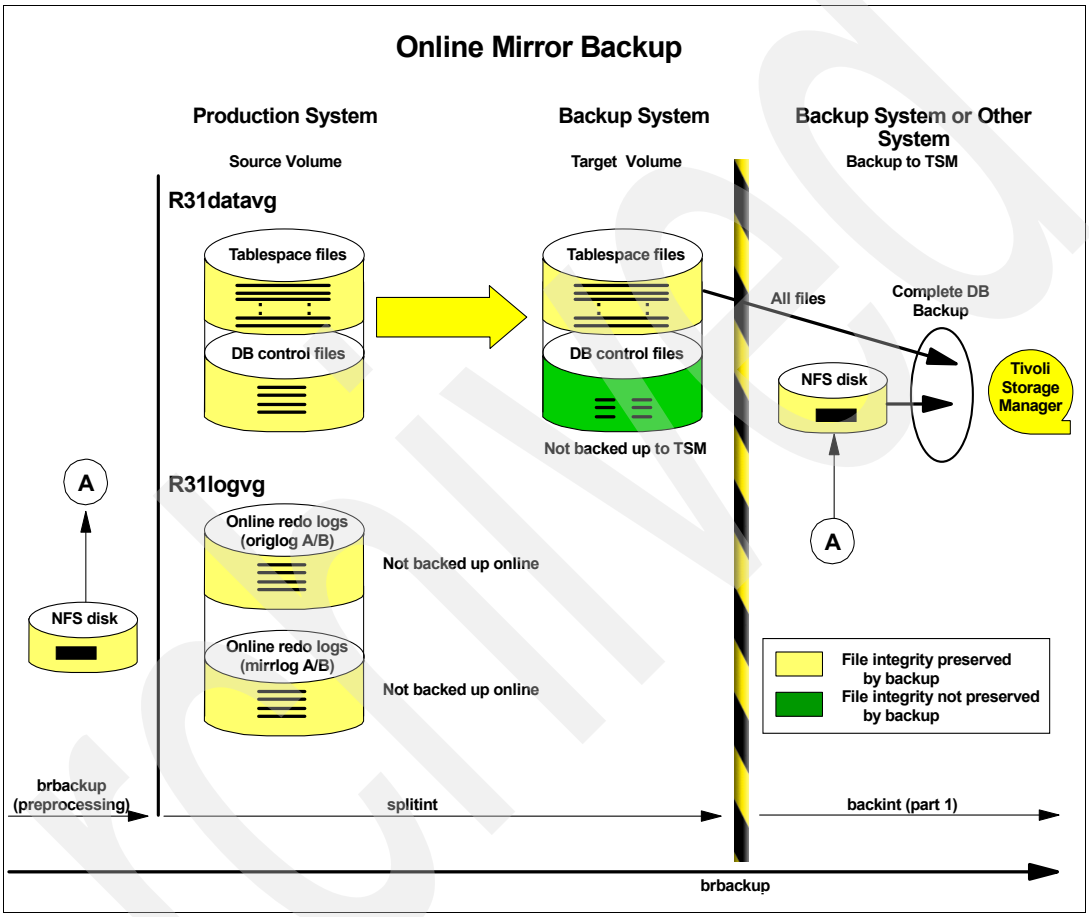


Figure 6-2 Complete database backup for online mirror backup

The **brbackup** calls two executables, **splitint** (for doing the FlashCopy) and **backint** (for doing the Tivoli Storage Manager backup). Both executables receive a different file list as input. In our version of the SAP software (4.7), **splitint** gets all the tablespace files, and all three files specified in the control_files section, and **backint** only gets the data files and temporary control file created within /oracle/<*SID*>/sapbackup.

6.2.1 Online database backup with FlashCopy

For the online backup (hot backup), the database is switched to hot backup mode before the backup is made. After the backup is complete, the database exits from hot backup mode.

Attention: **tdphdwora** cannot be used for the backup command — you must use the BR*Tools command **brbackup** for both online and offline backup on the backup server.

Current profile setting

We use the **brbackup -c -u system/redbook** command to start an online database backup for both FlashCopy disk and to Tivoli Storage Manager. This command references the configuration files below. Instead of specifying backup_type in the initR31.sap file as shown, you can enter the **brbackup** command option **-t online_mirror**. The **brbackup** command option takes priority over the backup_type specified on the initR31.sap file:

- /oracle/R31/920_64/dbs/initR31.sap

```
backup_type = online_mirror
split_option = "-p /oracle/R31/920_64/dbs/initR31.fcs"
split_resync = yes
backup_mode = all
util_par_file = /oracle/R31/920_64/dbs/initR31.utl
```

- /oracle/R31/920_64/dbs/initR31.fcs

```
FLASHCOPY_TYPE INCR
```

- /oracle/R31/920_64/dbs/initR31.utl

```
FCS_FILE /oracle/R31/920_64/dbs/initR31.fcs
```

Sample database backup procedure

This command, and other backup or restore operations, produce very lengthy output, and most of the output is the same with different operations. We have broken the output into sections in order to explain what is going on. We will perform an online database backup using **brbackup** in this section:

1. Log in to the backup system (uncletitus) as Oracle user id (orar31), as shown in Example 6-3.

Example 6-3 Log-in to the backup system

```
root@uncletitus:/ su - orar31
orar31@uncletitus:/oracle/R31>
```

2. We enter the **brbackup -c -u system/redbook** command from the backup server. First, it determines all the table space files that make up the Oracle database on the production server using an Oracle remote connection with Oracle client as shown in Example 6-4.

Example 6-4 Starting backup operation

```
orar31@uncletitus:/oracle/R31>brbackup -c -u system/redbook
BR0051I BRBACKUP 6.40 (36)
BR0055I Start of database backup: bdtekfvx.anf 2006-08-02 01.44.45
BR0477I Oracle pfile /oracle/R31/920_64/dbs/initR31.ora created from spfile
/oracle/R31/920_64/dbs/spfileR31.ora

BR0280I BRBACKUP time stamp: 2006-08-02 01.44.48
BR0319I Control file copy created: /oracle/R31/sapbackup/cntrlR31.dbf 5005312
:
```

3. **splitint** uses the list of files obtained in the previous step, and uses **rexec** on the production server to split the mirror disk as shown in Example 6-5.

Example 6-5 Run splitint on the production system

```
BRO295I Splitting mirror disks...
BRO280I BRBACKUP time stamp: 2006-08-04 17.52.57
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/splitint -u R31 -f split -i
/oracle/R31/sapbackup/.bdtexjjh.lst -t online -c -s -p
/oracle/R31/920_64/dbs/initR31.fcs':
```

4. **splitint** shows the Data Protection for FlashCopy profile setting, as in Example 6-6.

Example 6-6 Data Protection for FlashCopy option setting

```
                  IBM Tivoli Storage Manager for Hardware
   Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on Oracle(R)

         BR*Tools Interface SPLITINT for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
               Build: 304 generated at 14:34:45 on Mar 14 2006
        (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'INCR'.
Profile                         /oracle/R31/920_64/dbs/initR31.fcs
Log file                        splitint_?_20060408175257.log
Trace file                      splitint_?_20060408175257.trace

  -- Parameters of splitint profile --

LOGON_HOST_PROD                 auntmathilda    orar31
LOGON_HOST_BACK                 uncletitus
BACKUP_MAX                      30
IDS_CONTROL_FILE                /oracle/R31/sapbackup/idssave/idssave
CONFIG_FILE                     /oracle/R31/920_64/dbs/initR31.fcp
WORK_DIR                        /oracle/R31/sapbackup/work
TRACE                           YES
LOG_TRACE_DIR                   /oracle/R31/sapbackup/logtraces
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
PRIMARY_COPYSERVICES_SERVERNAME uncletitus
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  INCR
VOLUMES_FILE                    /oracle/R31/920_64/dbs/initR31.fct
```

5. **splitint** checks the IDS control file and determines whether a new backup cycle can be started. If the PSI (Progress Status Indication) and RSI (Restore Status Indicator) of the previous restore cycle are valid (as explained in 6.1.2, “Backup and restore cycles” on page 170), it starts a new backup cycle. At this stage, the oldest backup cycle entries are deleted from the IDS control file if the number of the backup cycles has been reached according to the BACKUP_MAX specified on the Data Protection for FlashCopy profile (initR31.fcs).

Example 6-7 Starts new backup cycle

```
IDS1005I Start of splitint program at: 08/04/06-17:52:57 .
IDS1035I The IDS control file exists and a new backup cycle entry has been
created.
IDS1101I New assigned Backup Sequence Number    00029
```

6. **splitint** starts from the production system with the parameters specified, as in Example 6-8.

Example 6-8 Starting splitint on the production system

```
IDS1411I The intended FlashCopy type has a value of 'INCR'.
Profile                         /oracle/R31/920_64/dbs/initR31.fcs
Log file                        splitint_?_20060408175257.log
Trace file                      splitint_?_20060408175257.trace
IDS1005I Start of splitint program at: 08/04/06-17:53:50 .
EE00020I ====>Performing DP FOR FlashCopy BACKUP command.
IDS1121I Getting the source volumes ...
Function                        getresources_prod
Subfunction                     performsplit
Backup list                     /oracle/R31/sapbackup/work/.bdtexjjh.lst
```

7. **splitint** (LVM component) gathers information about the volumes (for the online_mirror backup, the **splitint** gets the datafile and all the control files; these are located on the R31datavg and it holds 8 volumes) from the production system, and lists the matching target volumes for the FlashCopy (Example 6-9). The list of target volumes that we can use is in the Data Protection for FlashCopy target volume file (initPR1.fct). If more than one set of target volumes has been specified, an eligible (unused) one is selected.

Example 6-9 Gathering information about volumes

```
EE00156I Finding the serial numbers ...
IDS1404I The target set with ID '1' is selected for this run.
Matching pair tgt: <75924811048> src: <75924811038> size: <10737418240_Bytes>
Matching pair tgt: <75924811049> src: <75924811039> size: <10737418240_Bytes>
Matching pair tgt: <7592481104A> src: <7592481103A> size: <10737418240_Bytes>
Matching pair tgt: <7592481104B> src: <7592481103B> size: <10737418240_Bytes>
Matching pair tgt: <7592481111C> src: <7592481110C> size: <10737418240_Bytes>
Matching pair tgt: <7592481111D> src: <7592481110D> size: <10737418240_Bytes>
Matching pair tgt: <75924811127> src: <75924811117> size: <5368709120_Bytes>
Matching pair tgt: <75924811129> src: <75924811128> size: <10737418240_Bytes>
```

8. The database is requested to set to backup mode (Example 6-10). The request is propagated through to **brbackup** on the backup server, which will initiate the database shutdown in case of an offline_mirror backup.

Example 6-10 Setting the tablespaces in backup mode

```
IDS1320I Setting the tablespaces in backup mode or, in case of type offline, the
database will be shutdown.
BRO280I BRBACKUP time stamp: 2006-08-04 17.56.45
#BEGIN SPLIT /oracle/R31/sapbackup/TSMHW763jE2

BRO280I BRBACKUP time stamp: 2006-08-04 17.56.47
BRO315I 'Alter tablespace PSAPR31 begin backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.56.47
```

```
BRO315I 'Alter tablespace PSAPR31620 begin backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.56.47
BRO315I 'Alter tablespace PSAPR31USR begin backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.56.48
BRO315I 'Alter tablespace PSAPUNDO begin backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.56.48
BRO315I 'Alter tablespace SYSTEM begin backup' successful
```

9. When the backup mode established, as shown in Example 6-11, **brbackup** signals to **splitint** on the backup server, and **splitint** performs the FlashCopy operation from the production server using the FLASHCOPY_TYPE option. In this stage, the following steps are performed by **splitint** on the production server:

   a. Reset the BSI (Backup Status Indicator) to BSI_START.
   b. Before the FlashCopy, flush buffered data.
   c. Set the current backup cycle to the FlashCopy state.
   d. Generate a FlashCopy image from the source volume to the target volumes.
   e. Terminate execution on the production system.

   For an online_mirror backup, the FlashCopy copy operation is started only for the volume group that is holding Oracle database files. In our configuration, this is R31datavg, which consists of eight physical volumes.

Example 6-11 Start FlashCopy operation

```
IDS1122I FlashCopying the sources to the target volumes ...
Function                       flashcopy_prod
Subfunction                    performsplit
Backup list                    /oracle/R31/sapbackup/work/.bdtexjjh.lst
EEO0272I Flushing the buffers to disk...
IDS1030I FlashCopy started ...
EEO1625I Number of volumes to be processed by Flashcopy: 8
EEO0354I Performing INCR FlashCopy of source volume 75924811048 to target volume
75924811038
EEO0354I Performing INCR FlashCopy of source volume 75924811129 to target volume
75924811128
EEO0354I Performing INCR FlashCopy of source volume 75924811127 to target volume
75924811117
EEO0354I Performing INCR FlashCopy of source volume 7592481111D to target volume
7592481110D
EEO0354I Performing INCR FlashCopy of source volume 7592481111C to target volume
7592481110C
EEO0354I Performing INCR FlashCopy of source volume 7592481104B to target volume
7592481103B
EEO0354I Performing INCR FlashCopy of source volume 7592481104A to target volume
7592481103A
EEO0354I Performing INCR FlashCopy of source volume 75924811049 to target volume
75924811039
IDS1031I FlashCopy successful.
```

10. The Oracle database on the production server is requested to put the database tablespaces in end backup mode from the backup server, as shown in Example 6-12. In case of an offline_mirror backup, it also now starts the database.

Example 6-12 Setting the tablespaces in end backup mode

```
IDS1321I The tablespaces will end the backup mode or, in case of offline_split,
the database will be started.
BRO280I BRBACKUP time stamp: 2006-08-04 17.57.05
#END SPLIT /oracle/R31/sapbackup/TSMHWaZ3jE3

BRO280I BRBACKUP time stamp: 2006-08-04 17.57.06
BRO317I 'Alter tablespace PSAPR31 end backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.57.06
BRO317I 'Alter tablespace PSAPR3162O end backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.57.06
BRO317I 'Alter tablespace PSAPR31USR end backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.57.06
BRO317I 'Alter tablespace PSAPUNDO end backup' successful

BRO280I BRBACKUP time stamp: 2006-08-04 17.57.06
BRO317I 'Alter tablespace SYSTEM end backup' successful
IDS1024I Exiting with return code 0.
```

11. In Example 6-13, we see that the **splitint** operation on the production server is finished.

Example 6-13 End of splitint on the production server

```
#INFO remote shell terminated successfully
IDS1027I Splitint ended successfully on the production system.
```

12. Only if the FLASHCOPY_TYPE is set to COPY or INCR, the FlashCopy agent (**fcagent**) initiates on the backup system (Example 6-14) to monitor the FlashCopy progress in the storage system periodically. The results are logged in the FlashCopy agent log file (splitint_[plb]_runagent_jjjjmmddHHMMSS.log) created on the LOG_TRACE_DIR specified in the Data Protection for FlashCopy profile(initR31.fcs). For more information about log files, see 6.9.1, “Log file management”. When the FlashCopy physical operation is finished, it changes the BSI status to BSI_DISKONLY.

Example 6-14 Start of fcagent

```
IDS1540I Start of fcagent on the backup system ...
```

13. The file systems are imported and mounted on the backup server when the FlashCopy image copy is available, Example 6-15.

Example 6-15 Volume group import and mount on the backup system

```
IDS1123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /oracle/R31/sapbackup/.bdtexjjh.lst
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EE00126I Trying to find new devices to match the source device. This process will
take some time.......
EE00148I Importing volume groups now...
EE00149I Newly imported volume group: R31tdp1
EE00124I Mounting filesystem : /oracle/R31/sapdata1.
```

```
EEO0124I Mounting filesystem : /oracle/R31/sapdata2.
EEO0124I Mounting filesystem : /oracle/R31/sapdata3.
EEO0124I Mounting filesystem : /oracle/R31/sapdata4.
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/04/06-18:01:27.
BRO280I BRBACKUP time stamp: 2006-08-04 18.01.36
BRO629I SPLITINT command sent success message: #SUCCESS
IDS1024I Exiting with return code 0.

BRO280I BRBACKUP time stamp: 2006-08-04 18.01.39
BRO296I Split of mirror disks successful
```

14. In Example 6-16, the Oracle database is backed up to the Tivoli Storage Manager server (brbackup part 1). **brbackup** calls **backint** (Data Protection for mySAP) to do the Tivoli Storage Manager backup from the FlashCopy'd image.

    backint sends all the tablespace files and a temporary backup control file that was created by **brbackup** within /oracle/<*SID*>/sapbackup to Tivoli Storage Manager.

Example 6-16 brbackup part 1

```
BRO229I Calling backup utility with function 'backup'...
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/backint -u R31 -f backup -i
/oracle/R31/sapbackup/.bdtexjjh.lst -t file -p /oracle/R31/920_64/dbs/initR31.utl
-c':
.
.
.
```

15. With the second backup call (brbackup part 2), **brbackup** requests **backint** to back up a number of log and config files that are shared between the two servers. **brbackup** also informs Data Protection for FlashCopy (**splitint**) about the backup ID used and successful completion of the backup to the Tivoli Storage Manager server. This is shown in Example 6-17.

Example 6-17 brbackup part 2

```
BRO229I Calling backup utility with function 'backup'...
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/backint -u R31 -f backup -i
/oracle/R31/sapbackup/.bdtexjjh.lst -t file -p /oracle/R31/920_64/dbs/initR31.utl
-c':
.
.
.
```

16. If split_resync=yes is specified in the **brbackup** profile, then a resynchronization is performed for cleanup and to release system resources. **brbackup** calls **splitint -f resync**. The status of the current backup cycle will be set to PSI_UNMOUNT_DONE or PSI_WITHDRAW_DONE. When called by **brbackup**, the Data Protection for FlashCopy **splitint -f resync** function will perform the following operations, depending on the FLASHCOPY_TYPE used in the brbackup request:

    – If FLASHCOPY_TYPE COPY or INCR was used, run a **splitint -f unmount** to:

      - Unmount all file systems used
      - Vary off and export all volume groups used
      - Set the PSI for the backup cycle to PSI_UNMOUNT_DONE

– If FLASHCOPY_TYPE NOCOPY was used, run a **splitint -f withdraw** to:

  - Unmount all file systems used
  - Vary off and export all volume groups used
  - Withdraw the source/target relationship
  - Set the PSI for the backup cycle to PSI_WITHDRAW_DONE

In either case, the **brbackup** system sees a completed backup cycle, which allows a new **brbackup** to be started. In our example (FLASHCOPY_TYPE INCR), it performs a **splitint -f unmount** command as shown in Example 6-18.

Example 6-18 Unmounting file systems and exporting volume group

```
BRO297I Resynchronizing mirror disks...
BRO280I BRBACKUP time stamp: 2006-08-04 19.38.09
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/splitint -u R31 -f resync -i
/oracle/R31/sapbackup/.bdtexjjh.lst -c -s -p /oracle/R31/920_64/dbs/initR31.fcs':
.
.
.
IDS1060I Start of listing of exported volume groups/unmounting file systems ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
EEO0273I Unmounting the file system /oracle/R31/sapdata4...
EEO0273I Unmounting the file system /oracle/R31/sapdata3...
EEO0273I Unmounting the file system /oracle/R31/sapdata2...
EEO0273I Unmounting the file system /oracle/R31/sapdata1...
EEO0152I Removing volume group R31tdp1 ....
EEO0153I Varied off and exported volume group : R31tdp1
EEO0140I Flashcopy type is set to COPY or INCR.
Leaving disk meta data intact for all target disks...
This backup is valid for a FlashCopy restore.
EEO0127I Removing device : hdisk46
EEO0127I Removing device : hdisk45
EEO0127I Removing device : hdisk37
EEO0127I Removing device : hdisk36
EEO0127I Removing device : hdisk25
EEO0127I Removing device : hdisk24
EEO0127I Removing device : hdisk23
EEO0127I Removing device : hdisk22
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/04/06-19:40:23.
BRO280I BRBACKUP time stamp: 2006-08-04 19.40.23
BRO629I SPLITINT command sent success message: #SUCCESS
IDS1024I Exiting with return code 0.

BRO280I BRBACKUP time stamp: 2006-08-04 19.40.23
BRO298I Resynchronization of mirror disks successful

BRO056I End of database backup: bdtexjjh.anf 2006-08-04 19.40.26
BRO280I BRBACKUP time stamp: 2006-08-04 19.40.32
BRO052I BRBACKUP completed successfully
```

Note: For safety reasons, we strongly recommend that you specify the resync options, in order to release the system resources on the backup server that are used by the backup operation.

Checking the results of the backup

After the backup, we can check the backup status in the **brbackup** run log file and the **backfm** command. We can also check the backup results with the Data Protection for FlashCopy command **tdphdwora**.

Checking the backup results with Data Protection for FlashCopy

The **tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap** command gives you the results of the backup in interactive mode as shown in Example 6-19. This command gets the information from the **brbackup** run log file, **brbackup** summary log file, IDS control files, and others. Successful previous backups are listed here, along with the results of the latest backup, (regardless of whether it was successful or not).

Example 6-19 Checking the backup results with Data Protection for FlashCopy

```
orar31> tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap


                    Log history of the database backups
                                SystemID: R31

--------------------------------------------------------------------------------
 # Log          Start of backup   Type           BackupID         TSM FlashCopy
--------------------------------------------------------------------------------
 1 bdtexjjh.anf 06-08-04 17.52.29 online_mirror  R31___AOEQH5XEQ3 ok  ok
 2 bdtesqng.anf 06-08-03 18.48.24 online_mirror  R31___AOEQFS5BU5 ok  invalid
 3 bdtepmmj.anf 06-08-03 03.24.09 online_mirror  R31___AOEQEVEMA4 *   invalid
 4 bdtekfvx.anf 06-08-02 01.44.45 online_mirror  R31___AOEQDCB8VT -   invalid
 5 bdtefsqa.aff 06-08-01 03.44.00 offline_mirror R31___AOEQC1BXPJ -   invalid
 6 bdtdpzbh.anf 06-07-28 22.49.33 online_mirror  R31___AOEQ7GC1AA -   invalid


    d -  show details
    r -  refresh display
    o -  choose from older backups
    # -  restore the backup number #, including pre- and post-processing
    f -  show FlashCopy backups only (target set state IN_USE)
    e -  emergency FlashBack Restore
    x -  exit tdphdwora

 Enter your selection => d
```

The first line of the output Figure 6-19 displays the latest backup results. There are *ok* entries in both the TSM and FlashCopy column — indicating that the backup was sent to both, and is valid for a restore. The columns in the history provide the following information:

- #: This column shows the number you can use to request a restore from one of the backups shown.

- Log: This shows the base name of the **brbackup** run log file, to which is appended the suffix .aff (if the backup type is offline_mirror) or .anf (if the backup type is online_mirror).
- Start of backup: Date and time the **brbackup** run was started.
- Type: Backup type used for **brbackup**.
- BackupID: The backup ID established by Data Protection for mySAP. For a **brbackup** in progress, question marks will be shown.
- TSM: The current status of backups sent to Tivoli Storage Manager. For a still-running **brbackup**, question marks "??" will be shown. If the status is "ok?", it means either that not all the files are yet backed up to Tivoli Storage Manager or that the Local Snapshot™ Repository of Data Protection for FlashCopy does not know about this backup ID. If the BACKUP_MAX value is set too small to cover all the valid backup versions, it can show a status of "ok?" or "?". So, make sure to set the BACKUP_MAX to a sufficiently high value.
- FlashCopy: The current status of backup objects with type "FlashCopy" as recorded by Data Protection for FlashCopy (**splitint** and FlashCopy agent) in its control file.

Note: If the status of the target volumes was changed using the storage system user interfaces (that is, externally to Data Protection for FlashCopy), the actual status does not match these FlashCopy backup objects and might contradict what is shown in the **tdphdwora** menu. Therefore, to avoid conflicts, you should create and manipulate FlashCopy SAP images only by using Data Protection for FlashCopy.

We enter `d` at Example 6-19, to display detailed information as shown in Example 6-20.

Example 6-20 Checking the backup results from the Data Protection for FlashCopy - detailed

```
                    Log history of the database backups
                                 SystemID: R31

--------------------------------------------------------------------------------
# Log          Start of backup   Type          BackupID         TSM FlashCopy
  BSN   FCType TargetID HdwID    Start-LSN     End-LSN              RTime(min)
                                               Restore Status       RTime(min)
--------------------------------------------------------------------------------
 1 bdtexjjh.anf 06-08-04 17.52.29 online_mirror  R31___AOEQH5XEQ3 ok  ok
   00029 INCR   1              1436                1437                 0
                                                   -                    -
 2 bdtesqng.anf 06-08-03 18.48.24 online_mirror  R31___AOEQFS5BU5 ok  invalid
   00028        1              1435                1436                 -
                                                   -                    -
 3 bdtepmmj.anf 06-08-03 03.24.09 online_mirror  R31___AOEQEVEMA4 *   invalid
   00027        1              1434                1435                 -
                                                   -                    -
 4 bdtekfvx.anf 06-08-02 01.44.45 online_mirror  R31___AOEQDCB8VT -   invalid
   00026        1              1433                1434                 -
                                                   -                    -
 5 bdtefsqa.aff 06-08-01 03.44.00 offline_mirror R31___AOEQC1BXPJ -   invalid
   00025        1              1432                1432                 -
                                                   -                    -
 6 bdtdpzbh.anf 06-07-28 22.49.33 online_mirror  R31___AOEQ7GC1AA -   invalid
   00024        1              1431                1432                 -
                                                   -                    -
```

Example 6-20 includes a second line of information about the backup run. This information is helpful when you want to restore from a FlashCopy backup. The additional fields shown are:

- BSN: Backup sequence number.
- FCType: Shows the value of the FLASHCOPY_TYPE used for the FlashCopy for this backup, but only if a valid disk backup is available for a FlashBack Restore or a NOCOPY source/target relationship still exists.
- Target ID: Refers to the target set number (used in the Data Protection for FlashCopy target volumes file, .fct) that was used in the backup run.
- HdwID: When using the Data Protection for FlashCopy functionality for AIX LVM mirrored environments, the hardware ID of the storage unit used for the FlashCopy backup will be shown. For all other environments, this field is empty.
- Start_LSN: Start redo log sequence number of the backup.
- End_LSN: End redo log sequence number of the backup.
- RTime (min): The remaining time, in minutes, to complete the bitwise copy in the storage system. This is an estimated value provided by the FlashCopy agent. This value also depends on the current workload within the storage system, and it is therefore impossible to project exact values. The remaining time is derived from the time elapsed for the portion of the disk already copied.

Checking the backup results from Data Protection for mySAP

We can check the backup results from Data Protection for mySAP using the **backfm** command on the production and backup servers as shown in Example 6-21.

Example 6-21 Checking the backup results from Data Protection for mySAP

```
orar31> backfm -p /oracle/R31/920_64/dbs/initR31.utl
BACKINT-Filemanager V1.7D, Copyright IBM 2004
 .------------------+-------------------------------------------------------.
 |   Backup-ID's    | Files stored under R31___AOEQH5XEQ3                   |
 |------------------+-------------------------------------------------------|
 | R31___AOEQH9CUEY |  /oracle/R31/sapbackup/cntrlR31.dbf                   |
 | R31___AOEQH5XEQ3 |  /oracle/R31/sapdata1/r31usr_1/r31usr.data1           |
 | R31___AOEQFT6NOF |  /oracle/R31/sapdata1/r31usr_1/r31usr.data1           |
 | R31___AOEQFS5BU5 |  /oracle/R31/sapdata1/system_1/system.data1           |
 |                  |  /oracle/R31/sapdata1/system_1/system.data1           |
 |                  |  /oracle/R31/sapdata2/undo_1/undo.data1               |
 |                  |  /oracle/R31/sapdata2/undo_1/undo.data1               |
 |                  |  /oracle/R31/sapdata3/r31620_1/r31620.data1           |
 |                  |  /oracle/R31/sapdata3/r31620_1/r31620.data1           |
 |                  |  /oracle/R31/sapdata3/r31620_2/r31620.data2           |
 |                  |  /oracle/R31/sapdata3/r31620_2/r31620.data2           |
 |                  |  /oracle/R31/sapdata3/r31620_3/r31620.data3           |
 |                  |  /oracle/R31/sapdata3/r31620_3/r31620.data3           |
 |                  |  /oracle/R31/sapdata3/r31620_4/r31620.data4           |
 |                  |  /oracle/R31/sapdata3/r31620_4/r31620.data4           V
 |------------------+-------------------------------------------------------|
 |  4 BIDs          | 45 File(s) - 0 marked                                 |
 `------------------+-------------------------------------------------------'
 TAB change windows F2 Restore    F3 Mark all     F4 Unmark all      F5 reFresh
 F6 fileInfo        F7 redireCt   F8 Delete       F10 eXit    ENTER mark file
```

This output shows the list of the files stored under the same Backup ID. In this example, there are 45 files are stored with the backup ID R31___A0EQH5XEQ3. The data files are actually listed twice - one set for the object stored in Tivoli Storage Manager, and the other for the object stored on the FlashCopy backup disk. The F6 key displays information about an individual file as shown in Example 6-22.

Example 6-22 Checking the backup results from Data Protection for mySAP - Checking the detailed file Information

```
orar31> backfm -p /oracle/R31/920_64/dbs/initR31.utl
BACKINT-Filemanager V1.7D, Copyright IBM 2004
 .------------------+-------------------------------------------------------.
 |   Backup-ID's    | Files stored under R31___A0EQH5XEQ3                   |
 |------------------+-------------------------------------------------------|
 | R31___A0EQH9CUEY |  /oracle/R31/sapbackup/cntrlR31.dbf                   |
 | R31___A0EQH5XEQ3 |  /oracle/R31/sapdata1/r31usr_1/r31usr.data1           |
 | R31___A0EQFT6N0F |  /oracle/R31/sapdata1/r31usr_1/r31usr.data1           |
 | R31___A0EQFS5BU5 |  /oracle/R31/sapdata1/system_1/system.data1           |
 |                  |  /oracle/R31/sapdata1/system_1/system.data1           |
 |             .-------------------------------------------------.           |
 |             |                                                 |           |
 |             |                R31___A0EQH5XEQ3                 |           |
 |             |    /oracle/R31/sapdata1/r31usr_1/r31usr.data1   |           |
 |             |      Expires: object controlled by splitint     |           |
 |             |                                                 |           |
 |             `-------------------------------------------------'           |
 |                  |  /oracle/R31/sapdata3/r3162O_3/r3162O.data3           |
 |                  |  /oracle/R31/sapdata3/r3162O_4/r3162O.data4           |
 |                  |  /oracle/R31/sapdata3/r3162O_4/r3162O.data4          V
 |------------------+-------------------------------------------------------|
 |  4 BIDs          | 45 File(s) - 0 marked                                 |
 `------------------+-------------------------------------------------------'
 TAB change windows F2 Restore    F3 Mark all     F4 Unmark all      F5 reFresh
 F6 fileInfo        F7 redireCt   F8 Delete       F10 eXit    ENTER mark file
```

The data file information shows "`object controlled by splitint`" on Example 6-22, which means the file was backed up to the FlashCopy image.

6.2.2 Database restore from Tivoli Storage Manager

In this section we describe the database restore from the backup image stored in the Tivoli Storage Manager storage pool. To restore from the FlashCopy image, see 6.5.2, "FlashBack restore" on page 211.

Tivoli Storage Manager backup objects should be restored from the Tivoli Storage Manager server only to the production server using either a LAN or SAN connection.

There is a lot of documentation available which shows how to deal with such Tivoli Storage Manager backup objects when running a restore/recovery, for example:

- *SAP Database Administration: Oracle Restore and Recovery*
- *SAP Database Guide: Oracle (BC-DB-ORA-DBA)*
- *Data Protection for mySAP Installation & User's Guide for Oracle*, SC33-6340
- *Using ADSM to Back Up Databases*, SG24-4335

There are many options for restoring Oracle SAP databases. As well as the menu-guided tools **brtools** and **brrecover**, many experienced administrators have established restore/recovery procedures using **brrestore** (a BR*Tools component) or **backfm** (a Data Protection for mySAP program), among other reasons, to shorten the restore/recovery processes.

We can use the **backfm -p $ORACLE_HOME/dbs/initSID.utl** command to restore all objects backed up by Data Protection for mySAP with or without involvement of Data Protection for FlashCopy. Because this type of restore is outside the control of BR*Tools, it is the responsibility of the DBA to determine whether recovery is necessary, and to perform the necessary database recovery.

To allow the administrator to easily check on the Tivoli Storage Manager or FlashCopy status of the two backup types, the Data Protection for FlashCopy command **tdphdwora** can be used in the restore/recovery process.

When Data Protection for FlashCopy (**splitint**) is called for a restore by **brrestore** or **backfm**, **splitint** interactively works together with Data Protection for mySAP (**backint**) in order to

- Provide information about which backup levels are available for a restore.
- Prompt the administrator for which backup level and which backup type (either Tivoli Storage Manager or FlashCopy, if available) to select for a restore.
- Restore and recover based on the values entered by the administrator.

Sample online database backup restore procedure using brrestore

We start the restore process with **brrestore**. BR*Tools will show the various available backup levels so we can select the level to restore and also how far the recovery should proceed:

1. Log in to the production system (auntmathilda) with the Oracle user id (orar31).
2. We start the restore with the **brrestore -m full -b bdtexjjh.anf** command. Example 6-23 shows the list of the files that will be restored and gives us the choice to either stop here or continue. We enter c to continue.

Example 6-23 Start the database restore from Tivoli Storage Manager

```
orar31> brrestore -m full -b bdtexjjh.anf
BRO401I BRRESTORE 6.40 (36)
BRO169I Value 'online_mirror' of parameter/option 'backup_type/-t' ignored for
'brrestore' - 'offline' assumed
BRO405I Start of file restore: rdtexzlm.rsb 2006-08-04 20.53.42

BRO428W File /oracle/R31/sapdata4/r31_1/r31.data1 will be overwritten
BRO428W File /oracle/R31/sapdata4/r31_2/r31.data2 will be overwritten
BRO428W File /oracle/R31/sapdata4/r31_3/r31.data3 will be overwritten
.
.
.
BRO428W File /oracle/R31/sapdata3/cntrl/cntrlR31.dbf will be overwritten
BRO280I BRRESTORE time stamp: 2006-08-04 20.53.43
BRO256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:
c
```

3. In Example 6-24, we see the list of the control files that will be recovered and overwritten. We enter c to continue.

Example 6-24 Show the list of files that will be overwritten

```
BRO407I Restore of database: R31
BRO408I BRRESTORE action ID: rdtexzlm
BRO409I BRRESTORE function ID: rsb
BRO449I Restore mode: FULL
BRO411I Database files for restore:
/oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf
/oracle/R31/sapdata2/cntrl/cntrlR31.dbf
/oracle/R31/sapdata3/cntrl/cntrlR31.dbf
BRO419I Files will be restored from backup: bdtexjjh.anf 2006-08-04 17.52.29
BRO416I 23 files found to restore, total size 63144.945 MB
BRO421I Restore device type: util_file
BRO280I BRRESTORE time stamp: 2006-08-04 20.53.49
BRO256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:
c
```

4. **brrestore** passes control to **backint** to perform the restore operation, as shown in Example 6-25.

Example 6-25 Start of backint

```
BRO229I Calling backup utility with function 'restore'...
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/backint -u R31 -f restore -i
/oracle/R31/sapbackup/.rdtexzlm.lst -t file -p
/oracle/R31/920_64/dbs/initR31.utl':
.
.
.
```

5. **backint** checks the availability of the Tivoli Storage Manager and FlashCopy backups via **splitint**, and if both backup types exist, it provides the option to select which backup type to use for the restore. We selected the Tivoli Storage Manager image, as shown in Example 6-26.

Example 6-26 Display and select the backup type

```
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
get_disk_backups':
.
.
.
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
flashback_check -i /tmp/baaAxUhqb -b R31___AOEQH5XEQ3':
.
.
.
BKI7316I: The following backup types for the BACKUPID R31___AOEQH5XEQ3 have been
found:
  - TSM
  - FLASHCOPY
Select which backup type you want to be used for the restore
  [t] TSM
  [f] FLASHCOPY
t
```

6. Now we start the restore process as shown in Example 6-27. **brrestore** restores files from Tivoli Storage Manager.

Example 6-27 Start restore using brrestore from Tivoli Storage Manager

```
BKI7319I: Start TSM restore.
BKI5016I: Time: 08/04/06 20:54:12 New TSM session created: MGMNT-CLASS: ,
TSM-Server: UNCLETITUS, type: SIMPLE
BKI0027I: Time: 08/04/06 20:54:14 Object: 2 of 23 in process:
/oracle/R31/sapdata4/r31_11/r31.data11 Size: 4.863 GB, MGMNT-CLASS: R31DBS,
TSM-Server: UNCLETITUS .
BKI0027I: Time: 08/04/06 20:54:14 Object: 1 of 23 in process:
/oracle/R31/sapdata3/r3162O_1/r3162O.data1 Size: 3.262 GB, MGMNT-CLASS: R31DBS,
TSM-Server: UNCLETITUS .
BKI0023I: Time: 08/04/06 20:56:07 Done: 4.863 GB (7.9 %) of 61.665 GB. Estimated
end time: 08/04/06 21:21:48.
.
.
.
```

7. After the restore is complete, you have to recover the database, as shown in Example 6-28. This is a straightforward recovery example; however, your particular situation might require more steps.

Example 6-28 Recover the database

```
orar31> sqlplus '/ as sysdba'

SQL*Plus: Release 9.2.0.1.0 - Production on Fri Aug 11 02:08:09 2006

Copyright (c) 1982, 2002, Oracle Corporation.  All rights reserved.

Connected to an idle instance.

SQL> startup mount
ORACLE instance started.

Total System Global Area  941589424 bytes
Fixed Size                   742320 bytes
Variable Size             905969664 bytes
Database Buffers           33554432 bytes
Redo Buffers                1323008 bytes
Database mounted.
SQL> recover database
Media recovery complete.
SQL> alter database open;

Database altered.
```

Note: Coverage of Oracle recovery techniques is beyond the scope of this book. If you are not sure how to perform the Oracle database and SAP software application recovery, be sure to contact your SAP consultant or an Oracle specialist. Do not attempt a recovery if you are not confident, as an incorrectly performed recovery can lead to irretrievable loss of data in your database.

If your recovery was successful, the database is ready for transactions on the production server.

6.3 Offline database backup and restore with FlashCopy

In this section, we cover the offline database backup to FlashCopy disk and the Tivoli Storage Manager server. As always with Data Protection for FlashCopy, the backup is initiated from the backup server and restore is initiated on the production server. The backup creates two backup images — one FlashCopy image and one stored to Tivoli Storage Manager. Each backup can be restored separately; in this section, we will restore from the Tivoli Storage Manager backup image. We will show how to restore from the FlashCopy in 6.5.2, “FlashBack restore” on page 211.

The backup can be initiated only by BR*Tools (**brbackup**), whereas for restore, we have the choice of using BR*Tools (**brrestore**), Data Protection for mySAP (**backfm**, **backint**), or Data Protection for FlashCopy (**tdphdwora**).

Figure 6-3 shows the files that constitute a complete offline_mirror database backup. This kind of complete database backup is recorded at the file level in the **brbackup** run log and is identified with one backup ID. It can be requested as an entity for a restore activity. For the offline_mirror backup, **brbackup** causes a FlashCopy process to be initiated via Data Protection for FlashCopy for all volumes with the following files:

- All tablespace files
- The database control file(s):
  - For SAP R/3 4.5B, only the first file specified in the control_files section of $ORACLE_HOME/dbs/init<*SID*>.ora
  - For higher releases (4.6D and following), all files specified in the control_files section
- Redo log files:
  - For SAP R/3 4.5B, the first member of each group usually in /oracle/<*SID*>/origlogA and /oracle/<*SID*>/origlogB
  - For higher releases (4.6D and following) all members of each log-file group usually in /oracle/<*SID*>>/origlogA, /oracle/<*SID*>/origlogB, /oracle/<*SID*>/mirrlogA, /oracle/<*SID*>/mirrlogB.

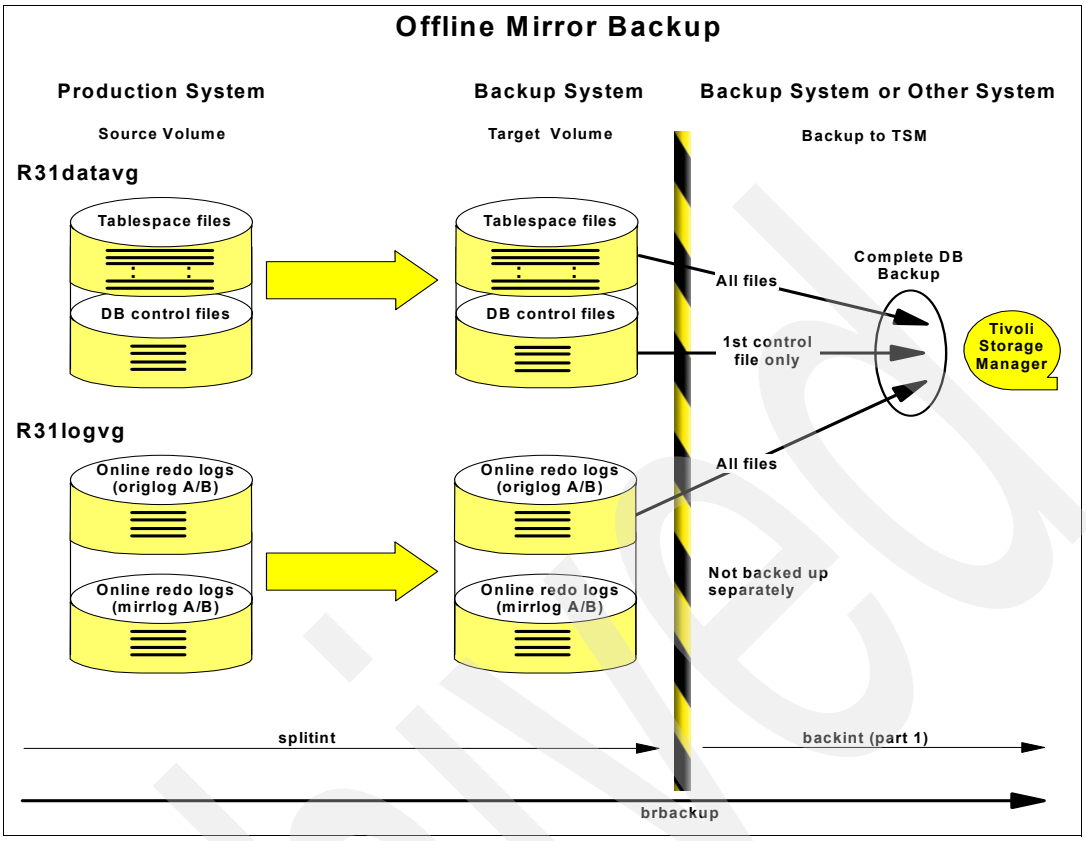


Figure 6-3 Complete database backup for offline mirror backup

brbackup calls two executables, **splitint** (for doing the FlashCopy) and **backint** (for doing the Tivoli Storage Manager backup). Each executable gets a different file list as input. In our SAP version (4.7), **splitint** gets the files described above, and **backint** only gets the data files, first control file, and origA/B.

6.3.1 Offline database backup with FlashCopy backup

For an offline backup (also known as cold backup), the database is shut down before the backup is made and is restarted when the backup is complete. The SAP application is not available (for a few seconds) while the backup is being made.

tdphdwora cannot be used to perform the backup — the BR*Tools command **brbackup** supports online and offline backup for this purpose. The backups must be started on the backup system.

Current profile setting

We use the **brbackup -t offline_mirror -c -u system/redbook** command to start an offline database backup to FlashCopy and Tivoli Storage Manager. This command references the configuration files listed below. Note that the **-t offline_mirror** option specified in the **brbackup** command takes priority over the backup_type specified on the initR31.sap file.

These are the configuration files:

- /oracle/R31/920_64/dbs/initR31.sap

```
backup_type = online_mirror
split_option = "-p /oracle/R31/920_64/dbs/initR31.fcs"
split_resync = yes
backup_mode = all
util_par_file = /oracle/R31/920_64/dbs/initR31.utl
```

- /oracle/R31/920_64/dbs/initR31.fcs

```
FLASHCOPY_TYPE INCR
```

- /oracle/R31/920_64/dbs/initR31.utl

```
FCS_FILE /oracle/R31/920_64/dbs/initR31.fcs
```

Sample database backup procedure

This command, and other backup or restore operations, produce very lengthy output, and most of the output is the same with different operations. We have broken the output into sections in order to explain what is going on. We will perform an offline database backup using **brbackup** in this section:

1. Log in to the backup system (uncletitus) as Oracle user id (orar31).
2. We issue the **brbackup -t offline_mirror -c -u system/redbook** command from the backup server. First, it determines all the table space files that make up the Oracle database on the production server, using an Oracle remote connection with Oracle client as shown in Example 6-29.

Example 6-29 Start backup operation

```
orar31@uncletitus:/oracle/R31> brbackup -t offline_mirror -c -u system/redbook
BR0051I BRBACKUP 6.40 (36)
BR0055I Start of database backup: bdtefsqa.aff 2006-08-01 03.44.00
BR0477I Oracle pfile /oracle/R31/920_64/dbs/initR31.ora created from spfile
/oracle/R31/920_64/dbs/spfileR31.ora

BR0280I BRBACKUP time stamp: 2006-08-01 03.44.03
BR0304I Starting and opening database instance R31 ...

BR0280I BRBACKUP time stamp: 2006-08-01 03.44.13
BR0305I Start and open of database instance R31 successful
```

3. **splitint** uses the list of files obtained in the previous step, and uses **rexec** on the production server to split the mirror disk as shown in Example 6-30.

Example 6-30 Run splitint on the production system

```
BR0295I Splitting mirror disks...
BR0280I BRBACKUP time stamp: 2006-08-01 03.44.33
BR0278I Command output of '/usr/sap/R31/SYS/exe/run/splitint -u R31 -f split -i
/oracle/R31/sapbackup/.bdtefsqa.lst -t offline -c -s -p
/oracle/R31/920_64/dbs/initR31.fcs':
```

4. **splitint** shows the Data Protection for FlashCopy profile setting as in Example 6-31.

Example 6-31 Data Protection for FlashCopy option settings

```
                  IBM Tivoli Storage Manager for Hardware
               Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on
Oracle(R)

         BR*Tools Interface SPLITINT for IBM Tivoli Storage Manager
          - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
                Build: 304 generated at 14:34:45 on Mar 14 2006
        (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.

IDS1411I The intended FlashCopy type has a value of 'INCR'.
Profile                         /oracle/R31/920_64/dbs/initR31.fcs
Log file                        splitint_?_20060408175257.log
Trace file                      splitint_?_20060408175257.trace

  -- Parameters of splitint profile --

LOGON_HOST_PROD                 auntmathilda    orar31
LOGON_HOST_BACK                 uncletitus
BACKUP_MAX                      30
IDS_CONTROL_FILE                /oracle/R31/sapbackup/idssave/idssave
CONFIG_FILE                     /oracle/R31/920_64/dbs/initR31.fcp
WORK_DIR                        /oracle/R31/sapbackup/work
TRACE                           YES
LOG_TRACE_DIR                   /oracle/R31/sapbackup/logtraces
SUPPORT_ADMIN_ASSISTANT         NO
COPYSERVICES_HARDWARE_TYPE      DS8000
PRIMARY_COPYSERVICES_SERVERNAME uncletitus
COPYSERVICES_SERVERPORT         5988
COPYSERVICES_USERNAME           superuser
FLASHCOPY_TYPE                  INCR
VOLUMES_FILE                    /oracle/R31/920_64/dbs/initR31.fct
```

5. In Example 6-32, **splitint** checks the IDS control file and determines whether a new backup cycle can be started. If the PSI (Progress Status Indication) and RSI (Restore Status Indicator) of the previous restore cycle are valid (as explained in 6.1.2, “Backup and restore cycles” on page 170), it starts a new backup cycle. At this stage, the oldest backup cycle entries are deleted from the IDS control file if the number of the backup cycle has been reached according to the BACKUP_MAX specified on the Data Protection for FlashCopy profile (initR31.fcs).

Example 6-32 Start new backup cycle

```
IDS1005I Start of splitint program at: 08/01/06-03:44:33 .
IDS1035I The IDS control file exists and a new backup cycle entry has been
created.
IDS1101I New assigned Backup Sequence Number    00020
```

6. The **splitint** starts from the production server with the parameters specified, as in Example 6-33.

Example 6-33 Start splitint on the production server

```
IDS1411I The intended FlashCopy type has a value of 'INCR'.
Profile                         /oracle/R31/920_64/dbs/initR31.fcs
Log file                        splitint_?_20060108034433.log
Trace file                      splitint_?_20060108034433.trace
IDS1005I Start of splitint program at: 08/01/06-03:44:38 .
EE00020I ====>Performing DP FOR FlashCopy BACKUP command.
IDS1121I Getting the source volumes ...
Function                        getresources_prod
Subfunction                     performsplit
Backup list                     /oracle/R31/sapbackup/work/.bdtefsqa.lst
```

7. **splitint** (LVM component) gathers information about the volumes from the production server (for the offline_mirror backup). This information includes the datafile, all the control files, origlogA/B and mirrlogA/B, which are located on the R31datavg and R31logvg. In our configuration, 9 volumes are listed, in Example 6-34, along with the matching target volumes for the FlashCopy. The list of target volumes that we can use is in the Data Protection for FlashCopy target volume file (initPR1.fct). If more than one set of target volumes has been specified, an eligible set is selected.

Example 6-34 Gather volume information

```
EE00156I Finding the serial numbers ...
IDS1404I The target set with ID '1' is selected for this run.
Matching pair tgt: <7592481111F> src: <7592481110F> size: <1073741824_Bytes>
Matching pair tgt: <75924811048> src: <75924811038> size: <10737418240_Bytes>
Matching pair tgt: <75924811049> src: <75924811039> size: <10737418240_Bytes>
Matching pair tgt: <7592481104A> src: <7592481103A> size: <10737418240_Bytes>
Matching pair tgt: <7592481104B> src: <7592481103B> size: <10737418240_Bytes>
Matching pair tgt: <7592481111C> src: <7592481110C> size: <10737418240_Bytes>
Matching pair tgt: <7592481111D> src: <7592481110D> size: <10737418240_Bytes>
Matching pair tgt: <75924811127> src: <75924811117> size: <5368709120_Bytes>
Matching pair tgt: <75924811129> src: <75924811128> size: <10737418240_Bytes>
IDS1210I Not all source/target pairs are in an incremental FlashCopy relation.
```

8. **brbackup** initiates the database shutdown, which is propagated through to **brbackup** on the backup server (Example 6-35).

Example 6-35 Shutdown of the database instance

```
BR0280I BRBACKUP time stamp: 2006-08-01 03.48.28
BR0307I Shutting down database instance R31 ...

BR0280I BRBACKUP time stamp: 2006-08-01 03.48.37
BR0308I Shutdown of database instance R31 successful
```

9. When the database is shutdown, **brbackup** signals to **splitint** on the backup server, and **splitint** performs the FlashCopy operation from the production server using the FLASHCOPY_TYPE option (Example 6-36). In this stage, the following steps are performed by **splitint** on the production server:

   a. Reset the BSI (Backup Status Indicator) to BSI_START
   b. Before the FlashCopy, flush buffered data
   c. Set the current backup cycle to the FlashCopy state

d. Generate a FlashCopy image from the source volume to the target volumes
e. Terminate execution on the production server.

For the offline_mirror backup, the FlashCopy copy operation is performed for the database volume group and redo log volume group. In our example, that is R31datavg and R31logvg. R31datavg holds eight physical volumes and R31logvg holds one physical volume.

Example 6-36 Starts FlashCopy operation

```
IDS1122I FlashCopying the sources to the target volumes ...
Function                       flashcopy_prod
Subfunction                    performsplit
Backup list                    /oracle/R31/sapbackup/work/.bdtefsqa.lst
EEO0272I Flushing the buffers to disk...
IDS1030I FlashCopy started ...
EEO1625I Number of volumes to be processed by Flashcopy: 9
EEO0354I Performing INCR FlashCopy of source volume 7592481110F to target volume
7592481111F
EEO0354I Performing INCR FlashCopy of source volume 75924811128 to target volume
75924811129
EEO0354I Performing INCR FlashCopy of source volume 75924811117 to target volume
75924811127
EEO0354I Performing INCR FlashCopy of source volume 7592481110D to target volume
7592481111D
EEO0354I Performing INCR FlashCopy of source volume 7592481110C to target volume
7592481111C
EEO0354I Performing INCR FlashCopy of source volume 7592481103B to target volume
7592481104B
EEO0354I Performing INCR FlashCopy of source volume 7592481103A to target volume
7592481104A
EEO0354I Performing INCR FlashCopy of source volume 75924811039 to target volume
75924811049
EEO0354I Performing INCR FlashCopy of source volume 75924811038 to target volume
75924811048
IDS1031I FlashCopy successful.
```

10. **brbackup** starts the database as shown in Example 6-37. In an offline_mirror backup, it requests the Oracle database on the production server to start and opens the database from the backup server.

Example 6-37 Start the database instance

```
IDS1321I The tablespaces will end the backup mode or, in case of offline_split,
the database will be started.
BRO280I BRBACKUP time stamp: 2006-08-01 03.48.50
#END SPLIT /oracle/R31/sapbackup/TSMHWu-mlE3

BRO280I BRBACKUP time stamp: 2006-08-01 03.48.50
BRO304I Starting and opening database instance R31 ...

BRO280I BRBACKUP time stamp: 2006-08-01 03.49.02
BRO305I Start and open of database instance R31 successful
IDS1024I Exiting with return code 0.
```

11. Example 6-38 shows that the **splitint** operation from the production server is complete.

Example 6-38 End of splitint on the production server

```
#INFO remote shell terminated successfully
IDS1027I Splitint ended successfully on the production system.
```

12. If the FLASHCOPY_TYPE is set to COPY or INCR, the FlashCopy agent (**fcagent**) initiates on the backup server to monitor the FlashCopy progress in the storage system periodically. The results are recorded in the FlashCopy agent log file (splitint_[p|b]_runagent_jjjjmmddHHMMSS.log) created on the LOG_TRACE_DIR specified in the Data Protection for FlashCopy profile(initR31.fcs). When the FlashCopy physical operation completes, it changes the BSI status to BSI_DISKONLY.

Example 6-39 Start of fcagent

```
IDS1540I Start of fcagent on the backup system ...
```

13. The file systems are imported and mounted on the backup server after the FlashCopy image copy is available, Example 6-40. For the offline_mirror backup, the volume group containing the Oracle redo log files is also imported and those file systems are mounted.

Example 6-40 Volume group import and mount on the backup system

```
IDS1123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /oracle/R31/sapbackup/.bdtefsqa.lst
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EE00126I Trying to find new devices to match the source device. This process will
take some time.......
EE00148I Importing volume groups now...
EE00149I Newly imported volume group: R31tdp1
EE00149I Newly imported volume group: R31tdp2
EE00124I Mounting filesystem : /oracle/R31/mirrlogA.
EE00124I Mounting filesystem : /oracle/R31/mirrlogB.
EE00124I Mounting filesystem : /oracle/R31/origlogA.
EE00124I Mounting filesystem : /oracle/R31/origlogB.
EE00124I Mounting filesystem : /oracle/R31/sapdata1.
EE00124I Mounting filesystem : /oracle/R31/sapdata2.
EE00124I Mounting filesystem : /oracle/R31/sapdata3.
EE00124I Mounting filesystem : /oracle/R31/sapdata4.
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/01/06-03:53:56.
BR0280I BRBACKUP time stamp: 2006-08-01 03.54.03
BR0629I SPLITINT command sent success message: #SUCCESS
IDS1024I Exiting with return code 0.
```

14. **brbackup** calls **backint** (Data Protection for mySAP) to back up the Oracle database to the Tivoli Storage Manager server from the FlashCopy'd image, as in Example 6-41.

    For an offline_mirror backup, backint sends all of the tablespace files and the first control file, and all the online redo log files (origlogA/B) except the mirror log files (mirrorA/B), to the Tivoli Storage Manager server.

Example 6-41 Running the brbackup to backup from the FlashCopy'd image

```
BRO057I Backup of database: R31
BRO058I BRBACKUP action ID: bdtefsqa
BRO059I BRBACKUP function ID: aff
BRO110I Backup mode: ALL
BRO077I Database files for backup:
/oracle/R31/origlogA/log_g11m1.dbf
/oracle/R31/origlogB/log_g12m1.dbf
/oracle/R31/origlogA/log_g13m1.dbf
/oracle/R31/origlogB/log_g14m1.dbf
/oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf
BRO061I 27 files found for backup, total size 63324.947 MB
BRO143I Backup type: offline_mirror
BRO130I Backup device type: util_file
BRO109I Files will be saved by backup utility
BRO126I Unattended mode active - no operator confirmation required

BRO280I BRBACKUP time stamp: 2006-08-01 03.54.16
BRO229I Calling backup utility with function 'backup'...
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/backint -u R31 -f backup -i
/oracle/R31/sapbackup/.bdtefsqa.lst -t file -p /oracle/R31/920_64/dbs/initR31.utl
-c':
.
.
.
```

15. **brbackup** then requests **backint** to back up a number of log and config files that are shared between the two systems. **brbackup** also informs Data Protection for FlashCopy (**splitint**) about the backup ID used and the successful completion of the backup to the Tivoli Storage Manager server. This is shown in Example 6-42.

Example 6-42 brbackup part 2

```
BRO229I Calling backup utility with function 'backup'...
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/backint -u R31 -f backup -i
/oracle/R31/sapbackup/.bdtexjjh.lst -t file -p /oracle/R31/920_64/dbs/initR31.utl
-c':
.
.
.
```

16. If split_resync=yes is specified in the **brbackup** profile, then a resynchronization is performed for cleanup and to release system resources. **brbackup** calls **splitint -f resync**. The status of the current backup cycle will be set to PSI_UNMOUNT_DONE or PSI_WITHDRAW_DONE. When called by **brbackup**, the Data Protection for FlashCopy **splitint -f resync** function will perform the following depending on the FLASHCOPY_TYPE used in the **brbackup** request:
    - If FLASHCOPY_TYPE COPY or INCR was used, run a **splitint -f unmount** to:
        i. Unmount all file systems used
        ii. Vary off and export all volume groups used
        iii. Set the PSI for the backup cycle to PSI_UNMOUNT_DONE
    - If FLASHCOPY_TYPE NOCOPY was used, run a **splitint -f withdraw** to:
        i. Unmount all file systems used
        ii. Vary off and export all volume groups used

iii. Withdraw the source/target relationship
iv. Set the PSI for the backup cycle to PSI_WITHDRAW_DONE

In either case, the **brbackup** system sees a completed backup cycle, which allows a new **brbackup** to be started.

Note: For safety reasons, we strongly recommend that you specify the resync options, in order to release the system resources on the backup server that are used by the backup operation.

Example 6-43 Unmounting file systems and exporting volume group

```
BRO297I Resynchronizing mirror disks...
BRO280I BRBACKUP time stamp: 2006-08-01 05.58.40
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/splitint -u R31 -f resync -i
/oracle/R31/sapbackup/.bdtefsqa.lst -c -s -p /oracle/R31/920_64/dbs/initR31.fcs':
.
.
.
IDS1060I Start of listing of exported volume groups/unmounting file systems ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
EEO0273I Unmounting the file system /oracle/R31/mirrlogB...
EEO0273I Unmounting the file system /oracle/R31/mirrlogA...
EEO0273I Unmounting the file system /oracle/R31/origlogB...
EEO0273I Unmounting the file system /oracle/R31/origlogA...
EEO0273I Unmounting the file system /oracle/R31/sapdata4...
EEO0273I Unmounting the file system /oracle/R31/sapdata3...
EEO0273I Unmounting the file system /oracle/R31/sapdata2...
EEO0273I Unmounting the file system /oracle/R31/sapdata1...
EEO0152I Removing volume group R31tdp1 ....
EEO0152I Removing volume group R31tdp2 ....
EEO0153I Varied off and exported volume group : R31tdp1
EEO0153I Varied off and exported volume group : R31tdp2
EEO0140I Flashcopy type is set to COPY or INCR.
Leaving disk meta data intact for all target disks...
This backup is valid for a FlashCopy restore.
EEO0127I Removing device : hdisk46
EEO0127I Removing device : hdisk45
EEO0127I Removing device : hdisk39
EEO0127I Removing device : hdisk37
EEO0127I Removing device : hdisk36
EEO0127I Removing device : hdisk25
EEO0127I Removing device : hdisk24
EEO0127I Removing device : hdisk23
EEO0127I Removing device : hdisk22
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/01/06-06:04:24.
BRO280I BRBACKUP time stamp: 2006-08-01 06.04.26
BRO629I SPLITINT command sent success message: #SUCCESS
IDS1024I Exiting with return code 0.
BRO280I BRBACKUP time stamp: 2006-08-01 06.04.32
BRO298I Resynchronization of mirror disks successful
BRO280I BRBACKUP time stamp: 2006-08-01 06.04.57
BRO307I Shutting down database instance R31 ...
```

```
BRO280I BRBACKUP time stamp: 2006-08-01 06.05.04
BRO308I Shutdown of database instance R31 successful
BRO056I End of database backup: bdtefsqa.aff 2006-08-01 06.04.50
BRO280I BRBACKUP time stamp: 2006-08-01 06.05.04
BRO052I BRBACKUP completed successfully
```

Checking the results of the backup

After the backup, we can check the backup status in the **brbackup** run log file and the **backfm** command. We can also check the backup results with the Data Protection for FlashCopy command **tdphdwora**.

Checking the backup results with Data Protection for FlashCopy

The **tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap** command gives you the results of the backup in interactive mode as shown in Figure 6-19. This command gets the information from the **brbackup** run log file, **brbackup** summary log file, IDS control files, and others.

Example 6-44 Checking the backup results from the Data Protection for FlashCopy

```
orar31> tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap


                    IBM Tivoli Storage Manager for Hardware
          Data Protection for IBM Disk Storage and SAN VC for mySAP(R) on
Oracle(R)

                              (TDPHDWORA)

         - Version 5, Release 3, Level 1.2  for AIX (32 Bit) -
              Build: 304 generated at 14:34:52 on Mar 14 2006
       (c) Copyright IBM Corporation, 2000, 2005, All Rights Reserved.


                   Log history of the database backups
                                SystemID: R31

--------------------------------------------------------------------------------
 # Log          Start of backup   Type           BackupID         TSM FlashCopy
--------------------------------------------------------------------------------
 1 bdtefsqa.aff 06-08-01 03.44.00 offline_mirror R31___AOEQC1BXPJ ok  ok
 2 bdtdpzbh.anf 06-07-28 22.49.33 online_mirror  R31___AOEQ7GC1AA ok  invalid
 3 bdtdpmld.anf 06-07-28 20.27.21 online_mirror  R31___AOEQ7B9W4I -   invalid
 4 bdtdozej.anf 06-07-28 17.57.57 online_mirror  R31___AOEQ75WVR2 -   invalid
 5 bdtdnbgk.anf 06-07-28 08.35.30 online_mirror  R31___AOEQ6LTN33 -   invalid
 6 bdtdmzhi.anf 06-07-28 08.13.22 online_mirror  R31___AOEQ6L1L8N ok  invalid


   d -  show details
   r -  refresh display
   o -  choose from older backups
   # -  restore the backup number #, including pre- and post-processing
   f -  show FlashCopy backups only (target set state IN_USE)
   e -  emergency FlashBack Restore
   x -  exit tdphdwora

 Enter your selection => d
```

The first line of the output Example 6-19 displays the latest backup results. If it is .aff, this indicates that the backup was an offline_mirror backup. There are “ok” entries in both the TSM and FlashCopy column — indicating that the backup was sent to both, and is valid for a restore. The columns in the history provide the following information:

- #: This column shows the number you can use to request a restore from one of the backups shown.
- Log: This column displays the base name of the brbackup run log file, to which is appended the suffix .aff (if the backup type is offline_mirror) or .anf (if the backup type is online_mirror).
- Start of backup: Date and time the **brbackup** run was started.
- Type: Backup type used for **brbackup**.
- BackupID: The backup ID established by Data Protection for mySAP. For a **brbackup** in progress, question marks will be shown.
- TSM: The current status of backups sent to Tivoli Storage Manager. For a still-running **brbackup**, question marks “??” will be shown. If the status is “ok?”, it means that either not all the files are yet backed up to Tivoli Storage Manager or that the Local Snapshot Repository of Data Protection for FlashCopy does not know about this backup ID. If the BACKUP_MAX value is set too small to cover all the valid backup versions, it can show a status of “ok?” or “?”. So, make sure to set the BACKUP_MAX to a sufficiently high value.
- FlashCopy: The current status of backup objects with type ‘FlashCopy’ as recorded by Data Protection for FlashCopy (**splitint** and the FlashCopy agent) in its control file.

For more information, see “Checking the results of the backup” on page 182.

Note: If the status of the target volumes was changed using the storage system user interfaces (that is, externally to Data Protection for FlashCopy), the actual status does not match these FlashCopy backup objects and might contradict what is shown in the **tdphdwora** menu. Therefore, to avoid conflicts, you should create and manipulate FlashCopy SAP images only using Data Protection for FlashCopy.

6.3.2 Offline database restore from Tivoli Storage Manager

In this section we describe the database restore from an offline backup image stored in Tivoli Storage Manager. To restore from a FlashCopy image, see 6.5.2, “FlashBack restore” on page 211.

Tivoli Storage Manager backup objects should be restored from the Tivoli Storage Manager server only to the production server using either a LAN or SAN connection.

There is a great deal of documentation available that shows how to deal with such Tivoli Storage Manager backup objects when running a restore/recovery, for example:

- *SAP Database Administration: Oracle Restore and Recovery*
- *SAP Database Guide: Oracle (BC-DB-ORA-DBA)*
- *Data Protection for mySAP Installation and User’s Guide for Oracle*, SC33-6340
- *Using ADSM to Back Up Databases*, SG24-4335

There are many options for restoring Oracle SAP databases. As well as the menu-guided tools **brtools** and **brrecover**, many experienced administrators have established restore/recovery procedures using **brrestore** (a BR*Tools component) or **backfm** (a Data Protection for mySAP program), among other reasons, to shorten the restore/recovery processes.

We can use the **backfm -p $ORACLE_HOME/dbs/initSID.utl** command to restore all objects backed up by Data Protection for mySAP with or without involvement of Data Protection for FlashCopy. Because this type of restore is outside the control of BR*Tools, it is the responsibility of the DBA to determine whether recovery is necessary and to perform the necessary database recovery.

To allow the administrator to easily check on the Tivoli Storage Manager or FlashCopy status of the two backup types, the Data Protection for FlashCopy command **tdphdwora** can be used in the restore/recovery process.

Sample offline database restore procedure using brrestore

We will start the restore process with **brrestore**. BR*Tools will show the various available backup levels so we can select the level to restore and also how far the recovery should proceed.

1. Log in to the production system (auntmathilda) as oracle user id (orar31).
2. We start the restore using the **brrestore -m full -b bdtefsqa.aff** command, as shown in Example 6-45. The output shows the redo log mirror files and control files that will be restored and allows us to choose whether to stop here or continue. We enter c to continue. These files are restored only when restoring from an offline backup.

Example 6-45 Start the database restore

```
orar31> brrestore -m full -b bdtefsqa.aff
BRO401I BRRESTORE 6.40 (36)
BRO169I Value 'online_mirror' of parameter/option 'backup_type/-t' ignored for
'brrestore' - 'offline' assumed
BRO405I Start of file restore: rdtejoek.rsb 2006-08-01 22.25.38

BRO428W File /oracle/R31/mirrlogA/log_g11m2.dbf will be overwritten
BRO428W File /oracle/R31/mirrlogB/log_g12m2.dbf will be overwritten
BRO428W File /oracle/R31/mirrlogA/log_g13m2.dbf will be overwritten
BRO428W File /oracle/R31/mirrlogB/log_g14m2.dbf will be overwritten
BRO428W File /oracle/R31/sapdata2/cntrl/cntrlR31.dbf will be overwritten
BRO428W File /oracle/R31/sapdata3/cntrl/cntrlR31.dbf will be overwritten
BRO280I BRRESTORE time stamp: 2006-08-01 22.25.38
BRO256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:
c
```

3. Example 6-46 shows the database files required for the restore.

Example 6-46 file list for the restore

```
BRO280I BRRESTORE time stamp: 2006-08-01 22.25.42
BRO407I Restore of database: R31
BRO408I BRRESTORE action ID: rdtejoek
BRO409I BRRESTORE function ID: rsb
BRO449I Restore mode: FULL
BRO411I Database files for restore:
/oracle/R31/origlogA/log_g11m1.dbf
/oracle/R31/mirrlogA/log_g11m2.dbf
/oracle/R31/origlogB/log_g12m1.dbf
/oracle/R31/mirrlogB/log_g12m2.dbf
/oracle/R31/origlogA/log_g13m1.dbf
/oracle/R31/mirrlogA/log_g13m2.dbf
/oracle/R31/origlogB/log_g14m1.dbf
```

```
/oracle/R31/mirrlogB/log_g14m2.dbf
/oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf
/oracle/R31/sapdata2/cntrl/cntrlR31.dbf
/oracle/R31/sapdata3/cntrl/cntrlR31.dbf
BRO419I Files will be restored from backup: bdtefsqa.aff 2006-08-01 03.44.00
BRO416I 27 files found to restore, total size 63324.949 MB
BRO421I Restore device type: util_file
BRO280I BRRESTORE time stamp: 2006-08-01 22.25.42
BRO256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:
c
```

4. **brrestore** checks the availability of the FlashCopy backup with the **splitint** command, and shows the option to select which backup type we want to use for the restore, Example 6-47. We choose to restore from Tivoli Storage Manager.

Example 6-47 Choose which backup type to restore

```
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
get_disk_backups':
.
.
.
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
flashback_check -i /tmp/baaLZMlMb -b R31___AOEQC1BXPJ':
.
.
.
BKI7316I: The following backup types for the BACKUPID R31___AOEQC1BXPJ have been
found:
  - TSM
  - FLASHCOPY
Select which backup type you want to be used for the restore
  [t] TSM
  [f] FLASHCOPY
t
```

5. In Example 6-48, the restore process starts restoring files from Tivoli Storage Manager. For the offline_backup restore, it restores 27 files including 22 datafiles, 1 latest control file, and 4 redo log files.

Example 6-48 Start restore using brrestore from the Tivoli Storage Manager

```
BKI7319I: Start TSM restore.
BKI5016I: Time: 08/04/06 20:54:12 New TSM session created: MGMNT-CLASS: ,
TSM-Server: UNCLETITUS, type: SIMPLE
BKI0027I: Time: 08/04/06 20:54:14 Object: 2 of 23 in process:
/oracle/R31/sapdata4/r31_11/r31.data11 Size: 4.863 GB, MGMNT-CLASS: R31DBS,
TSM-Server: UNCLETITUS .
BKI0027I: Time: 08/04/06 20:54:14 Object: 1 of 23 in process:
/oracle/R31/sapdata3/r3162O_1/r3162O.data1 Size: 3.262 GB, MGMNT-CLASS: R31DBS,
TSM-Server: UNCLETITUS .
BKI0023I: Time: 08/04/06 20:56:07 Done: 4.863 GB (7.9 %) of 61.665 GB. Estimated
end time: 08/04/06 21:21:48.
.
.
.
```

6. After the completion of the restore, you have to recover the database, as we discussed in “Sample online database backup restore procedure using brrestore” on page 186.

6.4 Database backup and restore with NOCOPY option

In the following sections we discuss the use of the NOCOPY option.

6.4.1 Database backup with NOCOPY option

Here we explain database backup with NOCOPY.

Current profile setting

We will use **brbackup -c -u system/redbook** command to start the online database backup to FlashCopy and Tivoli Storage Manager. This command references these configuration files.

- /oracle/R31/920_64/dbs/initR31.sap

```
backup_type = online_mirror
split_option = “-p -C NOCOPY /oracle/R31/920_64/dbs/initR31.fcs”
split_resync = yes
backup_mode = all
util_par_file = /oracle/R31/920_64/dbs/initR31.utl
```

- /oracle/R31/920_64/dbs/initR31.fcs

```
FLASHCOPY_TYPE INCR
```

- /oracle/R31/920_64/dbs/initR31.utl

```
FCS_FILE /oracle/R31/920_64/dbs/initR31.fcs
```

You can change the FLASHCOPY_TYPE from INCR to NOCOPY, but we recommend to use the -C NOCOPY at the split_option, because you can then run different FlashCopy backup requests with different BR*Tools profiles (initR31.sap, initR31.sap2...) while using only one Data Protection for mySAP profile(.fcs).

Sample Online database backup with NOCOPY procedure

A NOCOPY backup and restore is very similar to 6.2, “Online backup and restore with FlashCopy disks”, therefore we will show only the output which is different here.

1. The FlashCopy is started with the NOCOPY option in Example 6-49.

Example 6-49 Performing NOCOPY FlashCopy

```
orar31@uncletitus:/oracle/R31>brbackup -c -u system/redbook
.
.
.
IDS1030I FlashCopy started ...
EE01625I Number of volumes to be processed by Flashcopy: 8
EE00354I Performing NOCOPY FlashCopy of source volume 75924811038 to target volume
75924811048
EE00354I Performing NOCOPY FlashCopy of source volume 75924811128 to target volume
75924811129
EE00354I Performing NOCOPY FlashCopy of source volume 75924811117 to target volume
75924811127
```

```
EE00354I Performing NOCOPY FlashCopy of source volume 7592481110D to target volume
7592481111D
EE00354I Performing NOCOPY FlashCopy of source volume 7592481110C to target volume
7592481111C
EE00354I Performing NOCOPY FlashCopy of source volume 7592481103B to target volume
7592481104B
EE00354I Performing NOCOPY FlashCopy of source volume 7592481103A to target volume
7592481104A
EE00354I Performing NOCOPY FlashCopy of source volume 75924811039 to target volume
75924811049
IDS1031I FlashCopy successful.
```

2. The backup process mounts the file system to the backup server and begins the backup, as shown in Example 6-50. Because this backup is using the NOCOPY option, the FlashCopy backup on disk cannot be used for the recovery. All the disks are deleted from the backup system, and the withdraw command is performed after finishing the backup to Tivoli Storage Manager. Notice the output message that you cannot use the disk backup for restore, you can only restore from the Tivoli Storage Manager Server.

Example 6-50 Withdrawing the FlashCopy volumes

```
IDS1005I Start of splitint program at: 08/11/06-04:01:46 .
Function                        withdraw
Backup list                     /oracle/R31/sapbackup/.bdtgcwde.lst
IDS1025I Time stamp: 08/11/06-04:01:47.
IDS1060I Start of listing of exported volume groups/unmounting file systems ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
EE00273I Unmounting the file system /oracle/R31/sapdata4...
EE00273I Unmounting the file system /oracle/R31/sapdata3...
EE00273I Unmounting the file system /oracle/R31/sapdata2...
EE00273I Unmounting the file system /oracle/R31/sapdata1...
EE00152I Removing volume group R31tdp1 ....
EE00153I Varied off and exported volume group : R31tdp1
EE00138I Flashcopy type is set to NOCOPY.
Removing disk meta data for all target disks...
This backup is NOT valid for a FlashCopy restore.
Please restore from TSM Server.
EE00127I Removing device : hdisk46
EE00127I Removing device : hdisk45
EE00127I Removing device : hdisk37
EE00127I Removing device : hdisk36
EE00127I Removing device : hdisk25
EE00127I Removing device : hdisk24
EE00127I Removing device : hdisk23
EE00127I Removing device : hdisk22
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/11/06-04:02:21.
IDS1061I Start of withdraw of the target-source pairs ...
EE00020I ====>Performing DP FOR FlashCopy WITHDRAW command.
EE00357I Performing FlashCopy withdraw of source volume 75924811038 from target
volume 75924811048
EE00357I Performing FlashCopy withdraw of source volume 75924811039 from target
volume 75924811049
```

```
EE00357I Performing FlashCopy withdraw of source volume 7592481103A from target
volume 7592481104A
EE00357I Performing FlashCopy withdraw of source volume 7592481103B from target
volume 7592481104B
EE00357I Performing FlashCopy withdraw of source volume 7592481110C from target
volume 7592481111C
EE00357I Performing FlashCopy withdraw of source volume 7592481110D from target
volume 7592481111D
EE00357I Performing FlashCopy withdraw of source volume 75924811117 from target
volume 75924811127
EE00357I Performing FlashCopy withdraw of source volume 75924811128 from target
volume 75924811129
IDS1047I End of listing.
IDS1025I Time stamp: 08/11/06-04:02:36.
```

Checking the results of the backup with NOCOPY option

After the backup with NOCOPY option is complete, we check the backup results with the **tdphdwdora** command, as in Example 6-51. We can see that only the Tivoli Storage Manager backup is available for the restore - the FlashCopy backup has an invalid status for the restore.

Example 6-51 Checking the results of the backup with NOCOPY option

```
                  Log history of the database backups
                                SystemID: R31

--------------------------------------------------------------------------------
 # Log          Start of backup   Type          BackupID         TSM FlashCopy
--------------------------------------------------------------------------------
 1 bdtgcwde.anf 06-08-11 03.37.14 online_mirror  R31___AOEQQB74BA ok  invalid
 2 bdtgcjzh.anf 06-08-11 01.20.21 online_mirror  R31___AOEQQ6C4VM *   invalid
 3 bdtgbann.aff 06-08-10 18.40.55 offline_mirror R31___AOEQPS1U9V ok  invalid
 4 bdtexjjh.anf 06-08-04 17.52.29 online_mirror  R31___AOEQH5XEQ3 -   invalid
 5 bdtesqng.anf 06-08-03 18.48.24 online         R31___AOEQFS5BU5 -   invalid
 6 bdtepmmj.anf 06-08-03 03.24.09 online_mirror  R31___AOEQEVEMA4 -   invalid


    d -  show details
    r -  refresh display
    o -  choose from older backups
    # -  restore the backup number #, including pre- and post-processing
    f -  show FlashCopy backups only (target set state IN_USE)
    e -  emergency FlashBack Restore
    x -  exit tdphdwora

 Enter your selection =>
```

6.4.2 Database restore from backup taken with NOCOPY option

The restore process from the Tivoli Storage Manager media is exactly the same as in 6.2.2, “Database restore from Tivoli Storage Manager” on page 185.

6.5 FlashCopy backup and FlashBack restore

In this section, we cover the FlashCopy backup (disk only backup) and FlashBack restore process without Tivoli Storage Manager. The backup creates only a FlashCopy backup and we will use this image to restore the database. This recovery process can be used to recover from the FlashCopy backup taken at 6.2.1, “Online database backup with FlashCopy”.

The backup operation must be initiated using BR*Tools (**brbackup**), but the restore operation can be initiated by BR*Tools (**brrestore**), or Data Protection for FlashCopy (**tdphdwora**).

6.5.1 FlashCopy backup

The FlashCopy backup operation is very similar to that shown in 6.2.1, “Online database backup with FlashCopy”; except that there is no backup to the Tivoli Storage Manager server. However, some files such as NFS files that do not reside on disk copies will still be transferred to the Tivoli Storage Manager if they are part of backup request. **backint**, which receives all backup requests by **brbackup** will report to **brbackup**, on the backup ID assigned, and the backup status from its run log. This information can be retrieved by the restore commands.

The FlashCopy backup type used for this FlashCopy backup is defined by the FLSAHCOPY_TYPE in the Data Protection for FlashCopy profile. If this parameter is set to NOCOPY, it is overridden with COPY to make sure it is possible to recover from the FlashCopy.

The BR*Tools command **brbackup** supports online and offline backup, and must be initiated from the backup server.

Current profile setting

We will use **brbackup -c -p /oracle/R31/920_64/dbs/initR31.sapd -u system/redbook** command on the backup system to start the online database FlashCopy backup. This command references these configuration files. The **-d** option for the split_option indicates the disk only (FlashCopy) backup. You can update split _option line in the initR31.sap file directly.

These are the files referenced:

- /oracle/R31/920_64/dbs/initR31.sapd

```
backup_type = online_mirror
split_option = “-d -p /oracle/R31/920_64/dbs/initR31.fcs”
split_resync = yes
backup_mode = all
util_par_file = /oracle/R31/920_64/dbs/initR31.utl
```

- /oracle/R31/920_64/dbs/initR31.fcs

```
FLASHCOPY_TYPE INCR
```

- /oracle/R31/920_64/dbs/initR31.utl

```
FCS_FILE /oracle/R31/920_64/dbs/initR31.fcs
```

Sample FlashCopy backup procedure

This command produces very similar output to previous backup examples, so we will show only some specific parts of the logs here.

1. Log in to the backup system (uncletitus) as the Oracle user id (orar31).
2. Start the FlashCopy backup from the backup system using the command shown in Example 6-52.

Example 6-52 Start backup operation

```
orar31@uncletitus:/oracle/R31>brbackup -c -p /oracle/R31/920_64/dbs/initR31.sapd
-u system/redbook
BR0051I BRBACKUP 6.40 (36)
BR0055I Start of database backup: bdtepmmj.anf 2006-08-03 03.24.09
BR0477I Oracle pfile /oracle/R31/920_64/dbs/initR31.ora created from spfile
/oracle/R31/920_64/dbs/spfileR31.ora

BR0280I BRBACKUP time stamp: 2006-08-03 03.24.11
BR0319I Control file copy created: /oracle/R31/sapbackup/cntrlR31.dbf 5005312
:
```

3. **splitint** gathers information about the volumes from the production server, in Example 6-53, and lists the matching target volumes for the FlashCopy. The list of target volumes that we can use is in the Data Protection for FlashCopy target volume file (initPR1.fct). If more than one set of target volumes has been specified, an eligible set is selected for use.

Example 6-53 Gather volume formation a

```
EE00156I Finding the serial numbers ...
IDS1404I The target set with ID '1' is selected for this run.
Matching pair tgt: <75924811048> src: <75924811038> size: <10737418240_Bytes>
Matching pair tgt: <75924811049> src: <75924811039> size: <10737418240_Bytes>
Matching pair tgt: <7592481104A> src: <7592481103A> size: <10737418240_Bytes>
Matching pair tgt: <7592481104B> src: <7592481103B> size: <10737418240_Bytes>
Matching pair tgt: <7592481111C> src: <7592481110C> size: <10737418240_Bytes>
Matching pair tgt: <7592481111D> src: <7592481110D> size: <10737418240_Bytes>
Matching pair tgt: <75924811127> src: <75924811117> size: <5368709120_Bytes>
Matching pair tgt: <75924811129> src: <75924811128> size: <10737418240_Bytes>
```

4. The database received the request to set to backup mode, which is propagated through to **brbackup** on the backup server. This initiates the database shutdown if an offline_mirror backup is specified.

Example 6-54 Setting the tablespaces in backup mode

```
IDS1320I Setting the tablespaces in backup mode or, in case of type offline, the
database will be shutdown.
BR0280I BRBACKUP time stamp: 2006-08-03 03.27.02
#BEGIN SPLIT /oracle/R31/sapbackup/TSMHWj6eny2

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.03
BR0315I 'Alter tablespace PSAPR31 begin backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.03
BR0315I 'Alter tablespace PSAPR31620 begin backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.03
BR0315I 'Alter tablespace PSAPR31USR begin backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.03
BR0315I 'Alter tablespace PSAPUND0 begin backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.03
```

```
BR0315I 'Alter tablespace SYSTEM begin backup' successful
```

5. **splitint** performs the FlashCopy operation from the production server using the FLASH_COPY option, as in Example 6-55.

Example 6-55 Starts FlashCopy operation

```
IDS1122I FlashCopying the sources to the target volumes ...
Function                        flashcopy_prod
Subfunction                     performsplit
Backup list                     /oracle/R31/sapbackup/work/.bdtepmmj.lst
EE00272I Flushing the buffers to disk...
IDS1030I FlashCopy started ...
EE01625I Number of volumes to be processed by Flashcopy: 8
EE00354I Performing INCR FlashCopy of source volume 75924811038 to target volume
75924811048
EE00354I Performing INCR FlashCopy of source volume 75924811128 to target volume
75924811129
EE00354I Performing INCR FlashCopy of source volume 75924811117 to target volume
75924811127
EE00354I Performing INCR FlashCopy of source volume 7592481110D to target volume
7592481111D
EE00354I Performing INCR FlashCopy of source volume 7592481110C to target volume
7592481111C
EE00354I Performing INCR FlashCopy of source volume 7592481103B to target volume
7592481104B
EE00354I Performing INCR FlashCopy of source volume 7592481103A to target volume
7592481104A
EE00354I Performing INCR FlashCopy of source volume 75924811039 to target volume
75924811049
IDS1031I FlashCopy successful.
```

6. The Oracle database on the production server is requested to put the database tablespaces in “end backup” mode from the backup server as shown in Example 6-56. In an offline_mirror backup, the database is started now.

Example 6-56 Setting the tablespaces in end backup mode

```
IDS1321I The tablespaces will end the backup mode or, in case of offline_split,
the database will be started.
BR0280I BRBACKUP time stamp: 2006-08-03 03.27.21
#END SPLIT /oracle/R31/sapbackup/TSMHWCxeny3

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.22
BR0317I 'Alter tablespace PSAPR31 end backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.22
BR0317I 'Alter tablespace PSAPR3162O end backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.22
BR0317I 'Alter tablespace PSAPR31USR end backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.22
BR0317I 'Alter tablespace PSAPUNDO end backup' successful

BR0280I BRBACKUP time stamp: 2006-08-03 03.27.22
```

```
BRO317I 'Alter tablespace SYSTEM end backup' successful
IDS1024I Exiting with return code 0.
```

7. If the FLASHCOPY_TYPE is set to COPY or INCR (FlashCopy backup without Tivoli Storage Manager backup is only possible with COPY or INCR type), the FlashCopy agent (**fcagent**) is initiated on the backup server to monitor the FlashCopy progress in the storage system periodically. It records the results in the FlashCopy agent log file (splitint_[p|b]_runagent_jjjjmmddHHMMSS.log) created on the LOG_TRACE_DIR specified in the Data Protection for FlashCopy profile(initR31.fcs). When the FlashCopy physical operation completes, it changes the BSI status to BSI_DISKONLY. See Example 6-57.

Example 6-57 Start of fcagent

```
IDS1025I Time stamp: 08/03/06-03:27:31.
IDS1540I Start of fcagent on the backup system ...
```

8. The file systems are imported and mounted on the backup server after the FlashCopy image copy is available, Example 6-58.

Example 6-58 Volume group import and mount on the backup system

```
IDS1123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /oracle/R31/sapbackup/.bdtepmmj.lst
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
EE00126I Trying to find new devices to match the source device. This process will
take some time.......
EE00148I Importing volume groups now...
EE00149I Newly imported volume group: R31tdp1
EE00124I Mounting filesystem : /oracle/R31/sapdata1.
EE00124I Mounting filesystem : /oracle/R31/sapdata2.
EE00124I Mounting filesystem : /oracle/R31/sapdata3.
EE00124I Mounting filesystem : /oracle/R31/sapdata4.
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/03/06-03:31:11.
BRO280I BRBACKUP time stamp: 2006-08-03 03.31.18
BRO629I SPLITINT command sent success message: #SUCCESS
```

9. **backint** reports to **brbackup**, by backup ID, that all files have been saved. **brbackup** records the successful backup status in its run log. In Example 6-59, the objects that were saved on the disk are shown as sent to the TSM-Server: splitint, MGMNT-Class: disk_only.

Example 6-59 Running the brbackup to backup from the backup system with FlashCopy'd image

```
BRO229I Calling backup utility with function 'backup'...
BRO278I Command output of '/usr/sap/R31/SYS/exe/run/backint -u R31 -f backup -i
/oracle/R31/sapbackup/.bdtepmmj.lst -t file -p /oracle/R31/920_64/dbs/initR31.utl
-c':
.
.
.
```

```
BKI0027I: Time: 08/03/06 03:32:57 Object: 2 of 23 in process:
/oracle/R31/sapdata4/r31_12/r31.data12 Size: 3.691 GB, MGMNT-CLASS: disk_only,
TSM-Server: splitint .
BKI0027I: Time: 08/03/06 03:32:57 Object: 6 of 23 in process:
/oracle/R31/sapdata3/r31620_2/r31620.data2 Size: 3.203 GB, MGMNT-CLASS: disk_only,
TSM-Server: splitint .
.
.
.
```

10. If split_resync=yes is specified in the **brbackup** profile, then a resynchronization is performed for cleanup and to release system resources. **brbackup** calls **splitint -f resync**. The status of the current backup cycle will be set to PSI_UNMOUNT_DONE or PSI_WITHDRAW_DONE. When called by **brbackup**, the Data Protection for FlashCopy **splitint -f resync** function will perform the following operations, depending on the FLASHCOPY_TYPE used in the **brbackup** request:
    - If FLASHCOPY_TYPE COPY or INCR was used, run a **splitint -f unmount** to:
        i. Unmount all file systems used.
        ii. Vary off and export all volume groups used.
        iii. Set the PSI for the backup cycle to PSI_UNMOUNT_DONE.
    - If FLASHCOPY_TYPE NOCOPY was used, run a **splitint -f withdraw** to:
        i. Unmount all file systems used.
        ii. Vary off and export all volume groups used.
        iii. Withdraw the source/target relationship.
        iv. Set the PSI for the backup cycle to PSI_WITHDRAW_DONE.

    In either case, the **brbackup** system sees a completed backup cycle, which allows a new **brbackup** to be started. Our resynchronization is shown in Example 6-60.

> **Note:** For safety reasons, we strongly recommended that you specify the resync options, in order to release the system resources on the backup server that are used by the backup operation.

Example 6-60 Unmounting file systems and exporting volume group

```
BR0297I Resynchronizing mirror disks...
BR0280I BRBACKUP time stamp: 2006-08-03 03.33.11
BR0278I Command output of '/usr/sap/R31/SYS/exe/run/splitint -u R31 -f resync -i
/oracle/R31/sapbackup/.bdtepmmj.lst -c -s -d -p
/oracle/R31/920_64/dbs/initR31.fcs':
.
.
.
EEO0273I Unmounting the file system /oracle/R31/sapdata4...
EEO0273I Unmounting the file system /oracle/R31/sapdata3...
EEO0273I Unmounting the file system /oracle/R31/sapdata2...
EEO0273I Unmounting the file system /oracle/R31/sapdata1...
EEO0152I Removing volume group R31tdp1 ....
EEO0153I Varied off and exported volume group : R31tdp1
EEO0140I Flashcopy type is set to COPY or INCR.
Leaving disk meta data intact for all target disks...
This backup is valid for a FlashCopy restore.
EEO0127I Removing device : hdisk46
EEO0127I Removing device : hdisk45
```

```
EE00127I Removing device : hdisk37
EE00127I Removing device : hdisk36
EE00127I Removing device : hdisk25
EE00127I Removing device : hdisk24
EE00127I Removing device : hdisk23
EE00127I Removing device : hdisk22
IDS1077I Semaphore released.
IDS1047I End of listing.
IDS1025I Time stamp: 08/03/06-03:34:10.
BRO280I BRBACKUP time stamp: 2006-08-03 03.34.10
BRO629I SPLITINT command sent success message: #SUCCESS
IDS1024I Exiting with return code 0.

BRO280I BRBACKUP time stamp: 2006-08-03 03.34.10
BRO298I Resynchronization of mirror disks successful

BRO056I End of database backup: bdtepmmj.anf 2006-08-03 03.34.11
BRO280I BRBACKUP time stamp: 2006-08-03 03.34.13
BRO052I BRBACKUP completed successfully
```

Checking the results of the FlashCopy backup

After the FlashCopy backup, we can check the backup status and current backup cycle using the Data Protection for FlashCopy **tdphdwora** command.

The **tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap** command shows the previous backup results, as in Example 6-61.

Example 6-61 Checking the FlashCopy backup result

```
orar31> tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap

                  Log history of the database backups
                                SystemID: R31

--------------------------------------------------------------------------------
 # Log          Start of backup   Type           BackupID          TSM FlashCopy
--------------------------------------------------------------------------------
 1 bdtepmmj.anf 06-08-03 03.24.09 online_mirror  R31___AOEQEVEMA4 *   ok
 2 bdtekfvx.anf 06-08-02 01.44.45 online_mirror  R31___AOEQDCB8VT ok  invalid
 3 bdtefsqa.aff 06-08-01 03.44.00 offline_mirror R31___AOEQC1BXPJ ok  invalid
 4 bdtdpzbh.anf 06-07-28 22.49.33 online_mirror  R31___AOEQ7GC1AA -   invalid
 5 bdtdpmld.anf 06-07-28 20.27.21 online_mirror  R31___AOEQ7B9W4I -   invalid
 6 bdtdozej.anf 06-07-28 17.57.57 online_mirror  R31___AOEQ75WVR2 -   invalid


   d -  show details
   r -  refresh display
   o -  choose from older backups
   # -  restore the backup number #, including pre- and post-processing
   f -  show FlashCopy backups only (target set state IN_USE)
   e -  emergency FlashBack Restore
   x -  exit tdphdwora

 Enter your selection =>
```

6.5.2 FlashBack restore

FlashBack restore uses the FlashCopy reverse copy to restore a database directly from the backup disk volumes (target volumes) to the original location (source volumes) of the production system.

FlashBack restore offers the following benefits. You can:

- Do a quick restore in the event of database failure.
- Restore operating system storage structure (file system, volume group, tablespaces.)
- Make multiple FlashCopy backups at different times, depending on how much disk you want to use for FlashCopies. This means that you can restore the database to different points in time, by selecting which target to FlashBack.

Data Protection for FlashCopy can run FlashBack Restore when requested by the suitable tools (**brrestore** or **backfm** before V5.3.0, now also **tdphdwora/brrestore**). **brrestore** and **backfm** will call Data Protection for mySAP (**backint**) for a complete database restore. The FlashCopy backup objects reside on a set of volumes (the target volumes) after the FlashCopy backup, which was initiated with **brbackup -t offline_mirror** or **-t online_mirror**).

tdphdwora can be used to run a complete restore cycle including pre- and post-restore activity using **PreRestore.sh** and **PostRestore.sh** as well as running **brrestore**.

For FlashBack restore, we recommend using **brrestore** because:

- It creates a restore run log in /oracle/<*SID*>/sapbackup directory, whereas **backfm** has no such recording capability.
- It uses a successful **brbackup** run log as a basis for the restore. For **backfm**, the files seen under one backup ID do not guarantee a successful backup so the administrator must manually check the run log.
- It selects all files automatically from the **brbackup** run log given to **brrestore** as a parameter at start time.
- It creates a directory below the directory mount points, if required.

There are a number of situations where FlashBack restore must not be used. We list some here, but it is very important to read carefully the sections “When Not to Use FlashBack Restore” and “FlashBack Restore Limitations” in the manual Data Protection for FlashCopy *Devices for mySAP Installation and User’s Guide for Oracle,* SC33-8207. Special attention is required when making any change to the production server’s hardware configuration, to make sure proper maintenance procedures are observed. We recommend thorough testing of FlashBack restore procedures. Also, the integrity of the FlashCopy target volumes must be maintained — for example, there must be no updates to them after the FlashCopy is complete.

We gave some examples of what happens during a FlashBack restore on DB2 where there are changes to the volume group after the backup, such as creating or deleting a file system or adding a volume to the volume group in 5.4.2, “FlashBack restore” on page 149. There will be similar results in Oracle environments.

FlashBack restore is not possible in these circumstances, among others:

- If the Data Protection for FlashCopy target volume file (.fct) for the FlashBack Restore is different from the target volume files used for the FlashCopy backup.
- If you are unsure of what backup images you have on the target volumes that you plan to restore using FlashBack Restore

- If the source volume configuration on the production system differs from the source volume configuration during the FlashCopy backup, and you want to preserve the new source volume configuration (for example, if a volume has been added or deleted on the production system since the FlashCopy backup).
- If the backup of the database was performed using Data Protection for FlashCopy with the FLASHCOPY_TYPE parameter specified as NOCOPY.
- If the FlashCopy agent process is not physically complete.
- If there are logical volumes or file systems that belong to other applications in the database volume group, this can cause integrity problems. We recommend having only file systems and logical volumes which are part of the SAP database in the database volume group.
- FlashBack Restore cannot restore a database that was backed up with a version of Data Protection for ESS earlier than V5.3.
- If you run the withdraw command for the target volumes, the integrity of the FlashCopy target volumes cannot be guaranteed - FlashBack restore is not possible.
- A FlashCopy backup from ESS volumes cannot be restored directly to DS volumes.

Sample FlashBack restore using brrestore

Before starting a FlashBack restore, we have to save the current DB control files and online redo logs because they will be overwritten in the FlashBack restore. This can be done manually or using the **PreRestore.sh** script. If you restore using **tdphdwora**, the **PreRestore.sh** script can be selected to run before the restore process using **brrestore**. We will restore the database using the **brrestore** command in this example:

1. Log in to the production system (auntmathilda) as the Oracle user id (orar31).
2. Start the restore as shown in Example 6-62. The output shows the files that will be restored and allows us to choose whether to stop here or continue. We enter **c** to continue.

Example 6-62 Start the database restore

```
orar31> brrestore -m full -b bdtepmmj.anf
BRO401I BRRESTORE 6.40 (36)
BRO169I Value 'online_mirror' of parameter/option 'backup_type/-t' ignored for
'brrestore' - 'offline' assumed
BRO405I Start of file restore: rdtesndg.rsb 2006-08-03 18.10.16

BRO428W File /oracle/R31/sapdata4/r31_1/r31.data1 will be overwritten
BRO428W File /oracle/R31/sapdata4/r31_2/r31.data2 will be overwritten
.
.
.
BRO428W File /oracle/R31/sapdata3/cntrl/cntrlR31.dbf will be overwritten
BRO280I BRRESTORE time stamp: 2006-08-03 18.10.16
BRO256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:
c
```

3. Now, we see the list of database files which will be restored. In Example 6-63, we request to continue.

Example 6-63 Check the availability of the FlashCopy backup

```
BRO280I BRRESTORE time stamp: 2006-08-03 18.10.22
BRO407I Restore of database: R31
BRO408I BRRESTORE action ID: rdtesndg
```

```
BRO409I BRRESTORE function ID: rsb
BRO449I Restore mode: FULL
BRO411I Database files for restore:
/oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf
/oracle/R31/sapdata2/cntrl/cntrlR31.dbf
/oracle/R31/sapdata3/cntrl/cntrlR31.dbf
BRO419I Files will be restored from backup: bdtepmmj.anf 2006-08-03 03.24.09
BRO416I 23 files found to restore, total size 63144.945 MB
BRO421I Restore device type: util_file
BRO280I BRRESTORE time stamp: 2006-08-03 18.10.22
BRO256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:
c
```

4. In Example 6-63, it checks the availability of the FlashCopy backup via **splitint**.

Example 6-64 Check the availability of FlashCopy backup

```
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
get_disk_backups':
.
.
.
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
flashback_check -i /tmp/baaez7eMb -b R31___AOEQEVEMA4':
splitint: IDS1411I The intended FlashCopy type has a value of 'INCR'.
splitint: Profile                    /oracle/R31/920_64/dbs/initR31.fcs
splitint: Log file                   splitint_?_20060308181050.log
splitint: Trace file                 splitint_?_20060308181050.trace
splitint: IDS1015I Start of splitint program at: 08/03/06-18:10:50 .
splitint: #FOUND R31___AOEQEVEMA4 /oracle/R31/sapdata4/r31_1/r31.data1 yes
splitint: #FOUND R31___AOEQEVEMA4 /oracle/R31/sapdata4/r31_2/r31.data2 yes
splitint: #FOUND R31___AOEQEVEMA4 /oracle/R31/sapdata4/r31_3/r31.data3 yes
splitint: #FOUND R31___AOEQEVEMA4 /oracle/R31/sapdata4/r31_4/r31.data4 yes
.
.
.
splitint: IDS1023I Exiting with return code 0.
```

5. The FlashBack restore starts as shown in Example 6-65.

Example 6-65 Start the FlashBack restore

```
BKI7320I: Start FLASHCOPY restore.
BKI7536I: Execute command 'splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f
flashback -i /tmp/caaeX7eMc -b R31___AOEQEVEMA4':
```

6. The status is shown in Example 6-66.

Example 6-66 Shows the detailed backup status

```
splitint: IDS1014I 1  BACKUP_SEQUENCE_NO        00028
splitint: 2  BACKUP_STATUS              BSI_DISKONLY
splitint: 3  PROCESSING_STATUS          PSI_UNMOUNT_DONE
splitint: 4  BACKUP_ID                  R31___AOEQEVEMA4
splitint: 5  VOL_TARGET_SET             1
splitint: 6  DT_FLASHCOPY_START         20060308032412
splitint: 7  DT_FLASHCOPY_END           08/03/06-03:24:07
```

```
splitint: 8  DT_MOUNT_END              20060308033111
splitint: 9  EXCHANGE_FILE             exchange.00028
splitint: 10 UTIL_FILE                 /oracle/R31/920_64/dbs/initR31.utl
splitint: 11 INPUT_FILE                /oracle/R31/sapbackup/.bdtepmmj.lst
splitint: 12 BACKINT_OPT_T             file
splitint: 13 BI_CALLER                 BRBACKUP
splitint: 14 BI_BACKUP                 FULL
splitint: 15 BI_REQUEST                NEW
splitint: 16 DATABASE_FILE             -
splitint: 17 DT_WITHDRAW_START         -
splitint: 18 DT_WITHDRAW_END           -
splitint: 19 VERSION                   531304
splitint: 20 FLASHCOPY_TYPE            INCR
splitint: 21 RSI                       RSI_DISKONLY
splitint: 22 BACKUP_DESTINATION        DISKONLY
```

7. **splitint** now checks the availability of the source volumes and checks the file system list on the volume group, as in Example 6-67.

Example 6-67 Shows the current volume group information

```
splitint: EEO0156I Finding the serial numbers ...
splitint: R31datavg:
splitint: LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT
POINT
splitint: lvR31data1          jfs2       16    16    1    open/syncd
/oracle/R31/sapdata1
splitint: loglv31             jfs2log    1     1     1    open/syncd    N/A
splitint: lvR31data2          jfs2       22    22    1    open/syncd
/oracle/R31/sapdata2
splitint: lvR31data3          jfs2       190   190   3    open/syncd
/oracle/R31/sapdata3
splitint: lvR31data4          jfs2       321   321   6    open/syncd
/oracle/R31/sapdata4
splitint: R31datavg:
splitint: PV_NAME          PV STATE          TOTAL PPs   FREE PPs    FREE
DISTRIBUTION
splitint: hdisk10          active            79          0
00..00..00..00..00
splitint: hdisk11          active            79          0
00..00..00..00..00
splitint: hdisk12          active            79          0
00..00..00..00..00
splitint: hdisk13          active            79          0
00..00..00..00..00
splitint: hdisk17          active            79          0
00..00..00..00..00
splitint: hdisk18          active            79          0
00..00..00..00..00
splitint: hdisk23          active            39          0
00..00..00..00..00
splitint: hdisk26          active            79          42
10..00..00..16..16
```

8. If the volumes are still assigned correctly, it displays the summary of the file systems as in Example 6-68. It includes their sizes of the backed up volumes and the file systems which will be restored. Only the file systems required for the SAP data recovery are listed.

   This is our last chance to either stop here, or continue with the restore. We must:

   – Note any changes made to the production system since the FlashCopy backup — because these will be lost.

   – Make notes of any manual steps to be performed after the FlashBack. For example, if we had created a new file system on the database volume group after the FlashCopy, it will no longer exist after the FlashBack restore. Therefor we must note here its name/size and other details, and back up its contents (for example to Tivoli Storage Manager or tar command) so that we can re-define, mount it and restore after the FlashBack.

   Enter `c` to continue the restore (or `s` to halt the process).

Example 6-68 Show the summary of the file system

```
splitint: EEOO293I List of the current file systems on the backed up volume groups
...
splitint: Name           Nodename   Mount Pt             VFS   Size    Options
Auto Accounting
splitint: /dev/lvR31data1 --        /oracle/R31/sapdata1   jfs2  4194304 rw
yes  no
splitint: /dev/lvR31data2 --        /oracle/R31/sapdata2   jfs2  5767168 rw
yes  no
splitint: /dev/lvR31data3 --        /oracle/R31/sapdata3   jfs2  49807360 rw
yes  no
splitint: /dev/lvR31data4 --        /oracle/R31/sapdata4   jfs2  84148224 rw
yes  no
splitint:
splitint: EEOO294I List of file systems which will be restored...
splitint: Name           Nodename   Mount Pt             VFS   Size    Options
Auto Accounting
splitint: /dev/lvR31data1 --        /oracle/R31/sapdata1   jfs2  4194304 rw
yes  no
splitint: /dev/lvR31data2 --        /oracle/R31/sapdata2   jfs2  5767168 rw
yes  no
splitint: /dev/lvR31data3 --        /oracle/R31/sapdata3   jfs2  49807360 rw
yes  no
splitint: /dev/lvR31data4 --        /oracle/R31/sapdata4   jfs2  84148224 rw
yes  no
splitint: IDS1084I This is your last chance to stop the FlashBack Restore. Enter
'c[ont]' to continue, 's[top]' to cancel.
c
```

9. All the file systems and the volume group on the production server are deleted.

Example 6-69 Delete the volume group and file systems

```
splitint: IDS1441I Checking the FlashCopy relations, please wait ...
splitint: IDS1134I Disabling the volumes and filesystems ...
splitint: IDS1076I Trying to set the semaphore for the critical part of
importing/exporting ...
splitint: #UNMOUNTING_FS
splitint: EEOO273I Unmounting the file system /oracle/R31/sapdata4...
splitint: EEOO402I rmfs -r /oracle/R31/sapdata4
```

```
splitint: EEO0273I Unmounting the file system /oracle/R31/sapdata3...
splitint: EEO0402I rmfs -r /oracle/R31/sapdata3
splitint: EEO0273I Unmounting the file system /oracle/R31/sapdata2...
splitint: EEO0402I rmfs -r /oracle/R31/sapdata2
splitint: EEO0273I Unmounting the file system /oracle/R31/sapdata1...
splitint: EEO0402I rmfs -r /oracle/R31/sapdata1
splitint: EEO0402I rmlv -f loglv31
splitint: EEO0152I Removing volume group R31datavg ....
splitint: EEO0153I Varied off and exported volume group : R31datavg
```

10. The FlashCopy reverse copy starts from the target to the source volumes (Example 6-70).

Example 6-70 Reverse FlashCopy

```
splitint: IDS1135I FlashCopying the target to the source volumes ...
splitint: IDS1030I FlashCopy started ...
splitint: EEO1625I Number of volumes to be processed by Flashcopy: 8
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 75924811048
to target volume 75924811038
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 75924811129
to target volume 75924811128
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 75924811127
to target volume 75924811117
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 7592481111D
to target volume 7592481110D
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 7592481111C
to target volume 7592481110C
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 7592481104B
to target volume 7592481103B
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 7592481104A
to target volume 7592481103A
splitint: EEO0354I Performing INCR reverse FlashCopy of source volume 75924811049
to target volume 75924811039
splitint: IDS1031I FlashCopy successful.
```

11. After the FlashBack restore completes, the volume group is imported and file systems are mounted on the production system, as in Example 6-71. File systems that are not used by the database itself will not be mounted automatically.

Example 6-71 Enable volumes and file systems

```
splitint: IDS1545I Start of fcagent on the production system ...
splitint: IDS1123I Enabling the volumes and filesystems ...
splitint: IDS1046I Start of listing of importing volume groups/mounting file
systems ...
splitint: EEO0402I importvg -V 40 -y R31datavg -n hdisk10
splitint: EEO0274I Bringing up the volume groups...
splitint: EEO0124I Mounting filesystem : /oracle/R31/sapdata1.
splitint: EEO0124I Mounting filesystem : /oracle/R31/sapdata2.
splitint: EEO0124I Mounting filesystem : /oracle/R31/sapdata3.
splitint: EEO0124I Mounting filesystem : /oracle/R31/sapdata4.
splitint: IDS1077I Semaphore released.
splitint: IDS1047I End of listing.
```

12. **brrestore** starts the restore operation for the extra files that were stored on Tivoli Storage Manager, as shown in Example 6-72.

Example 6-72 brrestore restore

```
BKI5016I: Time: 08/03/06 18:13:27 New TSM session created: MGMNT-CLASS: ,
TSM-Server: UNCLETITUS, type: SIMPLE
BKI0027I: Time: 08/03/06 18:13:27 Object: 23 of 23 in process:
/oracle/R31/sapbackup/cntrlR31.dbf Size: 4888.000 KB, MGMNT-CLASS: R31DBS,
TSM-Server: UNCLETITUS .
BKI0023I: Time: 08/03/06 18:13:28 Done: 4888.000 KB (100.0 %) of 4888.000 KB.
Estimated end time: 08/03/06 18:13:28.
BKI0054I: Time: 08/03/06 18:13:28 Object: 23 of 23 done:
/oracle/R31/sapbackup/cntrlR31.dbf with: 4888.000 KB restored with description
R31___AOEQEVEMA4 .
BKI0056I: Object /oracle/R31/sapbackup/cntrlR31.dbf with 4888.000 KB restored with
description R31___AOEQEVEMA4_UNCLETITUS@R31DBS#010238 00005.


BRO280I BRRESTORE time stamp: 2006-08-03 18.13.28
#FILE..... /oracle/R31/sapbackup/cntrlR31.dbf
#RESTORED. R31___AOEQEVEMA4
BKI0027I: Time: 08/03/06 18:13:28 Object: 7 of 23 in process:
/oracle/R31/sapdata3/r31620_6/r31620.data6 Size: 0 Bytes, MGMNT-CLASS: disk_only,
TSM-Server: splitint .
BKI0027I: Time: 08/03/06 18:13:28 Object: 15 of 23 in process:
/oracle/R31/sapdata4/r31_12/r31.data12 Size: 0 Bytes, MGMNT-CLASS: disk_only,
TSM-Server: splitint .
BKI0027I: Time: 08/03/06 18:13:28 Object: 1 of 23 in process:
/oracle/R31/sapdata1/system_1/system.data1 Size: 0 Bytes, MGMNT-CLASS: disk_only,
TSM-Server: splitint .
.
.
.
```

13. After the restore, perform the Oracle recovery.

Sample Online FlashCopy backup restore using tdphdwora

We will restore using **tdphdwora** in this example. **brbackup** is a file based backup utility, so we recommend to use **tdphdwora** to restore from a volume based backup such as a FlashCopy backup. The **tdphdwora** gives us the option of running **PreRestore.sh**, **brrestore** and **PostRestore.sh**. The BR*Tools (**brrestore**) will show the various available backup levels to enable a selection of the level to be restored and how far the recovery should proceed:

1. Log in to the production system (auntmathilda) as the Oracle user id (orar31).
2. Start the restore with the command **tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap**. It checks the Data Protection for FlashCopy profile (initR31.fcs), reads the SAP backup log and checks the status of Tivoli Storage Manager and FlashCopy backups. Then, the interactive menu in Example 6-73 is shown.

Example 6-73 Show the backup history

```
orar31> tdphdwora -p /oracle/R31/920_64/dbs/initR31.sap
--------------------------------------------------------------------------------
```

```
                    Log history of the database backups
                                SystemID: R31

-------------------------------------------------------------------------------
 # Log          Start of backup   Type           BackupID         TSM FlashCopy
-------------------------------------------------------------------------------
 1 bdtgcjzh.anf 06-08-11 01.20.21 online_mirror  R31___AOEQQ6C4VM *   ok
 2 bdtgbann.aff 06-08-10 18.40.55 offline_mirror R31___AOEQPS1U9V ok  invalid
 3 bdtexjjh.anf 06-08-04 17.52.29 online_mirror  R31___AOEQH5XEQ3 -   invalid
 4 bdtesqng.anf 06-08-03 18.48.24 online         R31___AOEQFS5BU5 -   invalid
 5 bdtepmmj.anf 06-08-03 03.24.09 online_mirror  R31___AOEQEVEMA4 -   invalid
 6 bdtekfvx.anf 06-08-02 01.44.45 online_mirror  R31___AOEQDCB8VT -   invalid


    d -  show details
    r -  refresh display
    o -  choose from older backups
    # -  restore the backup number #, including pre- and post-processing
    f -  show FlashCopy backups only (target set state IN_USE)
    e -  emergency FlashBack Restore
    x -  exit tdphdwora

 Enter your selection => 1
```

3. Because the backup log we selected has only a FlashCopy backup available, the production volumes and file systems are checked at this stage. It displays the current file system information and the list of file systems which will be restored, as in Example 6-74.

Example 6-74 Show the file system information

```
IDS1425I You selected to restore the backup log 'bdtgcjzh.anf'.
IDS1423I There is only a FlashCopy backup available for the backup log
'bdtgcjzh.anf'.
IDS1434I Production volumes and files systems will be checked.
IDS1435I Enter 'c[ont]' to continue or any other key to cancel.
c
IDS1180I The FlashCopy run 00036 is a valid disk backup.
EE00156I Finding the serial numbers ...
R31datavg:
LV NAME             TYPE       LPs   PPs   PVs  LV STATE      MOUNT POINT
lvR31data1          jfs2       16    16    1    open/syncd    /oracle/R31/sapdata1
loglv31             jfs2log    1     1     1    open/syncd    N/A
lvR31data2          jfs2       22    22    1    open/syncd    /oracle/R31/sapdata2
lvR31data3          jfs2       190   190   3    open/syncd    /oracle/R31/sapdata3
lvR31data4          jfs2       321   321   6    open/syncd    /oracle/R31/sapdata4
R31datavg:
PV_NAME           PV STATE          TOTAL PPs   FREE PPs    FREE DISTRIBUTION
hdisk10           active            79          0           00..00..00..00..00
hdisk11           active            79          0           00..00..00..00..00
hdisk12           active            79          0           00..00..00..00..00
hdisk13           active            79          0           00..00..00..00..00
hdisk17           active            79          0           00..00..00..00..00
hdisk18           active            79          0           00..00..00..00..00
hdisk23           active            39          0           00..00..00..00..00
hdisk26           active            79          42          10..00..00..16..16
```

```
EEO0293I List of the current file systems on the backed up volume groups ...
Name            Nodename   Mount Pt               VFS   Size    Options    Auto
Accounting
/dev/lvR31data1 --         /oracle/R31/sapdata1   jfs2  4194304 rw         yes  no
/dev/lvR31data2 --         /oracle/R31/sapdata2   jfs2  5767168 rw         yes  no
/dev/lvR31data3 --         /oracle/R31/sapdata3   jfs2  49807360 rw         yes
no
/dev/lvR31data4 --         /oracle/R31/sapdata4   jfs2  84148224 rw         yes
no
EEO0294I List of file systems which will be restored...
Name            Nodename   Mount Pt               VFS   Size    Options   Auto
Accounting
/dev/lvR31data1 --         /oracle/R31/sapdata1   jfs2  4194304 rw        yes  no
/dev/lvR31data2 --         /oracle/R31/sapdata2   jfs2  5767168 rw        yes  no
/dev/lvR31data3 --         /oracle/R31/sapdata3   jfs2  49807360 rw        yes  no
/dev/lvR31data4 --         /oracle/R31/sapdata4   jfs2  84148224 rw        yes  no
IDS1435I Enter 'c[ont]' to continue or any other key to cancel.
```

4. If we choose to continue, **tdphdwora** prompts us whether to run **PreRestore.sh** before the restore. We choose to run this script, as in Example 6-75.

Example 6-75 Getting the rollforward recovery option

```
IDS1433I
Do you want to run 'PreRestore.sh -b bdtgcjzh.anf -E tdphdwora'?
('y'es/'s'kip/'e'dit/'q'uit) [y] =>
y
```

5. The PreRestore.sh script:
   a. Checks that the restore request was started on the production server.
   b. Checks that the backup is eligible for restore.
   c. Checks that the database is no longer active.
   d. Checks there is space available to save the current database control files and online redo logs (in the file systems /oracle/<SID>/origlogA, origlogB,..., mirrorlogA and mirrorlogB...)
   e. Copies the current database control files and online redo logs so that they can be restored after the restore.

   If any check fails, **PreRestore.sh** will give the information, so that the problem can be fixed.

   Example 6-76 shows the start of the script execution.

Example 6-76 Starting the PreRestore.sh

```
IDS1306I Issuing command 'PreRestore.sh -b bdtgcjzh.anf -E tdphdwora
echo hdwIntRC: $?' ...
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore:                     IBM Tivoli Storage Manager for Hardware
PreRestore:          Data Protection for FlashCopy Devices for mySAP(R) on
Oracle(R)
PreRestore:
PreRestore:                          Restore Preprocessing script
PreRestore:
PreRestore:                   - Version 5, Release 3, Level 1.2 for AIX -
```

```
PreRestore:        (c) Copyright IBM Corporation, 2000, 2006, All Rights Reserved.
PreRestore:
PreRestore:
------------------------------------------------------------------------------
PreRestore: checking user ...
PreRestore:   Oracle user orar31 found
PreRestore:   $ORACLE_SID         = <R31>
PreRestore:   $ORACLE_HOME        = </oracle/R31/920_64>
PreRestore:   $SAPDATA_HOME       = </oracle/R31>
PreRestore:   AIX version: 5300 oslevel: 00
PreRestore: Time stamp: 08/11/06 01:55:18
```

6. **PreRestore.sh** checks the command line options specified, in Example 6-77.

Example 6-77 Part 1 of PreRestore.sh

```
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore:       PART 1: command line options
PreRestore:
PreRestore:
------------------------------------------------------------------------------
PreRestore: checking commandline options ...
PreRestore:   Option -d <backup_root_dir> is not specified
PreRestore:   Assuming default dir: </oracle/R31/sapbackup>
PreRestore:   backup_root_dir     = </oracle/R31/sapbackup>
PreRestore:   Option -r <sapreorg_dir> is not specified
PreRestore:   Assuming default dir: </oracle/R31/sapreorg>
PreRestore:   sapreorg_dir        = </oracle/R31/sapreorg>
PreRestore:   brbackup log        = </oracle/R31/sapbackup/bdtgcjzh.anf>
PreRestore: Time stamp: 08/11/06 01:55:19
```

7. **PreRestore.sh** does the following operations, in Part 2, Example 6-78:
   a. Check if SAP/Oracle is running, and if so, stop.
   b. Read **brbackup** detailed log.
   c. Check if this script was started on the production server and stop if not.
   d. Check for FlashBack Rerun (see 6.5.3, “FlashBack restore rerun” on page 227).
   e. Check for Oracle log files location.
   f. Check for Oracle control files location.
   g. Calculate the required space.
   h. Check for free space in backup directory (default: /oracle/<SID>/sapreorg); stop if not enough.
   i. Create backup subdirectory in /oracle/*<SID>*/sapreorg.

Example 6-78 Part 2 of PreRestore.sh

```
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore:       PART 2: check SAP / Oracle / DP for ESS environment
PreRestore:
```

```
PreRestore:
------------------------------------------------------------------------------
PreRestore: checking for running SAP instance R31 ... OK
PreRestore: checking for running Oracle instance R31 ... OK
PreRestore: reading brbackup log /oracle/R31/sapbackup/bdtgcjzh.anf ... OK
PreRestore:   brbackup backup type               = <online_mirror>
PreRestore:   SAP profile used                   =
</oracle/R31/920_64/dbs/initR31.sapd>
PreRestore:   Data Protection for mySAP util file used       =
</oracle/R31/920_64/dbs/initR31.utl>
PreRestore:   DP for ESS control file            =
</oracle/R31/sapbackup/idssave/idssave>
PreRestore:   DP for ESS backup sequence number  = <00036>
PreRestore:   Current Oracle log sequence number = <1238>
PreRestore: checking for FlashBack Rerun ... OK
PreRestore: No FlashBack with backup sequence number <00036> was
PreRestore: performed previously.
PreRestore: Oracle log file     : /oracle/R31/origlogA/log_g11m1.dbf    found
PreRestore: Oracle log file     : /oracle/R31/mirrlogA/log_g11m2.dbf    found
PreRestore: Oracle log file     : /oracle/R31/origlogB/log_g12m1.dbf    found
PreRestore: Oracle log file     : /oracle/R31/mirrlogB/log_g12m2.dbf    found
PreRestore: Oracle log file     : /oracle/R31/origlogA/log_g13m1.dbf    found
PreRestore: Oracle log file     : /oracle/R31/mirrlogA/log_g13m2.dbf    found
PreRestore: Oracle log file     : /oracle/R31/origlogB/log_g14m1.dbf    found
PreRestore: Oracle log file     : /oracle/R31/mirrlogB/log_g14m2.dbf    found
PreRestore: Oracle control file : /oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf
found
PreRestore: Oracle control file : /oracle/R31/sapdata2/cntrl/cntrlR31.dbf    found
PreRestore: Oracle control file : /oracle/R31/sapdata3/cntrl/cntrlR31.dbf    found
PreRestore: space needed for backup of log and control files:          517.91 MB
PreRestore: checking freespace in /oracle/R31/sapreorg ... OK
PreRestore:   freespace in directory </oracle/R31/sapreorg>      :         1599.36
MB
PreRestore:   freespace after copying all files             :         1081.45 MB
PreRestore: creating directory /oracle/R31/sapreorg/restore_060811015519 ... OK
PreRestore: Time stamp: 08/11/06 01:55:19
```

8. In Example 6-79, **PreRestore.sh** copies the Oracle online log files to the directory /oracle/R31/sapreorg/restore_060805002835 which was created in Example 6-78.

Example 6-79 Part 3 of PreRestore.sh

```
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore:       PART 3: copy Oracle online log files
PreRestore:
PreRestore:
------------------------------------------------------------------------------
PreRestore: copying /oracle/R31/origlogA/log_g11m1.dbf ...  OK
PreRestore: copying /oracle/R31/mirrlogA/log_g11m2.dbf ...  OK
PreRestore: copying /oracle/R31/origlogB/log_g12m1.dbf ...  OK
PreRestore: copying /oracle/R31/mirrlogB/log_g12m2.dbf ...  OK
PreRestore: copying /oracle/R31/origlogA/log_g13m1.dbf ...  OK
PreRestore: copying /oracle/R31/mirrlogA/log_g13m2.dbf ...  OK
PreRestore: copying /oracle/R31/origlogB/log_g14m1.dbf ...  OK
```

```
PreRestore: copying /oracle/R31/mirrlogB/log_g14m2.dbf ...  OK
PreRestore: Time stamp: 08/11/06 01:55:25
```

9. **PreRestore.sh** then copies the control files to the same directory, as shown in Example 6-80.

Example 6-80 Part 4 of PreRestore.sh

```
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore:       PART 4: copy Oracle control files
PreRestore:
PreRestore:
------------------------------------------------------------------------------
PreRestore: copying /oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf ... OK
PreRestore: copying /oracle/R31/sapdata2/cntrl/cntrlR31.dbf ... OK
PreRestore: copying /oracle/R31/sapdata3/cntrl/cntrlR31.dbf ... OK
PreRestore: Time stamp: 08/11/06 01:55:25
```

10. **PreRestore.sh** completes its execution, in Example 6-81.

Example 6-81 Completion of PreRestore.sh

```
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore:       Restore Preprocessing finished successfully
PreRestore:
PreRestore:
------------------------------------------------------------------------------
PreRestore:
PreRestore: Program PreRestore.sh completed successfully.
PreRestore: hdwIntRC: 0
```

Note: PreRestore.sh puts logs in the /tmp directory, which must be deleted periodically.

11. **tdphdwora** then prompts if we want to run **brrestore** for the database restore, in Example 6-82.

Example 6-82 Select to start the brrestore

```
Do you want to run 'brrestore -m full -b bdtgcjzh.anf -r
/oracle/R31/920_64/dbs/initR31.utl -p /oracle/R31/920_64/dbs/initR31.sapd'?
('y'es/'e'dit/'q'uit) [y] =>
y
```

12. It then starts the restore process using the **brrestore** command shown in Example 6-83.

Example 6-83 Start brrestore to restore database

```
IDS1306I Issuing command 'brrestore -m full -b bdtgcjzh.anf -r
/oracle/R31/920_64/dbs/initR31.utl -p /oracle/R31/920_64/dbs/initR31.sapd
echo hdwIntRC: $?
echo hdwIntRC: $?' ...
brrestore: BRO401I BRRESTORE 6.40 (11)
```

```
brrestore: BRO169I Value 'online_mirror' of parameter/option 'backup_type/-t'
ignored for 'brrestore' - 'offline' assumed
brrestore: BRO405I Start of file restore: rdtgcnck.rsb 2006-08-11 01.55.30
brrestore: BRO437W File /oracle/R31/sapdata3/temp_1/temp.data1 to be restored was
not saved
brrestore: BRO437W File /oracle/R31/origlogA/log_g11m1.dbf to be restored was not
saved
brrestore: BRO437W File /oracle/R31/mirrlogA/log_g11m2.dbf to be restored was not
saved
brrestore: BRO437W File /oracle/R31/origlogB/log_g12m1.dbf to be restored was not
saved
.
.
.
brrestore: BRO351I Restoring /oracle/R31/sapdata3/cntrl/cntrlR31.dbf
brrestore: BRO355I from /oracle/R31/sapbackup/cntrlR31.dbf ...
brrestore:
brrestore: BRO406I End of file restore: rdtgcnck.rsb 2006-08-11 01.59.53
brrestore: BRO280I BRRESTORE time stamp: 2006-08-11 01.59.53
brrestore: BRO403I BRRESTORE completed successfully with warnings
brrestore: hdwIntRC: 1
brrestore: hdwIntRC: 0
```

13. **tdphdwora** prompts us to run **PostRestore.sh** after the restore. We choose to run the script, in Example 6-84.

Example 6-84 Give the selection for starting the PostRestore.sh

```
Do you want to run 'PostRestore.sh -b bdtgcjzh.anf -E tdphdwora'?
('y'es/'s'kip/'e'dit/'q'uit) [y] =>
y
```

14. **tdphdwora** starts the **PostRestore.sh**, in Example 6-85.

Example 6-85 Start of PostRestore.sh

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:                      IBM Tivoli Storage Manager for Hardware
PostRestore:         Data Protection for FlashCopy Devices for mySAP(R) on
Oracle(R)
PostRestore:
PostRestore:                           Restore Postprocessing script
PostRestore:
PostRestore:                     - Version 5, Release 3, Level 1.2 for AIX -
PostRestore:        (c) Copyright IBM Corporation, 2000, 2006, All Rights
Reserved.
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore: checking user ...
PostRestore:   Oracle user orar31 found
PostRestore:   $ORACLE_SID         = <R31>
PostRestore:   $ORACLE_HOME        = </oracle/R31/920_64>
PostRestore:   $SAPDATA_HOME       = </oracle/R31>
```

```
PostRestore: Time stamp: 08/11/06 02:02:30
```

15. First, it checks the command line options and shows the parameter passed to **PostRestore.sh** as shown in Example 6-86.

Example 6-86 Part 1 of PostRestore.sh

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:       PART 1: command line options
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore: checking commandline options ...
PostRestore:   Option -d <backup_root_dir> is not specified
PostRestore:   Assuming default dir: </oracle/R31/sapbackup>
PostRestore:   backup_root_dir     = </oracle/R31/sapbackup>
PostRestore:   Option -r <sapreorg_dir> is not specified
PostRestore:   Assuming default dir: </oracle/R31/sapreorg>
PostRestore:   sapreorg_dir        = </oracle/R31/sapreorg>
PostRestore:   brbackup log        = </oracle/R31/sapbackup/bdtgcjzh.anf>
PostRestore:   Option -m <restoretype> is not be specified!
PostRestore:   Assuming default restore type: ALL
PostRestore:   Restore type        = <ALL>
PostRestore:   All log files and control files saved by PreRestore.sh will be
restored.
PostRestore: Time stamp: 08/11/06 02:02:30
```

16. **PostRestore.sh** checks the status of the SAP/Oracle/Data Protection for FlashCopy environment, in Example 6-87.

Example 6-87 Part 2 of PostRestore.sh

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:       PART 2: check SAP / Oracle / DP for ESS environment
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore: checking for running SAP instance R31 ... OK
PostRestore: checking for running Oracle instance R31 ... OK
PostRestore: reading brbackup log /oracle/R31/sapbackup/bdtgcjzh.anf ... OK
PostRestore:   brbackup backup type               = <online_mirror>
PostRestore:   SAP profile used                   =
</oracle/R31/920_64/dbs/initR31.sapd>
PostRestore:   Data Protection for mySAP util file used        =
</oracle/R31/920_64/dbs/initR31.utl>
PostRestore:   DP for ESS control file            =
</oracle/R31/sapbackup/idssave/idssave>
PostRestore:   DP for ESS backup sequence number  = <00036>
PostRestore:   Current Oracle log sequence number = <1238>
PostRestore: checking for FlashBack ... OK
PostRestore: A FlashBack with backup sequence number <00036> was
PostRestore: performed previously.
PostRestore:
```

```
PostRestore: check directory /oracle/R31/sapreorg/restore_060811015519 ... OK
PostRestore:
PostRestore: DP ESS mySAP has detected
PostRestore: - the current FlashBack Restore with
PostRestore:     backup sequence number <00036> used target set 1
PostRestore:
PostRestore: The PostRestore.sh script will now copy the log and control files
from the current
PostRestore: restore run to the original location.
PostRestore:
PostRestore: The following log files will be copied back to the original
destination
PostRestore: Oracle log file     : /oracle/R31/origlogA/log_g11m1.dbf
PostRestore: Oracle log file     : /oracle/R31/mirrlogA/log_g11m2.dbf
PostRestore: Oracle log file     : /oracle/R31/origlogB/log_g12m1.dbf
PostRestore: Oracle log file     : /oracle/R31/mirrlogB/log_g12m2.dbf
PostRestore: Oracle log file     : /oracle/R31/origlogA/log_g13m1.dbf
PostRestore: Oracle log file     : /oracle/R31/mirrlogA/log_g13m2.dbf
PostRestore: Oracle log file     : /oracle/R31/origlogB/log_g14m1.dbf
PostRestore: Oracle log file     : /oracle/R31/mirrlogB/log_g14m2.dbf
PostRestore: The following control files will be copied back to the original
destination
PostRestore: Oracle control file :
/oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf
PostRestore: Oracle control file : /oracle/R31/sapdata2/cntrl/cntrlR31.dbf
PostRestore: Oracle control file : /oracle/R31/sapdata3/cntrl/cntrlR31.dbf
PostRestore: Time stamp: 08/11/06 02:02:30
```

17. In Example 6-88, **PostRestore.sh** copies the saved Oracle online log files from the directory /oracle/R31/sapreorg/restore_060805002835, created in Example 6-78 on page 220, back to their original location.

Example 6-88 Part 3 of PostRestore.sh

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:       PART 3: copy Oracle online log files
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore: copying /oracle/R31/origlogA/log_g11m1.dbf ...  OK
PostRestore: copying /oracle/R31/mirrlogA/log_g11m2.dbf ...  OK
PostRestore: copying /oracle/R31/origlogB/log_g12m1.dbf ...  OK
PostRestore: copying /oracle/R31/mirrlogB/log_g12m2.dbf ...  OK
PostRestore: copying /oracle/R31/origlogA/log_g13m1.dbf ...  OK
PostRestore: copying /oracle/R31/mirrlogA/log_g13m2.dbf ...  OK
PostRestore: copying /oracle/R31/origlogB/log_g14m1.dbf ...  OK
PostRestore: copying /oracle/R31/mirrlogB/log_g14m2.dbf ...  OK
PostRestore: Time stamp: 08/11/06 02:02:35
```

18. Similarly, the saved Oracle control files are copied from the directory /oracle/R31/sapreorg/restore_060805002835 to their original location, as shown in Example 6-89.

Example 6-89 Part 4 of PostRestore.sh

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:       PART 4: copy Oracle control files
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore: copying /oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf ...  OK
PostRestore: copying /oracle/R31/sapdata2/cntrl/cntrlR31.dbf ...  OK
PostRestore: copying /oracle/R31/sapdata3/cntrl/cntrlR31.dbf ...  OK
PostRestore: Time stamp: 08/11/06 02:02:36
```

19. The **PostRestore.sh** script completes, and shows what could be done next, in Example 6-90:

    a. In order to perform a forward recovery you must have all Oracle redo log files beginning with log sequence number “Start LSN” (shown in Example 6-20 on page 183) up to the point in time to which you want to recover your database.

    b. Make sure you have restored all redo log files from Tivoli Storage Manager prior to starting recovery.

    c. You can now start the forward recovery using the SQLPlus command:

    ```
    SQL> recover database [ until time <timestamp> ]
    ```

Example 6-90 End of restore process

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:       Restore Postprocessing finished successfully
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:  In order to perform a forward recovery you will need all Oracle redo
log
PostRestore:  files beginning with log sequence number 1238 up to the point in
PostRestore:  time you want to recover your database.
PostRestore:
PostRestore:  Make sure you have restored all redo log files from TSM prior
starting the
PostRestore:  recovery.
PostRestore:
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore:  You can now start the forward recovery using the SQLPlus command
PostRestore:
PostRestore:    SQL> recover database [until time <timestamp>]
PostRestore:
```

```
PostRestore:
------------------------------------------------------------------------------
PostRestore:
PostRestore: Program PostRestore.sh completed successfully.
PostRestore: hdwIntRC: 0
```

Note: PostRestore.sh puts logs in the /tmp directory, which must be deleted periodically.

20. Recover the Oracle database.

6.5.3 FlashBack restore rerun

It is possible to restart a FlashBack restore that did not complete successfully.

If the FlashCopy running in the background has not yet finished for the latest FlashBack restore, Data Protection for FlashCopy allows the rerun of FlashBack restore with the same Backup ID. This capability is very useful if the rollforward recovery went beyond the desired point, or if the FlashBack was interrupted for some reason.

When performing a FlashBack restore rerun, be careful not to run the pre-restore activities as you did for the very first restore/recovery attempt — so you can answer 'n' when prompted to run the **PreRestore.sh** script, as in Example 6-75 on page 219.

If you start the restore from a FlashCopy backup with FLASHCOPY_TYPE INCR, and there is still a background copy with ICR (Incremental Change Recording) as result of the previous FlashBack restore, you can either stop and wait until the previous FlashBack restore is complete, or continue and cause the FlashBack restore to request the withdraw of the current source/target relationship. Because withdrawing the relationship means the ICR must be set again, the next incremental process will take longer, because it must performs a full copy.

Note: Do not stop the previous FlashBack restore with the withdraw function — this is important, so as not to violate the integrity of the volumes on the production system.

6.5.4 FlashCopy backup with multiple target volume sets

In certain situations you might want to restore an older backup version, for example, if a database corruption occurred before the last backup was done. Previous releases of Data Protection for FlashCopy supported only one target volume set (or two is using LVM mirroring), so a restore from a previous backup could only be done from the Tivoli Storage Manager server. V5.3.1 of Data Protection for FlashCopy now supports multiple target volume sets.

For our testing we had two target volume sets available. Example 6-91 shows the definition of a second target volume set in the target volumes file initR31.fct.

Example 6-91 Sample of the target volumes file initR31.fct

```
>>> volumes_set_1
TARGET_VOLUME 75924811048 75924811038 10737418240_Bytes
TARGET_VOLUME 75924811049 75924811039 10737418240_Bytes
TARGET_VOLUME 7592481104A 7592481103A 10737418240_Bytes
TARGET_VOLUME 7592481104B 7592481103B 10737418240_Bytes
TARGET_VOLUME 7592481111C 7592481110C 10737418240_Bytes
TARGET_VOLUME 7592481111D 7592481110D 10737418240_Bytes
```

```
TARGET_VOLUME 75924811129 75924811128 10737418240_Bytes
<<< volumes_set_1

>>> volumes_set_2
TARGET_VOLUME 75924811177
TARGET_VOLUME 75924811178
TARGET_VOLUME 75924811179
TARGET_VOLUME 75924811180
TARGET_VOLUME 75924811181
TARGET_VOLUME 75924811182
TARGET_VOLUME 75924811183
<<< volumes_set_2
```

After using the first target volume set for a backup, we started a backup on the second target volume set with:

```
brbackup -c -t online_mirror -p /oracle/R31/920_64/dbs/iniR31.sap2 -u
system/redbook
```

This command references these configuration files:

- /oracle/R31/920_64/dbs/initR31.sap2

  ```
  backup_type = online_mirror
  split_option = "-d -n 2 -C COPY -p /oracle/R31/920_64/dbs/initR31.fcs"
  split_resync = yes
  backup_mode = all
  util_par_file = /oracle/R31/920_64/dbs/initR31.utl
  ```

- /oracle/R31/920_64/dbs/initR31.fcs

  ```
  FLASHCOPY_TYPE INCR
  ```

- /oracle/R31/920_64/dbs/initR31.utl

  ```
  FCS_FILE /oracle/R31/920_64/dbs/initR31.fcs
  ```

You can change the FLASHCOPY_TYPE from INCR to COPY, but we recommend to use the -C COPY at the split_option, because we can then run different FlashCopy backup requests with different BR*Tools profiles (initR31.sap, initR31.sap2...) while using only one Data Protection for mySAP profile(.fcs).

After the backup is complete, we can check the results with **tdphdwora**. As shown in Example 6-92, two FlashCopy backup versions are available.

Example 6-92 Multiple target set creation results

```
                    Log history of the database backups
                                 SystemID: R31

--------------------------------------------------------------------------------
 # Log          Start of backup   Type           BackupID         TSM FlashCopy
--------------------------------------------------------------------------------
 1 bdtgvthc.anf 06-08-14 23.50.52 online_mirror  R31___AOEQVSVLJK *   ok
 2 bdtgvkvk.anf 06-08-14 22.15.40 online_mirror  R31___AOEQVPI2W7 *   ok
 3 bdtgqeoh.anf 06-08-13 20.40.19 online_mirror  R31___AOEQU6NGSI *   invalid
 4 bdtgqdyg.anf 06-08-13 20.33.22 online_mirror  R31___AOEQU6EKZM *   invalid
 5 bdtgqadm.anf 06-08-13 19.50.34 online_mirror  R31___AOEQU4VKO1 ok  invalid
 6 bdtgpzll.anf 06-08-13 19.42.45 online_mirror  R31___AOEQU4LHZ5 ok  invalid
```

```
    d -  show details
    r -  refresh display
    o -  choose from older backups
    # -  restore the backup number #, including pre- and post-processing
    f -  show FlashCopy backups only (target set state IN_USE)
    e -  emergency FlashBack Restore
    x -  exit tdphdwora

 Enter your selection =>
```

The **splitint -f inquire** command gives information about the backup on the second target set, as shown in Example 6-93.

Example 6-93 inquire command after a DISKONLY backup using a second target volume set

```
orar31> splitint -p /oracle/R31/920_64/dbs/initR31.fcs -f inquire
.
.
.
IDS1014I 00071 BSI_START PSI_FLASHCOPY_QUERY XXXXXXYYMMDDHHMM 2 20061408224107 - -
exchange.00071 - - - - flashcopy - - - - 531304 INCR - DISKANDTSM
IDS1014I 00072 BSI_DISKONLY PSI_UNMOUNT_DONE R31___AOEQVSVLJK 2 20061408235103
08/14/06-23:50:57 20061408235307 exchange.00072 /oracle/R31/920_64/dbs/initR31.utl
/oracle/R31/sapbackup/.bdtgvthc.lst file BRBACKUP FULL NEW - - - 531304 COPY -
DISKONLY

IDS1023I Exiting with return code 0.
```

Now we can have independent backup types of FlashCopy operation at different times during the day.

For example, we make an initial backup each day to DISKANDTAPE. Subsequently, several backups of the redo logs were done automatically by Oracle. Then at lunchtime, we do a DISKONLY backup to the second target volume set. In the afternoon we could choose to run a FlashBack restore from either of the two target volume sets, depending to what point in time we want to recover the database. In case of a hardware error, we can also restore from Tivoli Storage Manager, because the offline logs were continuously written to the Tivoli Storage Manager server.

6.6 Database backup and restore without FlashCopy backup

We can back up and restore to and from Tivoli Storage Manager, using Data Protection for mySAP function from the production server. In this case, there will be no FlashCopy made. In this case, partial backups of a database (such as tablespace backups) can be performed as opposed to FlashCopy which is always at the database level.

For this purpose, the backup_type parameter must not be “offline_mirror” or “online_mirror”. If you set backup_type to the default values “offline” or “online”, or override the type by means of -t, then you can successfully run **brbackup** without interfering with Data Protection for FlashCopy. For more information, see the Data Protection for mySAP documents.

6.7 Backup of the offline redo log files

Clearly, backup of log files is critical for rollforward recovery. We do not cover this in detail here, because it is not automatically performed by Data Protection for FlashCopy. It is intended to provide this functionality in the future.

There are many backup methods available for backing up the Oracle offline redo log files. For example, BR*Tools includes the **brarchive** tool for this purpose, which performs offline redo log backup operation with Data Protection for mySAP. If we schedule the **brarchive -sd** command on the production system, it saves the offline Oracle redo log files to the Tivoli Storage Manager and deletes them from the directory. For more information about **brarchive**, refer to the BR*Tools documentation.

Note: After any online or online_mirror backup has been completed, a **brarchive** run must be scheduled to backup the offline redo log files. In the case of a restore of such online backups, the redo log files are required for a successful database recovery.

6.8 Schedule considerations

Typically backups will be automatically scheduled to make sure they execute regularly.

Scheduling backups on the backup server

For the backups using FlashCopy, you cannot define the backup schedule on the SAP software's CCMS (Computer Center Management System). That is because the backup operation has to be initiated from the backup system. But you can monitor the backup status on the CCMS because the brbackup on the backup system send the status to the repository. From the backup system, the backup schedule can be scheduled using the operating system crontab or Tivoli Storage Manager scheduler, or another external scheduler product like IBM Tivoli Workload Scheduler.

Scheduling Oracle offline redo log backup on the production server

Data Protection for FlashCopy does not handle the Oracle offline redo log file that is necessary for the complete database recovery. **brarchive** should be scheduled on the production system. We recommend sending the log files to a Tivoli Storage Manager disk storage pool rather than tape, to eliminate wait periods for a mount point, as well as tape mount times.

6.9 Monitoring backup and restore activity

For the daily monitoring of the scheduled backup operations and problem determination purposes, there are many various hardware and software logs available in our environment.

6.9.1 Log file management

Most of the backup and restore activity is performed by BR*Tools. For daily monitoring of the backup and restore activity and problem determination purposes, regularly check these logs:

- /oracle/<*SID*>/sapbackup - includes detailed logs for all the brbackup and brrestore operation
- /oracle/<*SID*>/sapbackup/back<*SID*>.log -brbackup summary log

- /oracle/<*SID*>/sapbackup/rest<*SID*>.log -brrestore summary log
- /oracle/<*SID*>/saparchive - includes detailed logs for brarchive operation

6.9.2 Other logs

Here we describe other logs and traces that can help you in troubleshooting problems.

Data Protection for mySAP logs and trace

If Data Protection for FlashCopy operations are performed, you will see activity in the Data Protection for FlashCopy logs. **`backfm`** (V5.3 or higher) provides its output to a file backfm_<timestamp>.log in the default directory /oracle/<*SID*>sapbackup.

Data Protection for FlashCopy logs and trace

Data Protection for FlashCopy logs are located in the directory that is specified by LOG_TRACE_DIR of the Data Protection for FlashCopy profile (init<*SID*>.fcs). If this value is not specified, the logs and traces will be placed in the directory as specified by WORK_DIR of the Data Protection for FlashCopy profile. The directory must be shared by NFS between the production and backup servers.

The Data Protection for FlashCopy **`splitint`** command creates a log file as shown below when running the various function like ‘split’, ‘resync’, ’withdraw’, ’ts_inquire’, ’runagent’ and ‘flashback’ (except for inquire and password). A trace file below can be requested by specifying the TRACE parameter in the Data Protection for FlashCopy profile. You can leave this parameter set permanently, as it does not create much overhead, and it will help IBM service to more readily isolate a problem. But you should make sure to clean up the directory regularly.

- splitint_b_<splitint function>_<date time stamp>.log - log file for **`splitint`** functions running on the backup server
- splitint_b_<splitint function>_<date time stamp>.trace - trace file for **`splitint`** functions running on the backup server
- splitint_p_<splitint function>_<date time stamp>.log - log file for **`splitint`** functions running on the production server
- splitint_p_<splitint function>_<date time stamp>.trace - trace file for **`splitint`** functions running on the production server

The <date time stamp> consists of yyyymmddHHMMSS.

CIM logs and traces

For the DS Open API CIM Agent installed on our environment, you can check the cimom.log in the directory where you installed the CIM agent to verify the CIMOM processing status. For more information for logging and tracing information for the CIM Server (Pegasus), DS Open API CIM Agent, and CIM Agent for SVC, refer to *DS Open Application Programming Interface Reference GC35-0516-00.*

Storage system logs and traces

Consult the documentation for the storage system which you are using.

AIX logs and traces

Information about disk problems can be displayed using the AIX error reporting command:

```
errpt -a
```

7

Automation and scheduling

In this chapter we discuss methods and issues for managing daily and frequently repeating tasks for protecting your system from corruption and disaster conditions.

As for any other important data, you should be making regularly scheduled backups of your SAP database system, using FlashCopy backup to the target volume sets, and to the Tivoli Storage Manager server. Additionally, you must back up the recovery logs regularly to the Tivoli Storage Manager server, to allow a forward recovery in case a restore of the database is required.

Although for testing purposes, these operations can be performed manually, in a production environment, these will be automated via scheduling.

Two methods are available for scheduling:

- Tivoli Storage manager scheduler
- UNIX® crontab

7.1 Tivoli Storage manager scheduler

Using the Tivoli Storage Manager scheduler allows you to integrate SAP software FlashCopy backups into your enterprise storage management environment. The scheduler gives you a single interface to define, update, and manage Tivoli Storage Manager client operations, from either the administrative command-line or the Administration Center.

A schedule is defined for a particular policy domain. One or more schedules can be defined within the policy domain - a schedule definition includes, at a minimum:

- The operation to be executed
- The time to start the scheduled operation
- How often to repeat the scheduled operation

The schedule can then be applied to one or more client nodes in the domain - this is called *associating* the nodes with a schedule. Once associated with a schedule, the nodes will run the scheduled operation at the defined time. The scheduled operation could be a Tivoli Storage Manager client action (for example, backup a database), or an operating system shell script.

For information about how to define and update different types of scheduled events, see the corresponding manuals, *Storage Manager for AIX Administrator's Guide*, GC32-0768; *Storage Manager for AIX Administrator's Reference Version 5.3,* GC32-0769; and the IBM Redbook, *IBM Tivoli Storage Manager Implementation Guide*, SG24-5416.

In an SAP environment the Tivoli Storage Manager scheduler can be used to automate the backups of log files (DB2) or redo logs (Oracle).

Note: You can also use the Tivoli Storage Manager scheduler to automate the database backups themselves. This is to avoid serialization and synchronization problems with the password for the Tivoli Storage Manager client scheduler, when using a single client nodename on both the backup and production server.

7.2 UNIX crontab

This is the other method for automating backups (or any other actions) on a UNIX-system.

Actions, scheduled under control of the UNIX operating system (called UNIX cron jobs), are maintained by the **crontab** command in the crontab file. The cron jobs will then be executed at the time defined in the crontab file. To update the crontab file, use:

```
crontab -e
```

As an example, to schedule a shell script called backup_flashcopy.ksh to run at 11:30 pm on Monday through Friday, enter into the crontab file:

```
30 23 * * 1-5 /usr/bin/su - db2<sid> -c "$HOME/sapscripts/backup_flashcopy.ksh"
```

or

```
30 23 * * 1-5 /usr/bin/su - ora<sid> -c "$HOME/sapscripts/backup_flashcopy.ksh"
```

An example shell script is provided with the Data Protection for FlashCopy installation in one of these directories:

```
/usr/tivoli/tsm/tdpessr3/db2/backup_flashcopy.ksh
/usr/tivoli/tsm/tdpessr3/oracle/backup_flashcopy.ksh
```

The shell scripts are described in “Appendix I. Backup Scheduling Examples” in *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for mySAP Installation & User’s Guide for Oracle,* SC33-6340 or “Appendix M. Backup Scheduling Examples” in *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for mySAP Installation & User’s Guide for DB2 UDB*, SC33-6341. You can customize these scripts for your use.

7.3 Total system backup

As well as the database itself, you must regularly back up other system components, including:

- The operating system; the database system data; SAP software system data
- The offline redo logs or the offline log files
- The backup protocols and the profiles

We recommend also that you run an incremental backup of the NFS-directories using the Tivoli Storage Manager backup/archive client on the production system after each offline or online backup of the database.

Figure 7-1 shows a typical sequence for backup which you can use.

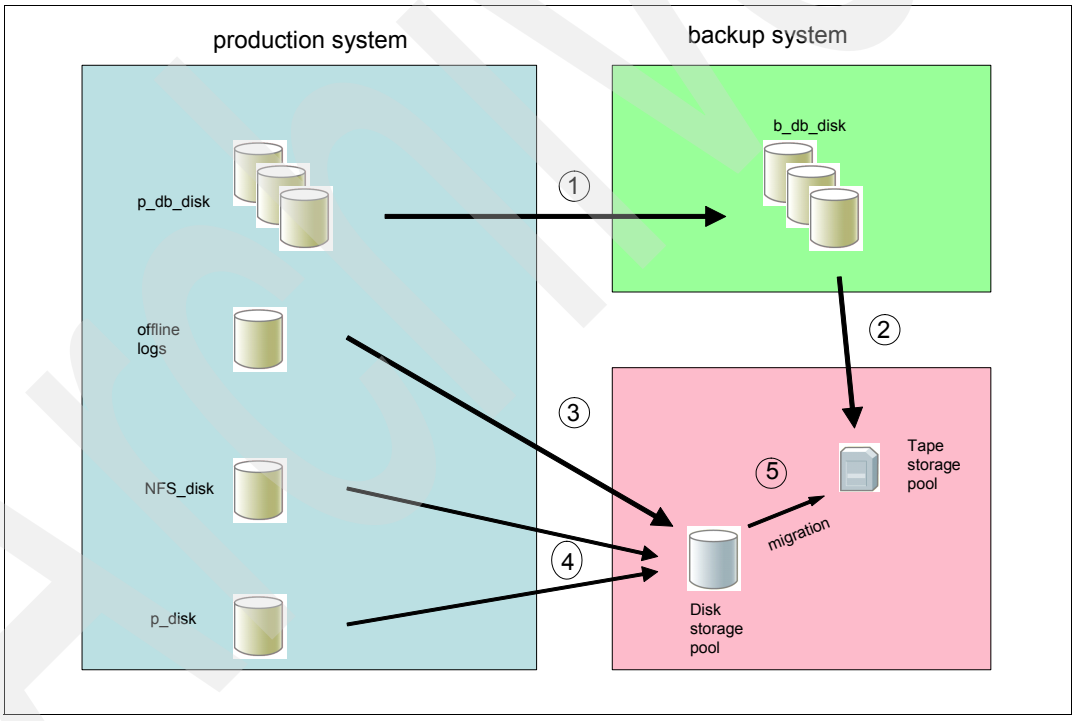


Figure 7-1 Backup sequence of an SAP software database system

Follow this procedure:

1. Run FlashCopy online or offline backup (with DB2, online backup only) on the backup server - **`splitint`** will create a copy of the p_db_disk, and b_db_disk.
   a. On DB2 and for online Oracle backups, this backs up only the database volume group(s).
   b. On offline Oracle backup, this backs up both the database volume group(s) and the log volume group(s).

2. When **splitint** finishes, backup the FlashCopy'd data to a tape storage pool on the Tivoli Storage Manager server.
3. While step 2 is still running, the offline log files (DB2) or archived redo log files (Oracle) can be backed up a disk storage pool of the Tivoli Storage Manager server.
4. The NFS_disk, hosting the configuration files, the profiles and the log files, as well as the p_disk, hosting the database system and SAP system program files, should be backed up incrementally by the Tivoli Storage Manager backup-archive client. This can also include other operating system files. This might be done to a disk storage pool as well.
5. When both, step 2 and steps 3 and 4, finished, the data from the disk storage pool can be migrated to the tape storage pool.

Suggestion: To avoid loss of data due to a media fault, backup the tape storage pool to a copy storage pool. This also allows for offsite backups to provide for disaster recovery. Do this either with the **BAckup STGpool** command or by defining option COPYSTGpools for the tape and the disk storage pool.

Note: Be very careful if you are making changes in the volume group configuration. If possible, keep target volumes dedicated for use by Tivoli Storage Manager for Advanced Copy Services — that is, avoid using target volumes for different purposes.

If an authorized user does make changes to the definitions for the volume groups (for example, if volumes from a second target set are required on another system for different purposes), make sure that the Tivoli Storage Manager for Advanced Copy Services configuration is changed to reflect this new environment. This will avoid accidental overwriting of data, or restoring from the wrong target set.

If the same target volume set is used for FlashCopy backup of different SAP software instances, you must make sure one backup is complete before starting another, to avoid inadvertently overwriting a target set before it is backed up to Tivoli Storage Manager.

Data Protection for FlashCopy requires dedicated target volume sets for backup of each individual SAP software database instance, if you will maintain these FlashCopies for restore. In certain conditions you might share target volume sets, if they are used only for backup to Tivoli Storage Manager from a backup server, because in this case, the target volume set will be freed after the backup is complete.

Note: If a target volume set should be shared for backup of different SAP software database systems then only FlashCopy type of NOCOPY is recommended. Using FLASHCOPY_TYPE COPY or INCR is not recommended in sharing scenarios and can result in an unpredictable state.

As mentioned, you have to make sure, that the backups run strictly sequentially. That means, one backup to the Tivoli Storage Manager server has to be finished and the target volume set has to be withdrawn before the next backup can be initiated. In your testing, you should record the typical time taken for each backup, so that you can schedule the backup operations accordingly.

FRONTEND, BACKEND options

One possibility to serialize processes on the Tivoli Storage Manager server is the FRONTEND and BACKEND options in the init<*SID*>.utl file (Oracle) or the DB2_FRONTEND and DB2_BACKEND options in the init<*SID*>.fcs file (DB2).

Notice that this option is intended simply for controlling access to the Tivoli Storage Manager server — not for dealing with the issue of sharing target volume set for backups of different database instances. In this case, you will have to perform additional scripting and scheduling control.

On our test system we installed the SAP software on both an Oracle and a DB2 UDB database system. We wanted to serialize the backup and restore activities from/to the Tivoli Storage Manager server, because we wanted to avoid too much concurrent workload and contention for mount points on the Tivoli Storage Manager server. Simple shell scripts, started by the FRONTEND and BACKEND options, allowed us to serialize the backups.

Example 7-1 shows a script that is executed before a backup starts. It simply creates a file db2bkp_status.log and writes the word STARTED in it.

Example 7-1 db2_frontend.sh

```
echo STARTED > /tmp/serialize/db2bkp_status.log
```

The script in Example 7-2 overwrites the status file with the word COMPLETED, and is executed at the end of the backup.

Example 7-2 db2_backend.sh

```
echo COMPLETED > /tmp/serialize/db2bkp_status.log
```

Example 7-3 runs at the beginning of the Oracle backup operation. It loops every 5 minutes, checking for the keyword COMPLETED in the DB2 status file. Once it detects the COMPLETED keyword, it will terminate, and allow the backup to proceed.

Example 7-3 ora_frontend.sh

```
echo "Oracle Frontend triggered the script" > /tmp/serialize/oracheck.log
echo `date` >> /tmp/serialize/oracheck.log

while true
do
STATUS=`cat /tmp/serialize/db2bkp_status.log`
if [ $STATUS = "COMPLETED" ]
then
echo "DB2 backup completed so oracle can start" >>/tmp/serialize/oracheck.log
       exit
fi
echo "DB2 backup still running" >> /tmp/serialize/oracheck.log
sleep 300
done
```

We add the pointers to the DB2 scripts **db2_frontend.sh** and **db2_backend.sh** using the parameters DB2_FRONTEND and DB2_BACKEND in the initPR1.fcs file, as shown in Example 7-4.

Example 7-4 initPR1.fcs for DB2

```
# Parameters of the 'DB2' topic
>>> db2
::::::::::::
#-------------------------------------------------------------------#
# DB2_FRONTEND
# this option is used to process any program before other actions will
# be processed.
# There is no default value. If DB2_FRONTEND is not specified, no
# frontend processing is performed.
#-------------------------------------------------------------------#
DB2_FRONTEND /tmp/serialize/db2_frontend.sh

#-------------------------------------------------------------------#
# DB2_BACKEND
# this option is used to process any program after all other actions
# were processed.
# There is no default value. If DB2_BACKEND is not specified, no
# frontend processing is performed.
#-------------------------------------------------------------------#
DB2_BACKEND /tmp/serialize/db2_backend.sh

<<< db2
```

To configure the Oracle script, use the parameter FRONTEND in the init<*SAP*>.utl to point to the script ora_frontend.sh.

We found that the programs called by **FRONTEND/DB2_FRONTEND** begin execution when the actual backup to Tivoli Storage Manager is starting — that is, after processing **splitint**. This occurs because these parameters are specifically intended to serialize the access to the Tivoli Storage Manager server. Hence, if there is no backup to the Tivoli Storage Manager server, they will not be executed.

Another use for these parameters might be to execute a wait loop that queries for the availability of a tape mount point on the Tivoli Storage Manage server — because if this is not available, the backup might fail after a timeout.

A

Troubleshooting

In this appendix we describe a general troubleshooting approach. We also discuss some problem scenarios that we encountered during the testing process for writing this redbook.

Problem isolation

What can you do if your FlashCopy fails? As you have seen, there are many layers involved in this environment, so how do you start diagnosing the problem? In this section, we list some points for possible causes of a failing backup using Data Protection for FlashCopy for mySAP and show a few common error conditions. Refer to the problem determination flowchart in Figure A-1.

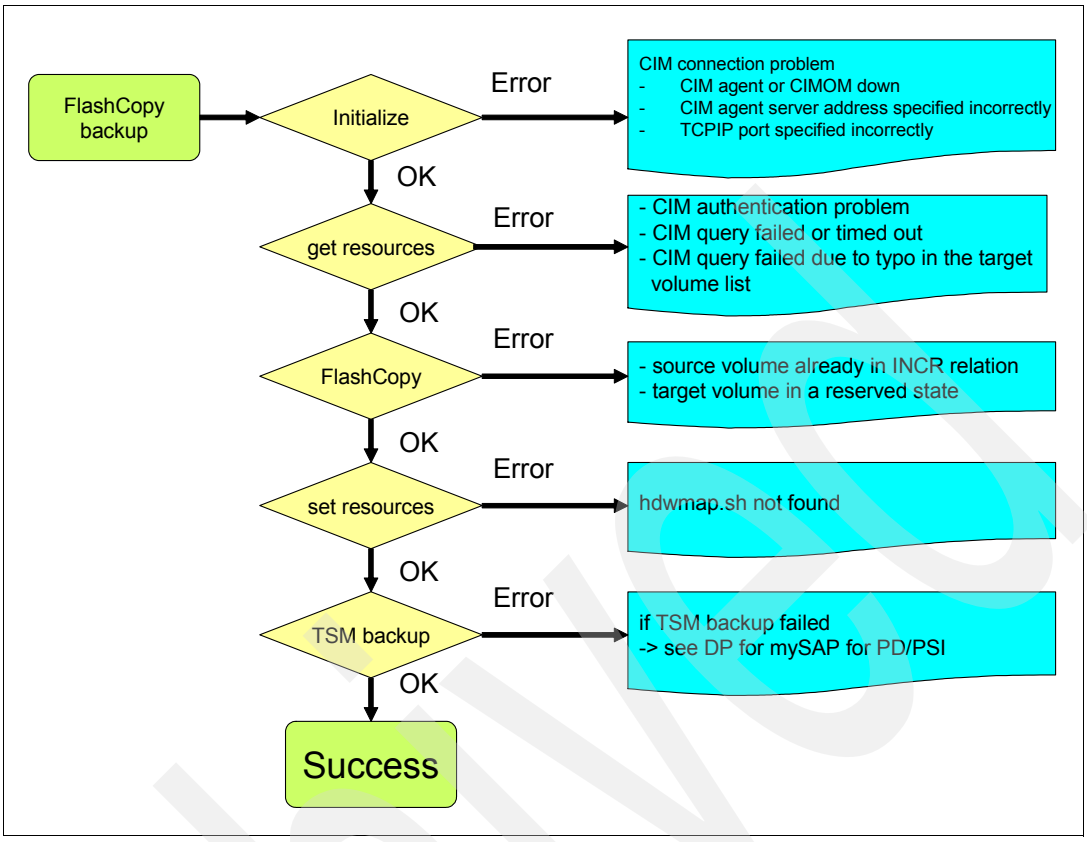


Figure A-1 Flowchart for PD of a FlashCopy backup failure

We will look at each of the phases in turn.

Initialize

If a new system is set up, initialization might fail, because of incorrect settings, for example, an incorrect definition of the CIM agent server address or IP port.

The CIM agent can be installed on the backup server, on some separate server, or on the Master Console (in the case of the SVC). See 3.5.3, “DS Open API CIM agent installation and configuration” on page 64.

If we suspect a configuration problem, check the **verifyconfig** command, as in Example A-1.

Example: A-1 Output from verifyconfig

```
root@uncletitus:/opt/IBM/cimagent ./verifyconfig -u cimuser -p secret
Tue Aug 08 01:16:52 GMT-06:00 2006
Verifying configuration of CIM agent for the IBM TotalStorage DS Open Application
Programming Interface...
Communicating with SLP to find WBEM services...
3 WBEM services found
   host=172.31.1.108, port=5988
   host=172.31.1.215, port=5988
   host=197.165.4.131, port=5988
Connecting to CIM agent, host=172.31.1.108, port=5988
Found 1 IBMTSESS_StorageSystem instances:
2107.7592481
Internal Server at 172.31.1.41 configured for 2107.92481
```

```
Verification Successful
root@uncletitus:/opt/IBM/cimagent
```

Verify that the DS or SAN Volume Controller system is found and that you receive the message "**Verification Successful**".

Check the configuration in the init<SID>.fcs file. Verify the correct system hosting the CIM Agent is configured in the PRIMARY_COPYSERVICES_SERVERNAME parameter, and that COPYSERVICES_SERVERPORT is set to 5988.

If the installation has previously been running successfully, a failure in the initialization phase might be caused by a communication problem. In our setup, we observed that the CIM Agent occasionally would hang because of the Java workload was too heavy. We saw the errors in Example A-2 when **splitint** was started.

Example: A-2 CIMOM error 1

```
IDS1005I Start of splitint program at: 07/28/06-03:59:52 .
EE00020I ====>Performing DP FOR FlashCopy BACKUP command.
IDS1121I Getting the source volumes ...
Function                       getresources_prod
Subfunction                    performsplit
Backup list                    /oracle/R31/sapbackup/work/.bdtdmcuk.lst
EE00156I Finding the serial numbers ...
EE00648E An unexpected error was encountered.
   TDP function name : DsHWInterface::HwGetSCS
   TDP function      : CIM Error: Failed to find the system name
   TDP return code   : 6119
   TDP file          : DsHWInterface.cpp (1177)
IDS1401E The target set '1' does not match the source volumes.
IDS1024I Exiting with return code 6119.
IDS1028E Splitint ended with errors on the production system.
IDS1024I Exiting with return code 2.
```

Another CIMOM error we saw is shown in Example A-3.

Example: A-3 CIMOM error 2

```
EE00648E An unexpected error was encountered.
   TDP function name : DsHWInterface::hwSystemInit
   TDP function      : CIM Error <Cannot connect to uncletitus:5988. Connection
failed.> while trying to connect to CIM Agent: <uncletitus> at port: <59
88> using username: <superuser>.
   TDP return code   : 6119
   TDP file          : DsHWInterface.cpp (1397)

IDS1024I Exiting with return code 6119.
```

Timeouts were another problem, as shown in Example A-4.

Example: A-4 CIMOM error 3

```
IDS1005I Start of splitint program at: 07/28/06-19:42:57 .
EE00020I ====>Performing DP FOR FlashCopy BACKUP command.
IDS1121I Getting the source volumes ...
Function                       getresources_prod
Subfunction                    performsplit
```

```
Backup list                     /oracle/R31/sapbackup/work/.bdtdpimk.lst
EE00156I Finding the serial numbers ...
EE00648E An unexpected error was encountered.
   TDP function name : DsHWInterface::HwGetSCS
   TDP function      : CIM Error <connection timed out> while retrieving Copy
Services Storage Configuration Service.
   TDP return code   : 6119
   TDP file          : DsHWInterface.cpp (1190)
IDS1401E The target set '1' does not match the source volumes.
IDS1024I Exiting with return code 6119.
IDS1028E Splitint ended with errors on the production system.
IDS1024I Exiting with return code 2.
```

To resolve these problems, we performed the following checks:

- Check the cimom.log for error entries. If there is no entry the CIM Agent might have caused the problem.
- Check the CIM Agent is running: **ps -ef | grep CIMOM**

  If it is running try to stop CIMOM: **/opt/IBM/cimagent/stopcimom**. If this fails, kill the process and restart CIMOM: **/opt/IBM/cimagent/startcimom**.
- Other CIMOM messages might indicate an incorrect CIMOM user or password. Perhaps this was changed - if so, make sure your configuration is updated.
- Check that rexecd is running on the production server
- In DB2 environments, check the Data Protection for FlashCopy (DB2) socket server is running on both the backup and production servers. The process is **tdphdwd2 -f initsocket -p** which is started in the /etc/inittab file.
- Check that the database is started on the production server.

Another symptom of a hanging CIM Agent is that the status of FlashCopy in the output from **tdphdwdb2** (or **tdphdwora**) **-f restore** will continually show `running`, and never completes.

In this case, check the splitint_b_runagent_....log for an entry, as shown in Example A-5.

Example: A-5 Checking the splitint_b_runagent_....log

```
08/08/06-23:39:48 IDS1190E: The information of the source / target volumes could
not be found.
08/08/06-23:39:48 EEP0648E An unexpected error was encountered.
   TDP function name : DsHWInterface::HwGetFCS
   TDP function      : CIM Error: <connection timed out>.
   TDP return code   : 6119
   TDP file          : DsHWInterface.cpp (630)

08/08/06-23:39:48 IDS1023I: Exiting with return code 6119.
```

The runagent periodically queries the CIM Agent whether the FlashCopy process finished. If the CIM Agent has hung, this causes the above error. You will have to restart the CIM Agent.

get resources

This phase is for the assignment of the target volumes. If this step fails, you might have incorrectly defined your target volume sets.

Make sure there are the same number of volumes available in the target set as in the source set and that each volume in the source set has a matching volume in the target set of the same size.

Make sure all volumes are available. That means that all volumes of the target set are allocated and available on the backup server. Example A-6 shows the output when we made a typographical error in the serial number of a volume in the init<*SID*>.fct file.

Example: A-6 getresources failed, because of a typo in the init<SID>.fct file

```
Function                        getresources_prod
Subfunction                     performsplit
Backup list                     /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0156I Finding the serial numbers ...
EEP2060W Cannot find a volume in the target data container 1 to match with the
source 75924811289.
IDS1401E The target set '1' does not match the source volumes.
IDS2124I Exiting with return code 121.
```

If multiple target volume sets are used, make sure that only one is being used for incremental FlashCopy — there can only be one target set with this type of message. If you try to do another backup with FLASHCOPY_TYPE is set to INCR, the backup will fail with the error message shown in Example A-7.

Example: A-7 getresources failed, if a second target is selected for incremental FlashCopy backup

```
IDS2121I Getting the source volumes ...
Function                        getresources_prod
Subfunction                     performsplit
Backup list                     /db2/PR1/dbs/auntmathilda/work/tdpessdb2_lst
EEP0156I Finding the serial numbers ...
IDS1418E The target set '1' is already using incremental FlashCopy.
IDS2124I Exiting with return code 2.
IDS1028E Splitint ended with errors on the production system.
```

FlashCopy

DB2 suspend or resume might fail for some DB2 partitions, for example, if it cannot finish a partial write on a particular database page.

Other reasons for failure of the FlashCopy process might be a *reserve* state of a target volume or the Copy Services server in the DataStorage system might have a problem.

set resources

This phase of the backup will fail, if the hdwmap.sh is not found or is not working as expected. See Example A-8 for the output of a missing hdwmap.sh.

Example: A-8 setresources failed, because hdwmap.sh could not be located

```
IDS1540I Start of fcagent on the backup system ...
IDS2123I Enabling the volumes and filesystems ...
Function                        setresources
Backup list                     /db2/PR1/dbs/auntmathilda/save/tdpessdb2_lst
IDS1075I Creating a semaphore for the critical part of importing/exporting ...
IDS1076I Trying to set the semaphore for the critical part of importing/exporting
...
IDS1046I Start of listing of importing volume groups/mounting file systems ...
```

```
EEP0126I Trying to find new devices to match the source device. This process will
take some time.......
EEP0358E No target volume is available. Terminating......
 (rc=22 HdwVm::psEnableTargetsOpt
IDS1077I Semaphore released.
IDS2124I Exiting with return code 1.
```

Verify that hdwmap.sh is in the Data Protection for FlashCopy for mySAP installation directory: (/usr/tivoli/tsm/tdpessr3/db2/5.3.1.2/ for DB2 or /usr/tivoli/tsm/tdpessr3/oracle/5.3.1.2 for Oracle. Check for DB2, that there is a link from the dbs directory (/db2/SID/dbs) for the DB2 instance and that the current directory (**'.:'**) is part of the PATH setting.

Other reasons for failing in this setresources step might be:

- **`rsList2105s.sh`** hangs
- **`importvg`** or **`rmdev`** hangs
- **`fsck`** failed - the jfs log wrapped

Tivoli Storage Manager backup

The backup to the Tivoli Storage Manager server might fail for various reasons — for example, if no free mount point could be found, the server ran out of scratch volumes, the IP connection failed, or the password was reset or expired.

For help in recovering from this condition, use the directions given in Appendix C. "Troubleshooting" in the *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for mySAP Installation and User's Guide for Oracle*, SC33-6340 or in the *IBM Tivoli Storage Manager for Enterprise Resource Planning Data Protection for mySAP Installation and User's Guide for DB2 UDB*, SC33-6341.

You will also find some general hints for problem solving in IBM *Tivoli Storage Manager: Problem Determination Guide,* SC32-9103.

Problems we encountered

Here are some of the issues we experienced when testing backups and restores.

Installation problem

The script setupDB2BS did not set the DB2 registry variable DB2_VENDOR_INI on the backup server. When we tried to do a backup, we received an error that the vendor configuration file was missing. We set the registry variable manually like this:

```
db2set DB2_VENDOR_INI=2/db2/PR1/dbs/vendor.env
```

Backup problem

The very first time we ran a FlashCopy backup, it terminated with the message:

```
IDS2515E SMS tablespaces are not supported
```

We ran a trace and found that the tablespace SYSTOOLSPACE was using SMS containers. Make sure that all tablespaces (including temporary tablespaces) are using DMS containers only.

Restore problem

Our restore from FlashCopy copy started by '**tdphdwdb2 -f restore -p auntmathilda/initPR1.fcs**' terminated with message:

```
EEP0290E The source volume with serial number 7592481137D is no longer attached to
the production system.
```

This problem was caused by a script provided by the SAP installation:

```
.sapenv_auntmathilda.sh
```

Tivoli Storage Manager for Advanced Copy Services provides a script **hdwmap.sh** for checking what volumes, source and target, belong together. If we run this script from the command shell, no problem is reported. If this was called from **tdphdwdb2**, it caused the above error condition.

After commenting out the command '**tset -I -Q**' in .sapenv_auntmathilda.sh, the problem was bypassed.

Restore problem

Because we initially ran tests on databases without users, there were no transactions generated between the backup and restore. This meant that no log entries were produced, and therefore there were no writes to the log files. Therefore, when we restored the database with the rollforward option to the end of the logs, this caused an error, because there were no logs to rollforward. This of course is unlikely to happen in a production environment, but when doing testing, remember to make some small changes to at least one database table, before running a rollforward recovery.

B

Installation and usage of the FlashCopy Cloning offering

In this appendix, we describe briefly the installation tasks and the usage of the service offering *FlashCopy Cloning of mySAP Databases*.

For details on prerequisites, installation, usage, and the latest changes, always refer to the current documentation and readme files, shipped with the package.

Note that we present only a brief summary of this product so that you can have a basic understanding of how to use it. Advanced skills in the various components are required — we strongly recommend that you use a services offering to implement this in your environment.

Contact your IBM services representative for information in how to obtain the FlashCopy Cloning of mySAP Databases and associated services offerings.

FlashCopy Cloning of SAP software on DB2 UDB databases

This section covers the procedure for DB2 UDB SAP software environments using FlashCopy Cloning of mySAP Databases.

Installation steps

The prerequisites for the FlashCopy Cloning of mySAP Databases, are the same as for the product described in the main part of this book, the Data Protection for FlashCopy. In fact, this package is an add-on to Data Protection for FlashCopy.

The only additional prerequisite is that you must install an additional SAP software instance on the cloning system. The cloning system can be a separate System p (which then must be connected to the same disk system as is used by the backup and production servers), or it can be the existing backup server. In our environment, we created a new SAP software instance, called PR2, on the backup server, uncletitus.

You have to NFS-mount the same directories, you mounted for the Data Protection for FlashCopy, as shown in Example B-1.

Example: B-1 Output from **mount** *after setting up the new NFS-mount*

```
auntmathilda /db2/PR1/dbs     /db2/PR1/dbs     nfs3
```

We run the **setup_cloning.sh** as root-user on our backup/cloning system. This copies the agentclone.lic, the db2clonedb executable file and the message catalog to the Data Protection for FlashCopy directory /usr/tivoli/tsm/tdpessr3/db2/5.3.1.2 and establishes a link to db2clonedb in the /db2/*<SID>*//dbs directory. It also copies the provided scripts into the /db2/*<SID>*/dbs directory and the /db2/*<SID>*//dbs/SQL-scripts directory.

Contrary to the description in the readme file and the Installation and Users Guide, do not run the script **setup_cloning.sh** on the production server. You will see the following return message if you do this:
"`The script setup_cloning.sh must only be started on the backup/cloning system.`**"**

Configuration steps

The configuration of the software, Tivoli Storage Manager API client, Data Protection for mySAP and Data Protection for FlashCopy is as shown in Chapter 3, "Installation for SAP software on DB2 UDB" on page 51.

In order to address the new copy volume set which will be used for the FlashCopy Cloning process, a new init*<SID>*.fct_Cloning file has to be created (in our case, initPR1.fct_Cloning). This has two target volume sets defined, which are both of the same number and size as the volumes in the source volume set, including both the datavg and the logvg (unlike in a FlashCopy backup, where only the datavg is copied). So, we must have more volumes in the target or copy volume sets than for the Data Protection for FlashCopy, since these must include target volumes for the log.

We also had to make the following changes shown in Example B-2, in a new profile init*<SID>*.fcs_Cloning after copying if from the init*<SID>*.fcs file. In our case we copied initPR1.fcs, and saved the modified version to initPR1.fcs_Cloning.

Example: B-2 init<SID>.fcs_Cloning file modifications

```
IDS_CONTROL_FILE             /db2/PR1/dbs/auntmathilda/save_Cloning/idssave
WORK_DIR                             /db2/PR1/dbs/auntmathilda/work_Cloning
DB2_FLASH_LOG_DIR        YES                                 (new option in the DB2
section)
VOLUMES_FILE                     /db2/PR1/dbs/auntmathilda/initPR1.fct_Cloning
FLASHCOPY_TYPE             COPY
```

Note that INCR can also be used for FLASHCOPY_TYPE.

For the remaining options we used the same values as for the Data Protection for FlashCopy processing.

Next the PreProcessing.ini and the PostProcessing.ini files must be edited in the directory /db2/*<SID>*/dbs, as shown in Example B-3 and Example B-4.

Example: B-3 PreProcessing.ini

```
SQL-scripts/PreProcessing2_stopsap.sh:pr2adm
SQL-scripts/PreProcessing2_stopdb.sh:db2pr2
```

The file PreProcessing.ini contains only these two lines - by adding '**:pr2adm**' to the script, FCClone will run the script as user pr2adm instead of db2pr1.

For PostProcessing.ini, we had to adapt these 4 lines:

Example: B-4 PostProcessing.ini

```
SQL-scripts/PostProcessing2_RenamePVIDs.sh:root db2pr2
/db2/PR1/dbs/auntmathilda/save_Cloning/idssave
SQL-scripts/PostProcessing2_RFC_R3_noNslookup.sh uncletitus:9.152.10.57
SQL-scripts/PostProcessing2_SPOOL_noNslookup.sh uncletitus:9.152.10.57
START_DVEBMGS22_uncletitus PR2_DVEBMGS22_uncletitus [1]
SQL-scripts/PostProcessing2_saplicense.sh:pr2adm
```

1 The arguments on the SQL-scripts/PostProcessing2_SPOOL_noNslookup.sh statement must match those specified in the SPOOL sql script, mentioned in chapter 3.3.2.4 of the installation guide. In our environment, these are:
R3HOSTS - uncletitus:9.152.10.57 - hostname and ip address of the cloning system
STARTUP_PROFILES - START_DVEBMGS22_uncletitus- start profile name of the cloning system
INSTANCE_PROFILES - PR2_DVEBMGS22_uncletitus - instance profile name of the cloning system

We copy the license.key file into the $HOME directory of the SAP administrator id since this is an installation of a new SAP software database instance. You will get the license.key file from your SAP vendor.

Figure B-1 summarizes the changes we made in our environment on the backup/cloning system.

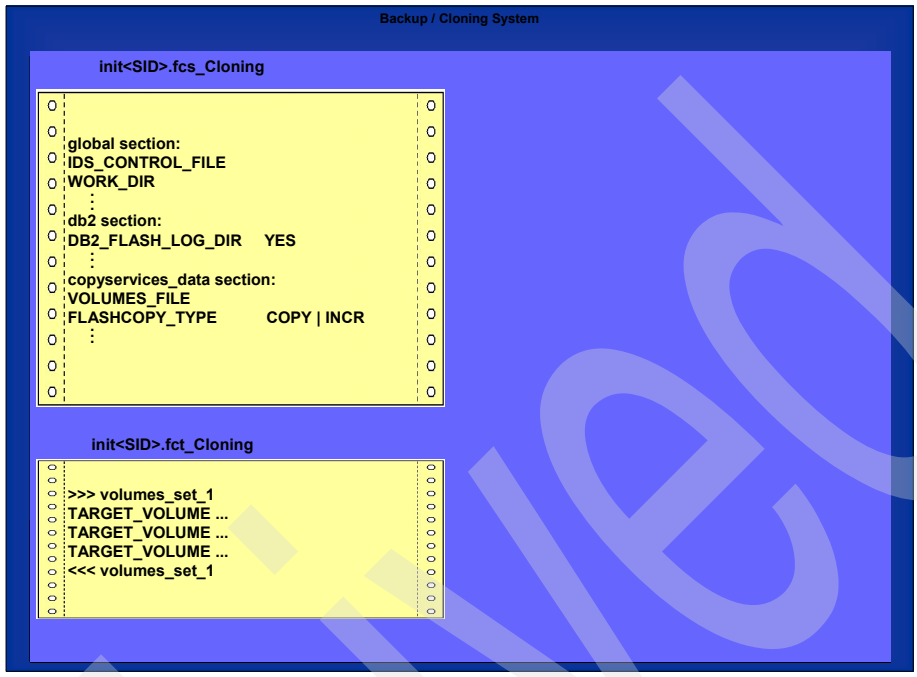


Figure B-1 Options which were adapted or added to the profiles to clone a DB2 SAP database

Running the FlashCopy cloning script FCclone.sh

The FlashCopy cloning script FCclone.sh has to be executed by the db2<oldSID> user db2pr1. The db2<newSID> user is not allowed to access the data on the production system. Therefore the **splitint** *cannot* be issued by db2pr2.

When we run the cloning process for the first time, no SAP system is yet available on the cloning system, therefore the FCclone.sh terminated with:

```
SAP system PR2 is not running
Login as user pr2adm and start the SAP system first!
```

Since the SAP system could not be started, we omitted the -Q option. So, the first cloning of the DB2 UDB database system should be started with:

```
db2pr1@:/db2/PR1/dbs ./FCclone.sh -O PR1 -N PR2
   -p /db2/PR1/dbs/auntmathilda/initPR1.fcs_Cloning
   -P /db2/PR1/dbs/PostProcessing.ini -m batch
```

Once an SAP instance is available on the cloning system, you must subsequently run the script using these options:

```
db2pr1@:/db2/PR1/dbs ./FCclone.sh -O PR1 -N PR2
   -p /db2/PR1/dbs/auntmathilda/initPR1.fcs_Cloning
   -Q /db2/PR1/dbs/PreProcessing.ini
   -P /db2/PR1/dbs/PostProcessing.ini -m batch
```

The FCclone.sh script unmounts the target volume set, creates a FlashCopy copy and then performs the actual cloning operation.

The unmount and the FlashCopy copy processes are performed by Data Protection for FlashCopy as previously discussed in this book with the exception that we copy the db2logvg volume group as well. This is done by specifying the new option DB2_FLASH_LOG_DIR in the init<*SID*>.fcs file, as shown in Example B-2.

The actual cloning process is than executed by the different pre- and post-processing scripts, initialized by the PreProcessing.ini and PostProcessing.ini files. That is, the new SAP software environment is set up to use the data on the cloning volume sets and the cloned database is updated to work within the new SAP software environment.

Since we have two target volume sets available, we have the opportunity to perform two cloning operations of the production SAP software database instances at different time stamps.

Figure B-2 shows the volumes which are processed by the cloning execution.

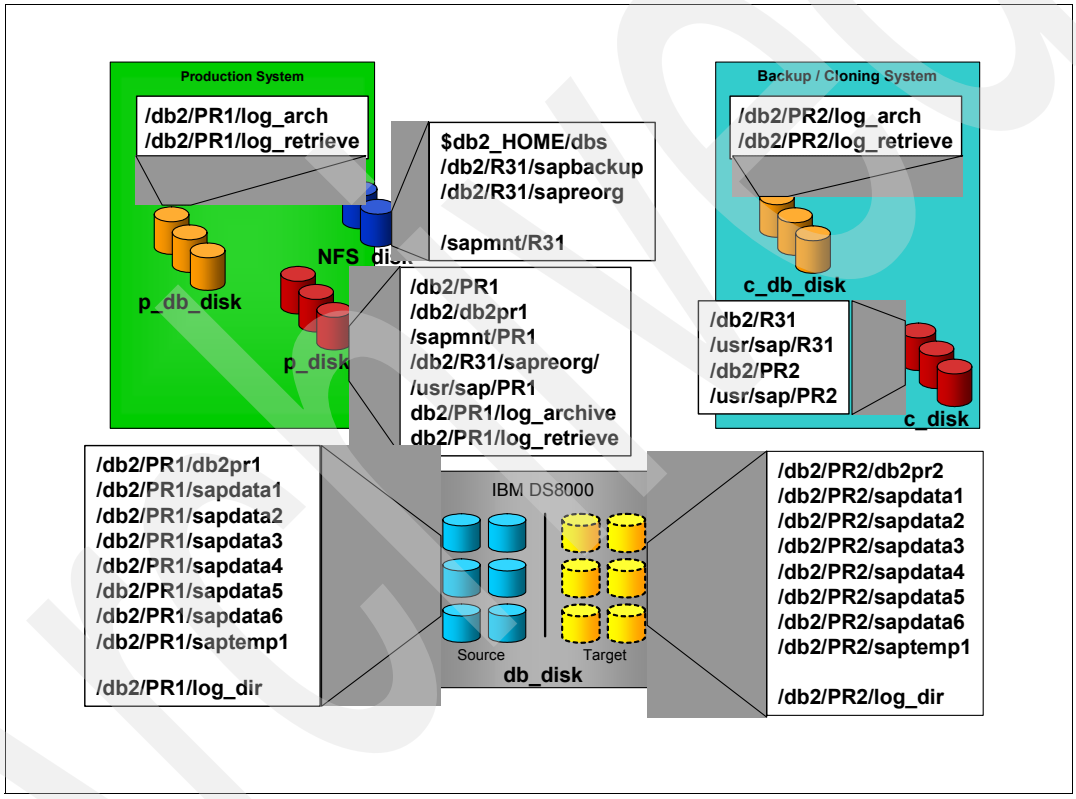


Figure B-2 Volumes processed by cloning

FlashCopy Cloning of SAP software on Oracle databases

This section covers the procedure for Oracle SAP environments using FlashCopy Cloning of mySAP Databases.

Installation steps

The prerequisites for the FlashCopy Cloning of mySAP Databases, are the same as for the product described in the main part of this book, the Data Protection for FlashCopy. In fact, this package is an add-on to the Data Protection for FlashCopy.

The only additional prerequisite is that you must install an additional SAP software instance on the cloning system. The cloning system can be a separate System p (which then must be connected to the same disk system as is used by the backup and production servers), or it can be the existing backup server. In our environment, we created a new SAP software instance, called R32, on the backup server, uncletitus.

You have to NFS-mount the same directories, you mounted for the Data Protection for FlashCopy, for the old SID environment only, as shown in Example B-5.

Example: B-5 output from **mount** *after setting up the new NFS-mount*

```
auntmathilda /oracle/R31/sapreorg   /oracle/R31/sapreorg  nfs3
auntmathilda /oracle/R31/sapbackup  /oracle/R31/sapbackup nfs3
auntmathilda /oracle/R31/920_64     /oracle/R31/920_64    nfs3
auntmathilda /sapmnt/R31            /sapmnt/R31           nfs3
```

We run the **setup_cloning.sh** as root-user on our backup/cloning system. This copies the agentclone.lic, the **oraclonedb** executable file and the message catalog to the Data Protection for FlashCopy directory /usr/tivoli/tsm/tdpessr3/oracle/5.3.1.2 and establishes a link to oracleclonedb in the in the /usr/sap/<*SID*>/SYS/exe/run. It also copies the provided scripts into the /oracle/<*SID*>/920_64/db directory and the /oracle/<*SID*>/920_64/dbs/SQL-scripts directory. On our system the /SQL-scripts directory was already available and we found two scripts there - PreProcessing2_stopdb.sql and PreProcessing2_stopsap.sh. We allowed **setup_cloning.sh** to overwrite the scripts.

Contrary to the description in the readme file and the Installation and Users Guide, do not run the script **setup_cloning.sh** on the production server. You will see the following return message if you do this:

"`The script setup_cloning.sh must only be started on the backup/cloning system.`**"**

Configuration steps

The configuration of the software, Tivoli Storage Manager API client, Data Protection for mySAP and Data Protection for FlashCopy is as shown in Chapter 4, "Installation for SAP software on Oracle" on page 91.

In order to address the new copy volume set which will be used for the FlashCopy Cloning process, a new init<*SID*>.fct_Cloning file has to be created (in our case, initPR1.fct_Cloning). We have just one target volume sets defined, which is of the same number and size as the volumes in the source volume set, including both the datavg and the logvg (unlike in a FlashCopy backup, where only the datavg is copied). In an Oracle environment, we always copy the <*SID*>logvg, therefore the target volume set is the same as we already used in a Data Protection for FlashCopy environment.

We also had to make the following changes shown in Example B-6, Example B-7, and Example B-8, in a new profile init<*SID*>.fcs_Cloning after copying if from the init<*SID*>.fcs file. In our case we copied initR31.fcs, and saved the modified version to initR31.fcs_Cloning.

Example: B-6 init<SID>.fcs_Cloning file modified options in global section

```
IDS_CONTROL_FILE        /oracle/R31/sapbackup/idssave_Cloning/idssave
WORK_DIR                        /oracle/R31/sapbackup/work_Cloning
```

Example: B-7 init<SID>.fcs_Cloning new options in the global section

```
ORA_CLONE_DB                YES
ORA_SUSPEND_DB            YES
ORA_FLASH_LOG_DIR       YES
```

Example: B-8 init<SID>.fcs_Cloning new options in the copyservices_data section

```
FLASHCOPY_TYPE            COPY                                (can be set to INCR
as well)
VOLUMES_FILE              /oracle/R31/920_64/dbs/initR31.fct_Clone
```

For the Oracle environment, we also had to adapt the init<SID>.sap file, copying the modified version to init<SID>.sap_Clone so that it points to the new .fcs_Clone file, as shown in Example B-9.

Example: B-9 Modified init<SID>.sap_Clone file

```
split_options = "-p /oracle/R31/920_64/dbs/initR31.fcs_Cloning [-n <TargetSet>]"
split_resync = no
```

Next the PreProcessing.ini and the PostProcessing.ini files must be edited in the directory /db2/*<SID>*/dbs, as shown in Example B-10 and Example B-11.

Example: B-10 PreProcessing.ini

```
SQL-scripts/PreProcessing2_stopsap.sh:r32adm
SQL-scripts/PreProcessing2_stopdb.sql
```

The file PreProcessing.ini contains only these two lines - by adding '**:r32adm**' to the script, FCClone will run the script as user r32adm instead of orar31.

For PostProcessing.ini, we had to adapt these four lines:

Example: B-11 PostProcessing.ini

```
SQL-scripts/PostProcessing2_RenamePVIDs.sh:root orar32
/oracle/R31/sapbackup/idssave_Cloning/idssave
SQL-scripts/PostProcessing2_RFC_R3_noNslookup.sql uncletitus:9.152.10.57
SQL-scripts/PostProcessing2_SPOOL_noNslookup.sql uncletitus:9.152.10.57
START_DVEBMGS01_uncletitus R32_DVEBMGS01_uncletitus [1]
SQL-scripts/PostProcessing2_saplicense.sh:r32adm
```

1 The arguments on the SQL-scripts/PostProcessing2_SPOOL_noNslookup.sh statement must match those specified in the SPOOL sql script, mentioned in chapter 3.3.2.4 of the installation guide. In our environment, these are:
R3HOSTS - uncletitus:9.152.10.57 - hostname and ip address of the cloning system
STARTUP_PROFILES - START_DVEBMGS02_uncletitus- start profile name of the cloning system
INSTANCE_PROFILES - PR2_DVEBMGS01_uncletitus - instance profile name of the cloning system

We copy the license.key file into the $HOME directory of the SAP administrator id since this is an installation of a new SAP software database instance. You will get the license.key file from your SAP vendor.

Figure B-3 summarizes the changes we made in our environment on the backup/cloning system.

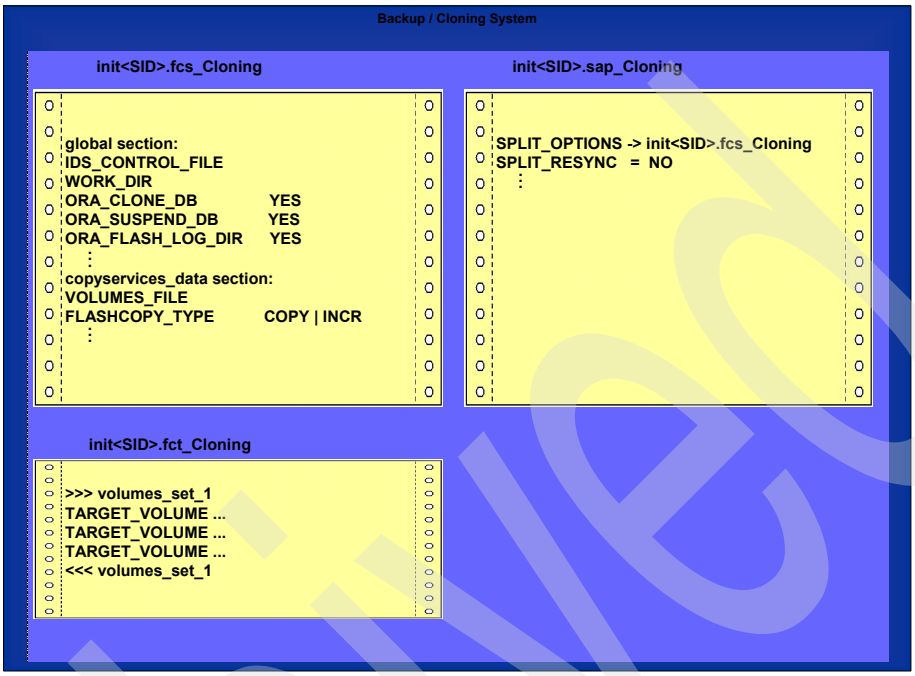


Figure B-3 Options which were adapted or added to the profiles to clone an Oracle SAP database

Running the FlashCopy cloning script FCclone.sh

The FlashCopy cloning script FCclone.sh has to be executed by the ora<oldSID> user orar31. The ora<*newSID*> user is not allowed to access the data on the production system. Therefore the **splitint** *cannot* be issued by orar32.

When we ran the cloning process for the first time, no SAP system is yet available on the cloning system, therefore the FCclone.sh terminated with:

```
SAP system R32 is not running
Login as user r32adm and start the SAP system first!
```

Since the SAP system could not be started, we omitted the -Q option. So, the first cloning of the Oracle UDB database system we had to start by:

```
orar3@:/oracle/R31/920_64/dbs ./FCclone.sh -t online_mirror -O R31 -N R32
-s initR31.sap_Cloning -p initR31.fcs_Cloning -P PostProcessing.ini -m batch
```

Once an SAP instance is available on the cloning system, you must subsequently run the script using these options:

```
orar3@:/oracle/R31/920_64/dbs ./FCclone.sh -t online_mirror -O R31 -N R32
-s initR31.sap_Cloning -p initR31.fcs_Cloning -Q PreProcessing.ini -P
PostProcessing.ini -m batch
```

Unfortunately, the FCclone process then terminated with RC34 in the oraclondb job at the database recovery step. The trace showed these messages:

```
SQL> ORA-00283: recovery session canceled due to errors
ORA-01110: data file 2: '/oracle/R31/sapdata2/undo_1/undo.data1'
ORA-01157: cannot identify/lock data file 2 - see DBWR trace file
ORA-01110: data file 2: '/oracle/R31/sapdata2/undo_1/undo.data1'
```

This is a typical issue, if the size of a data file is large and the fsize is low. In /etc/security/limits we found the fsize was set to 2097151 blocks, which is 1 GB. Setting the fsize to -1 (unlimited) solved that problem.

The FCclone.sh script resync s the target volume set (that is a cleanup step to prepare the target volume set for the next **brbackup** process on the backup server), a **brbackup** with either backuptype -t online_mirror or -t offline_mirror (that is the FlashCopy copy process) and then clones the database itself.

The cleanup or resync and the FlashCopy copy processes are done by the Data Protection for FlashCopy as previously discussed in this book.

The actual cloning process is executed by the different pre- and post-processing scripts, initialized by the PreProcessing.ini and PostProcessing.ini files. That is, the new SAP software environment is set up to use the data on the cloning volume sets and the cloned database is updated to work within the new SAP software environment. If you have two target volume sets available, you can perform two cloning operations of the production SAP database instances at different time stamps.

Figure B-4 shows the volumes that are processed by the cloning execution.

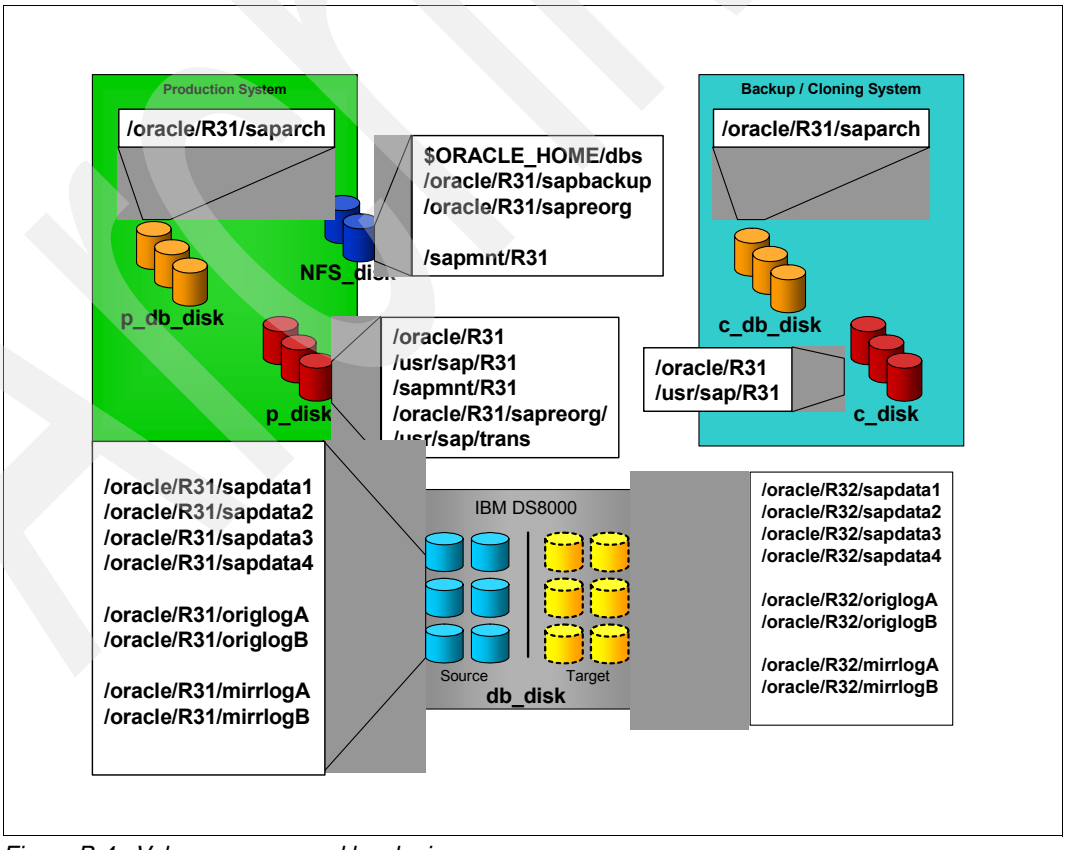


Figure B-4 Volumes processed by cloning

C

Sample configuration files

In this appendix we include the full configuration files used by Data Protection for FlashCopy for mySAP and associated components, customized for the environment shown in this redbook.

Tivoli Storage Manager client API options files

In this section we list the user options file and the system options file.

User options file

The Tivoli Storage Manager 64-bit API client options file /usr/tivoli/tsm/client/api/bin64/dsm.opt is shown in Example C-1.

Example: C-1 Tivoli Storage Manager API user options file

```
SErvername  uncletitus
```

System options file

TheTivoli Storage Manager 64-bit API system options file /usr/tivoli/tsm/client/api/bin64/dsm.sys is shown in Example C-2.

Example: C-2 Tivoli Storage Manage API system options file

```
SErvername  uncletitus
   COMMMethod         TCPip
   TCPPort            1500
   TCPServeraddress   9.152.10.57
   Errorlogname       /tmp/dsierror.log
```

Data Protection for mySAP utility file

In this section we list the utility file for the DB2 UDB and Oracle environments.

For SAP software with DB2 UDB database

Our Data Protection for mySAP (DB2 UDB) utility file /db2/PR1/dbs/initPR1.utl is shown in Example C-3. The SID used in our configuration is PR1. We have highlighted the options we changed.

Example: C-3 Sample Data Protection for mySAP (DB2 UDB) utility file

```
#------------------------------------------------------------------------
#
# Data Protection for mySAP (R) interface for DB2 UDB
#
# Sample profile for Data Protection for mySAP (R) Version 5.3
#
#------------------------------------------------------------------------
#
# See the 'Data Protection for mySAP (R) Installation &
# User's Guide' for a full description.
#
# For a comment symbol the character '#' can be used.
# Everything following this character will be interpreted as comment.
#
# Data Protection for mySAP (R) accesses its profile
# in "read only" mode. All variable parameters like passwords, date of
```

```
# last password change, current version number will be written into the file
# specified with the CONFIG_FILE parameter. The passwords will be encrypted.


#-----------------------------------------------------------------------
# Prefix of the 'Backup ID' which is used for communication with
# the SAP-DB2 Administration Tools and stored in the description field of
# the Tivoli Storage Manager archive function.
# Maximum 6 characters.
# Default: none.
#-----------------------------------------------------------------------
BACKUPIDPREFIX      PR1___


#-----------------------------------------------------------------------
# Number of parallel sessions to be established.
# Note: This number must not exceed the number of tape drives simultaneously
# available to the node on the Tivoli Storage Manager servers to be accessed.
# The valid range of MAX_SESSIONS is from 1 and 32.
# Default: none.
#-----------------------------------------------------------------------
MAX_SESSIONS            1 # Tivoli Storage Manager client sessions


#-----------------------------------------------------------------------
# Number of backup copies of the DB2 log files.
# The valid range of REDOLOG_COPIES is from 1 to 9.
# Default: 1.
#-----------------------------------------------------------------------
#REDOLOG_COPIES         2


#-----------------------------------------------------------------------
# Specifies the block size for disk I/O (in bytes).
# The default values have been chosen from our performance experiments in
# standard hardware environments.
# The valid range of BUFFSIZE is from 4KB to 32MB.
# Default: 131072 (128 KB) on UNIX, 32768 (32 KB) on Windows.
#-----------------------------------------------------------------------
BUFFSIZE                131072              # block size in bytes


#-----------------------------------------------------------------------
# This optional parameter controls how Data Protection for mySAP(R) uses
# the internal buffers for transferring data during a backup.
# Valid values:   SIMPLE | PREVENT | AUTO
# Default: SIMPLE
#-----------------------------------------------------------------------
#BUFFCOPY               AUTO


#-----------------------------------------------------------------------
# Name of a program to be called before the backup task is started.
# Default: none.
#-----------------------------------------------------------------------
```

```
# FRONTEND        /db2/PR1/dbs/script/db2_frontend.sh


#-----------------------------------------------------------------------
# Name of a program to be called after the backup task is completed.
# Default: none.
#-----------------------------------------------------------------------
# BACKEND         /db2/PR1/dbs/script/db2_backend.sh

#-----------------------------------------------------------------------
# Maximum number of data base backup versions to be kept.
# Note: Version control by Data Protection for mySAP (R) is only activated
# only activated if the parameter MAX_VERSION is not 0.
# The valid range of MAX_VERSIONS is from 0 to 9999.
# A value of 0 means no versioning.
# Default: 0, no versioning.
#-----------------------------------------------------------------------
MAX_VERSIONS            2


#-----------------------------------------------------------------------
# Specifies whether a null block compression of the data is to be performed
# before transmission to Tivoli Storage Manager.
# Although RL compression introduces additional CPU load, throughput can be
# improved when the network is the bottleneck. RL compression in Data
# Protection for mySAP(R) should not be used together with
# Tivoli Storage Manager API compression.
# Default: NO
#-----------------------------------------------------------------------
#RL_COMPRESSION         YES                # NO is default


#-----------------------------------------------------------------------
# Controls generation of a trace file.
# Note: We recommend using the trace function only in cooperation with
# Data Protection for mySAP (R) support.
# Default: OFF.
#-----------------------------------------------------------------------
#TRACE                  OFF
#TRACEFILE             /db2/C21/sqllib/log/tdpr3.trace


#-----------------------------------------------------------------------
# Denotes the maximum size of the trace file in KB.
# If not specified, the trace file size is unlimited.
#-----------------------------------------------------------------------
#TRACEMAX           <max. size>             # trace file size in KB

#-----------------------------------------------------------------------
# Specify the full path of the configuration file.
# Default: none.
#-----------------------------------------------------------------------
CONFIG_FILE      /db2/PR1/dbs/%DB2NODE/initPR1.bki
```

```
#-----------------------------------------------------------------------
# Denotes if Data Protection for mySAP (R) shall send error/status
# information to a Tivoli Storage Manager server.
# The servername must match one of the servers listed in a SERVER statement.
# Valid values for verbosity are ERROR | WARNING | DETAIL.
# Default: none.
#-----------------------------------------------------------------------
#LOG_SERVER             servername    [verbosity]
#LOG_SERVER             server_a      ERROR


#***********************************************************************
# Statement for servers and paths.
# Multiple servers may be defined.
#***********************************************************************


SERVER          uncletitus
  SESSIONS            2                 # Maximum number of sessions
                                        # to server_a
  PASSWORDREQUIRED    YES               # Use a password
  ADSMNODE            auntmathilda_sap
  BRBACKUPMGTCLASS    pr1dbs
  BRARCHIVEMGTCLASS   pr1log
# TCP_ADDRESS         192.168.1.1       # IP address of network interface
                                        # on server_a
                                        # Overrides IP address of dsm.sys
# USE_AT              0 1 2 3 4 5 6     # Days when server_a is used for
                                        # backup
#***********************************************************************
# USE_AT : 0=Su 1=Mo 2=Tu 3=We 4=Th 5=Fr 6=Sa
# The valid range of USE_AT is from 0 to 6.
# Default: all days
#***********************************************************************

#SERVER         server_b                # Servername, as defined in dsm.sys
#  SESSIONS           2                 # Maximum number of sessions
                                        # to server_b
#  PASSWORDREQUIRED    YES              # Use a password
#  ADSMNODE            NODE             # Tivoli Storage Manager Nodename
#  BRBACKUPMGTCLASS    MDB              # Mgmt-Classes for database backup
#  BRARCHIVEMGTCLASS   MLOG1 MLOG2      # Mgmt-Classes for redo log backup
#  TCP_ADDRESS         192.168.1.1      # IP address of network interface
                                        # on server_b
                                        # Overrides IP address of dsm.sys
#  USE_AT              0 1 2 3 4 5 6    # Days when server_b is used for
                                        # backup
#***********************************************************************
# USE_AT : 0=Su 1=Mo 2=Tu 3=We 4=Th 5=Fr 6=Sa
# Default: all days
#***********************************************************************



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

```
# End of profile


END
```

For SAP software in an Oracle environment

The Data Protection for mySAP (Oracle) utility file /oracle/R31/920_64/dbs/initR31.utl is shown in Example C-4. The SID used in our configuration is R31. We have highlighted the options we changed.

Example: C-4 Sample Data Protection for mySAP (Oracle) utility file

```
#------------------------------------------------------------------------
#
# Data Protection for mySAP (R) interface for ORACLE
#
# Sample profile for Data Protection for mySAP (R) Version 5.3
# for UNIX
#
#------------------------------------------------------------------------
#
# This file should be renamed to $ORACLE_HOME/dbs/init$ORACLE_SID.utl
# where $ORACLE_HOME is the home directory of the Oracle database and
# $ORACLE_SID is the system ID of the Oracle database.
# Default is '/oracle/C21/initC21.utl'.
#
# See the 'Data Protection for mySAP (R) Installation &
# User's Guide' for a full description.
#
# For a comment symbol the character '#' can be used.
# Everything following this character will be interpreted as comment.
#
# Data Protection for mySAP (R) V5R3 accesses its profile
# in "read only" mode. All variable parameters like passwords, date of
# last password change, current version number will be written into the file
# specified with the CONFIG_FILE parameter. The passwords will be encrypted.


#------------------------------------------------------------------------
# Prefix of the 'Backup ID' which will be used for communication with
# BR*Tools and stored in the description field of the Tivoli Storage Manager
# archive function.
# Must be 6 characters.
# Default: none.
#------------------------------------------------------------------------
BACKUPIDPREFIX          R31___


#------------------------------------------------------------------------
# Number of parallel sessions to be established.
# Note: This number must not exceed the number of tape drives simultaneously
# available to the node on the Tivoli Storage Manager servers to be accessed.
# The valid range of MAX_SESSIONS is from 1 and 32.
# Default: none.
```

```
#------------------------------------------------------------------------
MAX_SESSIONS            1 # Tivoli Storage Manager client sessions


#------------------------------------------------------------------------
# Number of parallel sessions to be established for the database backup.
# Note: This number must not exceed the number of tape drives simultaneously
# available to the node for a database backup on the Tivoli Storage Manager
# servers to be accessed.
# The valid range of MAX_BACK_SESSIONS is from 1 to 32.
# Default: MAX_SESSIONS.
#------------------------------------------------------------------------
#MAX_BACK_SESSIONS      1 # Tivoli Storage Manager client sessions for backup


#------------------------------------------------------------------------
# Number of parallel sessions to be established for the redo log backup.
# Note: This number must not exceed the number of tape drives simultaneously
# available to the node for a redo log backup on the Tivoli Storage Manager
# servers to be accessed.
# The valid range of MAX_ARCH_SESSIONS is from 1 to 32.
# Default: MAX_SESSIONS.
#------------------------------------------------------------------------
#MAX_ARCH_SESSIONS      1 # Tivoli Storage Manager client sessions for archive


#------------------------------------------------------------------------
# Number of parallel sessions to be established for the backup of control
# files. This number is typically used to reduce the number of sessions
# to be used for the control file backup after another backup operation.
# The valid range of MAX_CONTROL_SESSIONS is from 1 to 32.
# Default: MAX_BACK_SESSIONS or MAX_ARCH_SESSIONS, depending on the type of
#          the control file backup.
#------------------------------------------------------------------------
#MAX_CONTROL_SESSIONS   1 # Tivoli Storage Manager client sessions for control
                          # file backup.


#------------------------------------------------------------------------
# Number of parallel sessions to be established for the restore of files.
# Note: This number must not exceed the number of tape drives simultaneously
# available to the node for restore processing backup on the Tivoli Storage
# Manager servers to be accessed.
# The valid range of MAX_RESTORE_SESSIONS is from 1 to 32.
# Default: MAX_SESSIONS.
#------------------------------------------------------------------------
#MAX_RESTORE_SESSIONS   1 # Tivoli Storage Manager client sessions for restore


#------------------------------------------------------------------------
# Number of backup copies of redo logs.
# The valid range of REDOLOG_COPIES is from 1 to 9.
# Default: 1.
#------------------------------------------------------------------------
#REDOLOG_COPIES         2
```

```
#-------------------------------------------------------------------------
# Specifies whether a null block compression of the data is to be performed
# before transmission to Tivoli Storage Manager.
# Although RL compression introduces additional CPU load, throughput can be
# improved when the network is the bottleneck. RL compression in Data
# Protection for mySAP (R) should not be used together with
# Tivoli Storage Manager API compression.
# Default: NO
#-------------------------------------------------------------------------
#RL_COMPRESSION         YES


#-------------------------------------------------------------------------
# Specifies how many files are read simultaneously and are multiplexed into
# one data stream to a Tivoli Storage Manager server. Multiplexing is usefull
# when the data rate to a Tivoli Storage Manager server is higher (fast
# tapes, fast network) than the I/O rate of a single disk.
# The valid range of MULTIPLEXING is from 1 to 8.
# Default: 1 (meaning no multiplexing)
#-------------------------------------------------------------------------
MULTIPLEXING           2


#-------------------------------------------------------------------------
# Specifies the block size for disk I/O (in bytes).
# The default values have been chosen from our performance experiments in
# standard hardware environments.
# The valid range of BUFFSIZE is from 4KB to 32MB.
# Default: 131072 (128 KB) on UNIX, 32768 (32 KB) on Windows.
#-------------------------------------------------------------------------
BUFFSIZE               131072             # block size in bytes


#-------------------------------------------------------------------------
# This optional parameter controls how Data Protection for mySAP(R) uses
# the internal buffers for transferring data during a backup.
# Valid values:   SIMPLE | PREVENT | AUTO
# Default: SIMPLE
#-------------------------------------------------------------------------
#BUFFCOPY               AUTO


#-------------------------------------------------------------------------
# Name of a program to be called before the backup task is started.
# Default: none.
#-------------------------------------------------------------------------
#FRONTEND               pgmname parameterlist


#-------------------------------------------------------------------------
# Name of a program to be called after the backup task is completed.
# Default: none.
#-------------------------------------------------------------------------
```

```
#BACKEND                pgmname parameterlist


#-----------------------------------------------------------------------
# Maximum number of data base backup versions to be kept.
# Note: Version control by Data Protection for mySAP (R) is only activated
# if the R/3 release is 3.0C and higher and the parameter MAX_VERSIONS is
# not 0.
# The valid range of MAX_VERSIONS is from 0 to 9999.
# A value of 0 means no versioning.
# Default: 0, no versioning.
#-----------------------------------------------------------------------
MAX_VERSIONS            2


#-----------------------------------------------------------------------
# Indicates whether processing is to be done unattended or whether human
# intervention is allowed.
# Default:
# YES for backup processing
# NO  for restore processing
#-----------------------------------------------------------------------
#BATCH                  YES                 # unattended automated operation
#BATCH                  NO                  # manual operation


#-----------------------------------------------------------------------
# Control of error situations: Indicates whether and when database backups
# and restore operations should be ended when an error occurs during
# unattended processing.
# Valid values:
# YES: Exit if a single file cannot be backed up or restored.
# NO:  Do not exit when an error occurs.
# the number of errors resulting in exiting the processing.
# The valid range of EXITONERROR is from 0 to 100.
# Default: NO.
#-----------------------------------------------------------------------
#EXITONERROR            3                   # exit after 3 errors


#-----------------------------------------------------------------------
# Control of information for reporting purposes, e.g. messages, statistics.
# Default: NO (no additional data will be reported).
#-----------------------------------------------------------------------
#REPORT                 NO                  # no additional messages
#REPORT                 YES                 # all additional messages
#REPORT                 2                   # all additional messages + summary


#-----------------------------------------------------------------------
# Controls generation of a trace file.
# Note: we recommend using the trace function only in cooperation with
# Data Protection for mySAP (R) support.
# Default: OFF.
#-----------------------------------------------------------------------
```

```
#TRACE                  OFF


#-----------------------------------------------------------------------
# The full path of the trace file.
# Note: for an actual trace the string '%BID' will be replaced by
# the current backupid.
# (.../backint_%BID.trace changes to .../backint_SAP___9809182300.trace).
# Default: none.
#-----------------------------------------------------------------------
#TRACEFILE              /oracle/C21/dbs/backint.trace
#TRACEFILE              /oracle/C21/dbs/backint_%BID.trace


#-----------------------------------------------------------------------
# Denotes the maximum size of the trace file in KB.
# If not specified, the trace file size is unlimited.
#-----------------------------------------------------------------------
#TRACEMAX           <max. size>            # trace file size in KB

#-----------------------------------------------------------------------
# Specify the full path of the configuration file.
# Default: none.
#-----------------------------------------------------------------------
CONFIG_FILE             /oracle/R31/920_64/dbs/initR31.bki

FCS_FILE                /oracle/R31/920_64/dbs/initR31.fcs
#-----------------------------------------------------------------------
# Number of times to retry saving/restoring a file in case an error occurs.
# The valid range of FILE_RETRIES is from 0 to 100.
# Default: 3.
#-----------------------------------------------------------------------
#FILE_RETRIES           3


#-----------------------------------------------------------------------
# Denotes if Data Protection for mySAP (R) shall send error/status
# information to a Tivoli Storage Manager server.
# The servername must match one of the servers listed in a SERVER statement.
# Valid values for verbosity are ERROR | WARNING | DETAIL.
# Default: none.
#-----------------------------------------------------------------------
#LOG_SERVER             servername    [verbosity]
#LOG_SERVER             server_a      ERROR


#-----------------------------------------------------------------------
# Denotes if Data Protection for mySAP (R) shall use a manual sorting file
# for disk sorting.
# Default: none.
#-----------------------------------------------------------------------
#SORT_FILE              /oracle/C21/dbs/manual_sort_file


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

```
# Denotes if Data Protection for mySAP (R) shall use a compressed filesize
# sorting file for disk sorting.
# For backup simulations with compression (see manual) this parameter must
# be set to a valid file.
# Default: none.
#------------------------------------------------------------------------
#COMPR_INFO            /oracle/C21/dbs/initSID.cfi


#************************************************************************
# Statement for servers and paths.
# Multiple servers may be defined.
#************************************************************************


SERVER         uncletitus               # Servername, as defined in dsm.sys
  SESSIONS           2                  # Maximum number of sessions
                                        # to server_a
  PASSWORDREQUIRED   YES                # Use a password
  ADSMNODE           auntmathilda_r31   # Tivoli Storage Manager Nodename
  BRBACKUPMGTCLASS   R31DBS             # Mgmt-Classes for database backup
  BRARCHIVEMGTCLASS  R31LOG             # Mgmt-Classes for redo log backup
# TCP_ADDRESS        192.168.1.1        # IP address of network interface
                                        # on server_a
                                        # Overrides IP address of dsm.sys
# USE_AT             0 1 2 3 4 5 6      # Days when server_a is used for
                                        # backup
#************************************************************************
# USE_AT : 0=Su 1=Mo 2=Tu 3=We 4=Th 5=Fr 6=Sa
# The valid range of USE_AT is from 0 to 6.
# Default: all days
#************************************************************************

#SERVER        server_b                 # Servername, as defined in dsm.sys
#  SESSIONS          2                  # Maximum number of sessions
                                        # to server_b
#  PASSWORDREQUIRED   YES               # Use a password
#  ADSMNODE           NODE              # Tivoli Storage Manager Nodename
#  BRBACKUPMGTCLASS   MDB               # Mgmt-Classes for database backup
#  BRARCHIVEMGTCLASS  MLOG1 MLOG2       # Mgmt-Classes for redo log backup
#  TCP_ADDRESS        192.168.1.1       # IP address of network interface
                                        # on server_b
                                        # Overrides IP address of dsm.sys
#  USE_AT             0 1 2 3 4 5 6     # Days when server_b is used for
                                        # backup
#************************************************************************
# USE_AT : 0=Su 1=Mo 2=Tu 3=We 4=Th 5=Fr 6=Sa
# Default: all days
#************************************************************************



#------------------------------------------------------------------------
# End of profile
```

```
END
```

Sample Data Protection for FlashCopy profiles

In this section we list some sample profiles for the DB2 UDB and Oracle environments.

For SAP software with DB2 UDB

The Data Protection for FlashCopy (mySAP-DB2 UDB) profile /db2/PR1/dbs/auntmathilda/initPR1.fcs is shown in Example C-5.

Example: C-5 Data Protection for FlashCopy (mySAP-DB2 UDB) profile

```
################################################################################
#                        5.3.1.2
################################################################################
#      This profile contains setup information for the two components of
#      Tivoli Storage Manager for Hardware
#         Data Protection for Disk Storage and SAN VC for mySAP(R)
#      hereafter DP for FlashCopy (DP for FC).
#
#      File name:  initSID.fcs
#
#      Directory:  /db2/<SID>/dbs
#                  where <SID> stands for the DB2 System ID used.
#                  In mySAP(R) environments, 3 character System IDs are
#                  used. In the sample, DO1 is used as the System ID.
#
#      Usage    :
#        Whenever DP for FC will be used, a profile has to be passed
#        along with the DP for FlashCopy command tdphdwdb2
#        as the value of the -p parameter,
#        for example:
#
#        tdphdwdb2 -f xxxxxx -p /db2/<SID>/dbs/init<SID>.fcs
#
#        where xxxxxx stands for a function of DP for FlashCopy
#        (backup, flashcopy, restore, unmount, inquire,
#        configure, query, withdraw or withdraw_force) being performed by
tdphdwdb2.
#
#
# With the product deliverables, you get the sample file
# initSID.fcs. If you have not used the install script,
# rename it to $INSTHOME/dbs/init$DB2DBDFT.fcs,
# where $INSTHOME is the home directory of the DB2 instance.
#
# In the sample the name /db2/DO1/dbs/initDO1.fcs is used.
#
#
# Rules for the profile setup must be followed as shown:
#      - Directory names and files names are case sensitive
#      - All directories and file names must be available
```

```
#        via NFS mounts on the production (here: columbus)
#        or backup system (here: magellan)

# Any comments must start with the character '#' in column 1.
#
# Tabs should not be used.

# Layout of the profile
#   The profile is divided into topics. The present
#   release contains the following topics:
#        global
#        DB2
#        copyservices_data
#   Each topic has a unique set of specific parameters, of which
#   some are required and some will default to a value.
#   Each topic is enclosed by a topic begin statement (>>>) and a
#   topic end statement (<<<) followed by the topic name separated
#   by a blank character.
#
# Topic and parameter names are not case sensitive. By convention,
# topic names are shown in lowercase and parameters in uppercase.
#
# Parameters of the 'global' topic
>>> global

#------------------------------------------------------------------#
# LOGON_HOST_PROD
# Defines the parameters needed to reach the production system
# on which the mySAP(R) database server is running.
#
# The syntax with 2 parameters is :
#
# LOGON_HOST_PROD  tcp_name  userid
#
#  where  tcp_name is the TCP/IP name or the dot address under
#                  which the production system can be reached
#                  using rexec services
#                  (here called columbus_et)
#
#         userid   is the DB2 userid db2<sid> (here called db2d01)
#                  which the mySAP(R) DBA tools will work with.
#                  The password for this userid has to be provided
#                  - once DP for FlashCopy has been installed - using
#                  the password function of DP for FlashCopy and will be
#                  encrypted and stored in the file specified in
#                  CONFIG_FILE.
#
#
#
# The following syntax with 3 parameters (introduced with 1.1.0.3) is
# still supported, but the first parameter is no longer checked.
#
# LOGON_HOST_PROD  hostname  tcp_name  userid
#
#  where  hostname is the host name (result of hostname command)
```

```
#                  of the production system (here called columbus).
#         tcp_name is the TCP/IP name or the dot address of the
#                  production system.
#                  (here called columbus_et)
#         userid   is the DB2 userid db2<sid> (here called db2d01)
#                  which the mySAP(R) DBA tools will work with.
#                  The password for this userid has to be provided
#                  - once DP for FlashCopy has been installed - using
#                  the password function of DP for FlashCopy and will be
#                  encrypted and stored in the file specified in
#                  CONFIG_FILE.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
LOGON_HOST_PROD         auntmathilda db2pr1


#-------------------------------------------------------------------#
# LOGON_HOST_BACK
# Defines the host name of the backup system (as a result of the
# hostname command) on which DP for FlashCopy (tdphdwdb2)
# will be started with a FlashCopy request.
# (here called magellan)
#
# Once the task for this request has finished, tdphdwdb2 will
# start the backup on the backup system by calling
# Data Protection for mySAP(R).
#
# Parameter definition is required.
#-------------------------------------------------------------------#
LOGON_HOST_BACK         uncletitus


#-------------------------------------------------------------------#
# BACKUP_MAX
# Defines the number of backup cycles kept in the directory of the
# IDS_CONTROL_FILE path; if BACKUP_MAX is reached,
# the logs and traces belonging to a backup cycle will also be
# deleted (see also LOG_TRACE_DIR).
#
# Parameter definition is optional.
# Default: 30
#-------------------------------------------------------------------#
BACKUP_MAX              30


#-------------------------------------------------------------------#
# IDS_CONTROL_FILE
# Defines the file which contains the summary information
# of such a backup cycle entry. DP for FlashCopy will create an entry
# in this file each time it starts a FlashCopy.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /db2/D01/dbs is already available
```

```
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
IDS_CONTROL_FILE        /db2/PR1/dbs/auntmathilda/save/idssave


#-------------------------------------------------------------------#
# CONFIG_FILE
# Defines the file which contains the information required
# when the backup system needs to work with other hosts
# like the production system.
#
# The file will be created by calling the configure function of
# DP for FlashCopy, once it had been installed, and each time the
# password of the db2<sid> user (here in our sample db2dO1) or
# the password for the CIM agent user has been changed.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /db2/DO1/dbs is already available
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
CONFIG_FILE             /db2/PR1/dbs/auntmathilda/initPR1.fcp


#-------------------------------------------------------------------#
# WORK_DIR
# Specifies the directory where temporary files will be written
# by DP for FlashCopy.
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /db2/DO1/dbs is already available
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
WORK_DIR                /db2/PR1/dbs/auntmathilda/work


#-------------------------------------------------------------------#
# TRACE
# Controls the generation of a trace file.
# Note: We recommend using the trace function
#  - at implementation time and
#  - in cooperation with the hotline
#
# Possible parameter values :  YES or NO
#
# Parameter definition is optional.
# Default : YES
#-------------------------------------------------------------------#
TRACE                   YES
```

```
#-------------------------------------------------------------------#
# LOG_TRACE_DIR
# Specifies the directory for log and trace files to be written
# by DP for FlashCopy.
# Trace files will be written to this directory if YES is
# specified in the TRACE parameter.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /db2/DO1/dbs is already available
# as an NFS directory.
#
# Parameter definition is optional.
# Default : if not specified, logs and traces will be written to the
#           directory specified as the WORK_DIR parameter.
#-------------------------------------------------------------------#
LOG_TRACE_DIR           /db2/PR1/dbs/auntmathilda/logtraces


#-------------------------------------------------------------------#
# TDPR3_CONFIG_FILE
# Specifies the name of the DP for mySAP(R) for DB2 UDB
# configuration profile.
# For more information about this profile see 'Data Protection
# for mySAP(R) Installation and User's Guide for DB2 UDB'.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /db2/DO1/dbs is already available
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
TDPR3_CONFIG_FILE       /db2/PR1/dbs/initPR1.utl


#-------------------------------------------------------------------#
# SUPPORT_ADMIN_ASSISTANT
# Defines whether DP for FlashCopy sends its log records to
# the DP for mySAP Administration Assistant.
# For proper setup of the Administration Assistant see the
# DP for mySAP Installation and User's Guide
#
# If you specify YES, you must set up PROLE_SERVICE_NAME with the
# proper service name.
#
# Possible parameter values :  YES or NO
#
# Parameter definition is optional.
# Default : NO
#-------------------------------------------------------------------#
SUPPORT_ADMIN_ASSISTANT NO
```

```
#-------------------------------------------------------------------#
# PROLE_SERVICE_NAME
# This parameter specifies the service name with which DP for FlashCopy
# communicates with DP for mySAP prole to provide information
# to the Administration Assistant.
# The service name is defined by DP for mySAP at installation
# time in /etc/services. Check this file.
#
# This parameter is required only if SUPPORT_ADMIN_ASSISTANT
# is set to YES.
#
# Default: (no name provided)
#-------------------------------------------------------------------#
# PROLE_SERVICE_NAME tdpr3db264 or tdpr3db2

#-------------------------------------------------------------------#
# COPYSERVICES_HARDWARE_TYPE
# specifies the type of disk subsystem to be used
#
# Supported values :  ESS800 or SVC or DS6000 or DS8000
#
# Parameter definition is required.
#-------------------------------------------------------------------#
COPYSERVICES_HARDWARE_TYPE     DS8000

<<< global


# Parameters of the 'DB2' topic
>>> db2
#-------------------------------------------------------------------#
# DB2_REMOTE_DBALIAS
# Specifies the database alias on which the DB2 remote database is
# cataloged on the backup system. The remote database aliasname
# will be cataloged on the remote node REM<SID> (in the sample
# the remote node is REMDO1).
# For more information see 'Configuring DP for FlashCopy on the backup
# System (setupDB2BS)'.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
DB2_REMOTE_DBALIAS         R_PR1


#-------------------------------------------------------------------#
# DB2_RECOVERY_LOG
# Specifies the name of the DP for mySAP(R) for DB2 UDB recovery
# logfile. DP for mySAP(R) writes all information of backups in this
# file.
# For more information about this file see 'Data Protection
# for mySAP(R) Installation and User's Guide for DB2 UDB'.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
```

```
DB2_RECOVERY_LOG          /db2/PR1/dbs/tdplog/tdprlf.PR1.NODE0000.log


#-------------------------------------------------------------------#
# DB2_TDPR3_LIB
# Specifies the name of the DP for mySAP(R) for DB2 UDB vendor
# library which is called by the db2 backup and db2 restore commands.
# For more information about the vendor library see 'Data Protection
# for mySAP(R) Installation and User's Guide for DB2 UDB'.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
DB2_TDPR3_LIB             /usr/tivoli/tsm/tdp_r3/db264/libtdpdb264.a


#-------------------------------------------------------------------#
# DB2_PARALLELISM
# Determines the number of tablespaces which can be read in parallel
# by the DB2 backup utility.
# For more information about this parameter see backup command in
# 'Command Reference IBM DB2 Universal Database V7.2 Guide'.
#
# Possible parameter values :  # of parallel DB2 processes to read
#                              data from tablespaces at a db2 backup
#                              and db2 restore
#
# Parameter definition is optional.
# Default : 1
#-------------------------------------------------------------------#
DB2_PARALLELISM           1


#-------------------------------------------------------------------#
# DB2_NUM_BUFFERS
# The number of buffers to be used for db2 backup and db2 restore
# commands. When creating a backup to multiple locations, a larger
# number of buffers may be used to improve performance.
# For more information about this parameter see backup and restore
# commands in 'Command Reference IBM DB2 Universal Database V7.2
# Guide'.
#
# Possible parameter values :  # of buffers to be used for db2
#                              backup and db2 restore
#
# Parameter definition is optional.
# Default : 2
#-------------------------------------------------------------------#
DB2_NUM_BUFFERS           2


#-------------------------------------------------------------------#
# DB2_BUFFER_SIZE
# The size, in 4-KB pages, of the buffer used when building the
# db2 backup image and restoring a backup image.
# The minimum value for this parameter is 8 pages; the default
```

```
# value is 1024 pages. If a buffer size of zero is specified, the
# value of the database manager configuration parameter <backbufsz>
# will be used as the buffer allocation size.
# For more information about this parameter see backup and restore
# commands in 'Command Reference IBM DB2 Universal Database V7.2
# Guide'.
#
# Possible parameter values :  <size> in 4-KB pages of the buffer
#                              for db2 backup and db2 restore
#
# Parameter definition is optional.
# Default : 1024
#-------------------------------------------------------------------#
DB2_BUFFER_SIZE            1024

#-------------------------------------------------------------------#
<<< db2


# Parameters of the 'copyservices_data' topic
>>> copyservices_data
#-------------------------------------------------------------------#
# The 'copyservices_data' topic contains all the parameters
# required to let DP for FlashCopy use the CIM agent
# to request FlashCopy, withdraw, inquire and query
# operations on the storage box cluster in which the
# volumes of interest reside.
#
# To access the storage box via the CIM agent, a username and password
# are required. You will get the username and the password from the storage
# administrator, who likely has also set up for you the source volumes
# to allow you to install mySAP(R) with a DB2 DB. You also need the target
# volumes to store the FlashCopy backup.
#
# The password for this username has to be provided - once
# DP for FlashCopy has been installed - using the password function
# of DP for FlashCopy and will be encrypted and stored in the file
# specified in CONFIG_FILE (see above).
#-------------------------------------------------------------------#

#-------------------------------------------------------------------#
# PRIMARY_COPYSERVICES_SERVERNAME
# Defines the TCP/IP address of the host running the CIM Agent
# that can access the copy services of the storage box.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
PRIMARY_COPYSERVICES_SERVERNAME   9.152.10.57

#-------------------------------------------------------------------#
# COPYSERVICES_SERVERPORT
# Defines the port number of the CIM agent that can
# access the copy services of the storage box.
#
# Parameter definition is optional.
```

```
# Default: 5988
#-------------------------------------------------------------------#
COPYSERVICES_SERVERPORT    5988

#-------------------------------------------------------------------#
# BACKUP_COPYSERVICES_SERVERNAME
#
# Reserved for future use
#-------------------------------------------------------------------#
# BACKUP_COPYSERVICES_SERVERNAME    174.31.1.4

#-------------------------------------------------------------------#
# COPYSERVICES_USERNAME
# username which was set up by the CIM agent to access the
# storage box
#
# Parameter definition is required.
#-------------------------------------------------------------------#
COPYSERVICES_USERNAME      superuser


#-------------------------------------------------------------------#
# FLASHCOPY_TYPE
# Defines the type of FlashCopy type to be performed: NOCOPY, COPY or
# INCR. For the copy services provided by the SAN VC, the value INCR
# (incremental) is not supported.
#
# Parameter definition is optional.
# Default: COPY
#-------------------------------------------------------------------#
FLASHCOPY_TYPE             COPY

#-------------------------------------------------------------------#
# VOLUMES_FILE
# Defines the fully qualified file name containing a list of
# at least the target volumes.
# This file must be reachable via the NFS setup.
#
# To distinguish this from other profiles and control files,
# define the character string 'fct' as the name suffix.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
VOLUMES_FILE               /db2/PR1/dbs/auntmathilda/initPR1.fct

#-------------------------------------------------------------------#
# SVC_COPY_RATE
# Effective only if the parameter COPYSERVICES_HARDWARE_TYPE is set to the
# value SVC.
# The copy rate specifies the priority that the SVC will assign to the
# FlashCopy background process. A value of 100 is the highest,
# a value of 0 means that there is no background copy process.
#
# Parameter definition is optional.
# Default:
```

```
#   100 if FLASHCOPY_TYPE is COPY
#     0 if FLASHCOPY_TYPE is NOCOPY.
#-------------------------------------------------------------------#
#SVC_COPY_RATE              100

<<< copyservices_data
```

For mySAP with Oracle environment

The Data Protection for FlashCopy (mySAP-Oracle) profile /oracle/R31/920_64/dbs/initR31.fcs is shown in Example C-6.

Example: C-6 Sample Data Protection for FlashCopy (mySAP-Oracle) profile

```
#############################################################################
#                       5.3.1.2
#############################################################################
#      This profile contains setup information for the two components of
#      Tivoli Storage Manager for Hardware
#         Data Protection for Disk Storage and SAN VC for mySAP(R)
#      hereafter DP for FlashCopy (DP for FC).
#
#      File name:  initSID.fcs
#
#      Directory:  ORACLE_HOME/dbs
#          where SID stands for the used Oracle System ID. In mySAP(R)
#          environments, 3 character System IDs are used. In the sample,
#          AO1 is used as the System ID.
#
#      Usage    :
#        Whenever DP for FC will be used, a profile has to be passed
#        along with the command splitint as the value of the -p parameter,
#        for example:
#
#        splitint -f  xxxxxx -p /oracle/<SID>/920_64/dbs/init<SID>.fcs
#
#        where xxxxxx stands for a function of DP for FlashCopy.
#        (password, unmount, inquire, ts_inquire, inquire,
#        withdraw or withdraw_force when called directly, or
#        split, resync, flashback when called on behalf of either BR*Tools
#        (brbackup, brrestore) or the file manager of DP for mySAP (backfm).
#
# With the product deliverables, you get the sample file
# initSID.fcs. If you have not used the install script,
# rename it to $ORACLE_HOME/dbs/init$ORACLE_SID.fcs,
# where $ORACLE_HOME is the home directory of the Oracle database.
#
# In the sample the name /oracle/AO1/920_64/dbs/initAO1.fcs is used.
#
#
# Rules for the profile setup must be followed as shown:
#      - Directory names and files names are case sensitive
#      - All directories and file names must be available
#        via NFS mounts on the production (here: columbus)
#        or backup system (here: magellan)
```

```
#
# Any comments must start with the character '#' in column 1.
#
# Tabs should not be used.

# Layout of the profile
#   The profile is divided into topics. The present
#   release contains the following topics:
#        global      and
#        copyservices_data
#
#   Each topic has a unique set of specific parameters, of which
#   some are required and some will default to a value.
#   Each topic is enclosed by a topic begin statement (>>>) and a
#   topic end statement (<<<) followed by the topic name separated
#   by a blank character.
#
# Topic and parameter names are not case sensitive. By convention,
# topic names are shown in lowercase and parameters in uppercase.
#
# Parameters of the 'global' topic
>>> global

#------------------------------------------------------------------#
# LOGON_HOST_PROD
# Defines the parameters needed to reach the production system
# on which the mySAP(R) database server is running.
#
# The syntax with 2 parameters is :
#
# LOGON_HOST_PROD  tcp_name  userid
#
#  where  tcp_name is the TCP/IP name or the dot address under
#                  which the production system can be reached
#                  using rexec services
#                  (here called columbus_et)
#
#         userid   is the  mySAP(R) userid ora<sid> (here called
#                  oraa01) which the mySAP(R) DBA tools (BR*Tools) will
#                  work with.
#                  The password for this userid has to be provided
#                  - once DP for FlashCopy has been installed - using
#                  the password function of DP for FlashCopy and will be
#                  encrypted and stored in the file specified in
#                  CONFIG_FILE.
#
#
#
# The following syntax with 3 parameters (introduced with 1.1.0.3) is
# still supported, but the first parameter is no longer checked.
#
#
# LOGON_HOST_PROD  hostname  tcp_name  userid
#
#  where  hostname is the host name (result of hostname command)
```

```
#                   of the production system (here called columbus).
#         tcp_name is the TCP/IP name or the dot address of the
#                   production system.
#                   (here called columbus_et)
#         userid   is the  mySAP(R) userid ora<sid> (here called
#                   oraa01) which the mySAP(R) DBA tools will
#                   work with.
#                   The password for this userid has to be provided
#                   - once DP for FlashCopy has been installed - using
#                   the password function of DP for FlashCopy and will be
#                   encrypted and stored in the file specified in
#                   CONFIG_FILE.
#
#
#
#
# Parameter definition is required.
#-------------------------------------------------------------------#
LOGON_HOST_PROD         auntmathilda orar31


#-------------------------------------------------------------------#
# LOGON_HOST_BACK
# Defines the host name of the backup system (as a result of the
# hostname command ) on which the mySAP(R) DBA tool brbackup
# will be started with a FlashCopy request for DP for FlashCopy
# (here called magellan).
#
# Once the task for this request has finished, brbackup will
# start the backup on the backup system by calling
# Data Protection for mySAP(R).
#
# Parameter definition is required.
#-------------------------------------------------------------------#
LOGON_HOST_BACK         uncletitus


#-------------------------------------------------------------------#
# BACKUP_MAX
# The decimal value of this parameter specifies how many entries
# (backup cycles) will be kept in the IDS_CONTROL_FILE. Whenever the
# number of backup cycle entries reaches the BACKUP_MAX value, the
# oldest entry will be deleted. However, the files (such as splitint
# reports, traces etc.) for deleted entries are retained as long as
# they are within 3 days of the now oldest entry.
# A backup cycle that refers to a target set that is in the state
# IN_USE will not be deleted. These cycles can also be seen using the
# splitint 'ts_inquire' function.
# Parameter definition is optional.
# Default: 30
#-------------------------------------------------------------------#
BACKUP_MAX              30


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

```
# IDS_CONTROL_FILE
# Defines the file which contains the summary information
# of such a backup cycle entry. DP for FlashCopy will create an entry
# in this file each time it starts a FlashCopy on behalf of a
# FlashCopy request by mySAP(R) DBA tool brbackup.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /oracle/AO1/sapbackup is already available
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
IDS_CONTROL_FILE        /oracle/R31/sapbackup/idssave/idssave


#-------------------------------------------------------------------#
# CONFIG_FILE
# Defines the file which contains the information required
# when the backup system needs to work with other hosts
# like the production system.
#
# The file will be created by calling the password function of
# DP for FlashCopy, once it had been installed, and each time the
# password of the ora<sid> user (here in our sample oraa01) or
# the password for the CIM agent user has been changed.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /oracle/AO1/92O_64/dbs is already available
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
CONFIG_FILE             /oracle/R31/92O_64/dbs/initR31.fcp


#-------------------------------------------------------------------#
# WORK_DIR
# Specifies the directory where temporary files will be written
# by DP for FlashCopy.
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /oracle/AO1/92O_64/dbs is already available
# as an NFS directory.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
WORK_DIR                /oracle/R31/sapbackup/work


#-------------------------------------------------------------------#
# TRACE
# Controls the generation of a trace file.
# Note: We recommend using the trace function
```

```
#  - at implementation time and
#  - in cooperation with the hotline
#
# Parameter definition is optional.
# Default : YES
#-------------------------------------------------------------------#
TRACE                   YES


#-------------------------------------------------------------------#
# LOG_TRACE_DIR
# Specifies the directory for log and trace files to be written
# by DP for FlashCopy.
# Trace files will be written to this directory if YES is
# specified in the TRACE parameter.
#
# This file must be reachable via an NFS setup from the production
# and backup systems.
# In the sample, /oracle/AO1/92O_64/dbs is already available
# as an NFS directory.
#
# Parameter definition is optional.
# Default : if not specified, logs and traces will be written to the
#           directory specified as the WORK_DIR parameter.
#-------------------------------------------------------------------#
LOG_TRACE_DIR           /oracle/R31/sapbackup/logtraces

#-------------------------------------------------------------------#
# SUPPORT_ADMIN_ASSISTANT
# Defines whether DP for FlashCopy sends its log records to
# the DP for mySAP Administration Assistant.
# For proper setup of the Administration Assistant see the
# DP for mySAP Installation and User's Guide
#
# If you specify YES, you must set up PROLE_SERVICE_NAME with the
# proper service name.
#
# Possible parameter values :  YES or NO
#
# Parameter definition is optional.
# Default : NO
#-------------------------------------------------------------------#
SUPPORT_ADMIN_ASSISTANT NO

#-------------------------------------------------------------------#
# PROLE_SERVICE_NAME
# This parameter specifies the service name with which DP for FlashCopy
# communicates with DP for mySAP prole to provide information
# to the Administration Assistant.
# The service name is defined by DP for mySAP at installation
# time in /etc/services. Check this file.
# This parameter is required only if SUPPORT_ADMIN_ASSISTANT
# is set to YES.
#
# Default: (no name provided)
```

```
#-------------------------------------------------------------------#
# PROLE_SERVICE_NAME tdpr3ora64 or tdpr3ora

#-------------------------------------------------------------------#
# COPYSERVICES_HARDWARE_TYPE
# specifies the type of disk subsystem to be used
#
# Supported values :  ESS800 or SVC or DS6000 or DS8000
#
# Parameter definition is required.
#-------------------------------------------------------------------#
COPYSERVICES_HARDWARE_TYPE     DS8000

<<< global



>>> copyservices_data
#-------------------------------------------------------------------#
# The 'copyservices_data' topic contains all the parameters
# required to let DP for FlashCopy use the CIM agent
# to request FlashCopy, withdraw, inquire and query
# operations on the storage box cluster in which the
# volumes of interest reside.
#
# To access the storage box via the CIM agent, a username and password
# are required. You will get the username and the password from the storage
# administrator, who likely has also set up for you the source volumes
# to allow you to install mySAP(R) with an Oracle DB. You also need the target
# volumes to store the FlashCopy backup.
#
# The password for this username has to be provided - once
# DP for FlashCopy has been installed - using the password function
# of DP for FlashCopy and will be encrypted and stored in the file
# specified in CONFIG_FILE (see above).
#-------------------------------------------------------------------#

#-------------------------------------------------------------------#
# PRIMARY_COPYSERVICES_SERVERNAME
# Defines the TCP/IP address of the host running the CIM Agent
# that can access the copy services of the storage box.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
PRIMARY_COPYSERVICES_SERVERNAME   uncletitus

#-------------------------------------------------------------------#
# COPYSERVICES_SERVERPORT
# Defines the port number of the CIM agent that can
# access the copy services of the storage box.
#
# Parameter definition is optional.
# Default: 5988
#-------------------------------------------------------------------#
COPYSERVICES_SERVERPORT   5988
```

```
#-------------------------------------------------------------------#
# BACKUP_COPYSERVICES_SERVERNAME
#
# Reserved for future use
#-------------------------------------------------------------------#
# BACKUP_COPYSERVICES_SERVERNAME    174.31.1.4

#-------------------------------------------------------------------#
# COPYSERVICES_USERNAME
# username which was set up by the CIM agent to access the
# storage box
#
# Parameter definition is required.
#-------------------------------------------------------------------#
COPYSERVICES_USERNAME     superuser


#-------------------------------------------------------------------#
# FLASHCOPY_TYPE
# Defines the type of FlashCopy type to be performed: NOCOPY, COPY or
# INCR. For the copy services provided by the SAN VC, the value INCR
# (incremental) is not supported.
#
# Parameter definition is optional.
# Default: COPY
#-------------------------------------------------------------------#
FLASHCOPY_TYPE            INCR

#-------------------------------------------------------------------#
# VOLUMES_FILE
# Defines the fully qualified file name containing a list of
# at least the target volumes.
# This file must be reachable via the NFS setup.
#
# To distinguish this from other profiles and control files,
# define the character string 'fct' as the name suffix.
#
# Parameter definition is required.
#-------------------------------------------------------------------#
VOLUMES_FILE              /oracle/R31/920_64/dbs/initR31.fct

#-------------------------------------------------------------------#
# SVC_COPY_RATE
# Effective only if the parameter COPYSERVICES_HARDWARE_TYPE is set to the
# value SVC.
# The copy rate specifies the priority that the SVC will assign to the
# FlashCopy background process. A value of 100 is the highest,
# a value of 0 means that there is no background copy process.
#
# Parameter definition is optional.
# Default:
#   100 if FLASHCOPY_TYPE is COPY
#     0 if FLASHCOPY_TYPE is NOCOPY.
#-------------------------------------------------------------------#
```

```
#SVC_COPY_RATE              100

<<< copyservices_data
```

SAP profile

In this section we list the SAP profiles for the DB2 UDB and Oracle environments.

For Data Protection for mySAP (DB2 UDB) environment

No parameters had to be modified in the SAP profile for Data Protection for mySAP (DB2 UDB) environment.

For Data Protection for mySAP (Oracle) environment

The sample SAP profile for Data Protection for FlashCopy (mySAP-Oracle) environment is shown in Example C-7. Only sections of the file where the updates were made are shown.

Example: C-7 SAP profile for Data Protection for FlashCopy (mySAP-Oracle)

```
# @(#) $Id: //bas/640_REL/src/ccm/rsbr/initAIX.sap#7 $ SAP
#############################################################################
#                                                                           #
# SAP backup sample profile.                                                #
# The parameter syntax is the same as for init.ora parameters.              #
# Enclose parameter values which consist of more than one symbol in         #
# double quotes.                                                            #
# After any symbol, parameter definition can be continued on the next       #
# line.                                                                     #
# A parameter value list should be enclosed in parentheses, the list        #
# items should be delimited by commas.                                      #
# There can be any number of white spaces (blanks, tabs and new lines)      #
# between symbols in parameter definition.                                  #
#                                                                           #
#############################################################################
# backup mode [all | all_data | full | incr | sap_dir | ora_dir
# | <tablespace_name> | <file_id> | <file_id1>-<file_id2>
# | <generic_path> | (<object_list>)]
# default: all
backup_mode = all
# restore mode [all | all_data | full | incr | incr_only | incr_full
# | <tablespace_name> | <file_id> | <file_id1>-<file_id2>
# | <generic_path> | (<object_list>)]
# redirection with '=' is not supported here - use option '-m' instead
# default: all
restore_mode = all
# backup type [offline | offline_force | offline_standby | offline_split
# | offline_mirror | offline_stop | online | online_cons | online_split
# | online_mirror
# default: offline
backup_type = online_mirror
# backup device type
# [tape | tape_auto | tape_box | pipe | pipe_auto | pipe_box | disk
# | disk_copy | disk_standby | stage | stage_copy | stage_standby
```

```
# | util_file | util_file_online | rman_util | rman_disk | rman_stage
# | rman_prep]
# default: tape
backup_dev_type = util_file
# backup root directory [<path_name> | (<path_name_list>)]
# default: $SAPDATA_HOME/sapbackup
backup_root_dir = /oracle/R31/sapbackup
# stage root directory [<path_name> | (<path_name_list>)]
# default: value of the backup_root_dir parameter
stage_root_dir = /oracle/R31/sapbackup
# compression flag [yes | no | hardware | only]
# default: no
compress = no
.........................
# split mirror disks command
# used if backup_type = offline_split | online_split | offline_mirror
# | online_mirror
# no default
# split_cmd = "<split_cmd> [$]"
# resynchronize mirror disks command
# used if backup_type = offline_split | online_split | offline_mirror
# | online_mirror
# no default
# resync_cmd = "<resync_cmd> [$]"
# additional options for SPLITINT interface program
# no default
split_options = "-p /oracle/R31/920_64/dbs/initR31.fcs"
# resynchronize after backup flag [no | yes]
# default: no
split_resync = yes
.........................
# expiration period for backup volumes in days
# default: 30
expir_period = 30
# recommended usages of backup volumes
# default: 100
tape_use_count = 100
# backup utility parameter file
# default: no parameter file
util_par_file = initR31.utl
# mount/dismount command parameter file
# default: no parameter file
# mount_par_file = initR31.mnt
# Oracle instance string to the primary database
# [primary_db = <inst_str> | LOCAL]
# no default
primary_db = R31.WORLD
.........................
```

Data Protection for FlashCopy target volume file

In this section we list the target volume files for the various environments.

For ESS environment

The Data Protection for FlashCopy (mySAP-DB2 UDB) target volume file /db2/PR1/dbs/initPR1.fcs is shown in Example C-8. The syntax for Data Protection for FlashCopy (mySAP-Oracle) is the same as for mySAP-DB2 UDB, so is not shown separately.

Example: C-8 Sample Data Protection for FlashCopy (mySAP-DB2) target volume file

```
#=======================================================================#
#===                                                             5.3.1.2
#=======================================================================#
#===  This file contains setup information about source/target volumes
#===  as they will be used in a in the flascopy function.
#===
#===       The file will be pointed to by the file name specified
#===       in the VOLUMES_FILE parameter of the
#===       'Data Protection for Disk Storage and SAN VC for mySAP' profile
#===       (if standard naming convention have been used then
#===       this would be  /db2/<SID>/dbs/init<SID>.fcs)
#===
#===  It is required to embed the TARGET_VOLUMES  parameter
#===  between the topic start parameter (>>> volume_set_x)
#===  and topic end parameter (<<< volume_set_x) where x should
#===  indicate the TargetVolumeSet you would like to use.
#===  DP for FC supports only <<< volumes_set_1  unless you use
#===  an AIX LVM mirror environment. In such a case you need to add
#===  the topic volumes_set_2 for the second LVM mirror copy
#===  and in each topic the HARDWARE_ID_LVM_MIRROR with the
#===  appropriate Storage Subsystem unit.
#===
#===
#===  Example:
#===  File name      (suggested) :  init<SID>.fct
#===  Directory      (suggested) :  /db2/<SID>/dbs
#===
#===  ATT: on the parameter statement TARGET_VOLUME
#===       1st value  is   target_volume_serial_number
#===       2nd value  is   source_volume_serial_number  or  -
#===       3rd value  is   Size=2.00_GB   or  -
#===
#===       If you specify source volume serial number and size,
#===       you must ensure the target volume size is the same.
#===
#===       A target volume must be available in the same Storage
#==        subsystem as the source volume.
#=======================================================================#

>>> volumes_set_1
TARGET_VOLUME 30229927 00D29927 10737418240_Bytes
TARGET_VOLUME 20429927 10E29927 10737418240_Bytes
TARGET_VOLUME 00829927 40429927 10737418240_Bytes
TARGET_VOLUME 20229927 30A29927 10737418240_Bytes
```

```
TARGET_VOLUME 20629927 50229927 10737418240_Bytes
TARGET_VOLUME 00129927 70229927 10737418240_Bytes
TARGET_VOLUME 00429927 00929927 10737418240_Bytes
TARGET_VOLUME 30829927 10929927 10737418240_Bytes
TARGET_VOLUME 10529927 20929927 10737418240_Bytes
<<< volumes_set_1
```

In the example, the second field of TARGET_VOLUME line is the serial number of the target volume. The first 3 digits (that is, 302) of the target volume serial number is the LUN ID of the target volume and the next 5 digits (29927) are the last 5 digits of the actual serial number of ESS storage (that is, 75-29927). The third field (source volume serial number) and fourth field (source volume size) can be left as "**-**" (hyphen), which will be populated during execution of **splitint**. We have shown it after the fields are populated. You can use command **lscfg -vpl <harddisk name>** to see the serial numbers of the target volumes.

For DS environment

The sample Data Protection for FlashCopy (mySAP-DB2 UDB) target volume file for DS6000/DS8000 environment is shown in Example C-9. The syntax for Data Protection for FlashCopy (mySAP-Oracle) is the same as for mySAP-DB2, so it is not shown separately.

Example: C-9 Sample Data Protection for FlashCopy (mySAP-DB2) target volume file - DS environment

```
#=====================================================================#
#===                                                          5.3.1.2
#=====================================================================#
#===  This file contains setup information about source/target volumes
#===  as they will be used in a in the flascopy function.
#===
#===       The file will be pointed to by the file name specified
#===       in the VOLUMES_FILE parameter of the
#===       'Data Protection for Disk Storage and SAN VC for mySAP' profile
#===       (if standard naming convention have been used then
#===       this would be  /db2/<SID>/dbs/init<SID>.fcs)
#===
#===  It is required to embed the TARGET_VOLUMES  parameter
#===  between the topic start parameter (>>> volume_set_x)
#===  and topic end parameter (<<< volume_set_x) where x should
#===  indicate the TargetVolumeSet you would like to use.
#===  DP for FC supports only <<< volumes_set_1  unless you use
#===  an AIX LVM mirror environment. In such a case you need to add
#===  the topic volumes_set_2 for the second LVM mirror copy
#===  and in each topic the HARDWARE_ID_LVM_MIRROR with the
#===  appropriate Storage Subsystem unit.
#===
#===
#===  Example:
#===  File name      (suggested) :  init<SID>.fct
#===  Directory      (suggested) :  /db2/<SID>/dbs
#===
#===  ATT: on the parameter statement TARGET_VOLUME
#===       1st value  is   target_volume_serial_number
#===       2nd value  is   source_volume_serial_number  or  -
#===       3rd value  is   Size=2.00_GB   or  -
```

```
#===
#===       If you specify source volume serial number and size,
#===       you must ensure the target volume size is the same.
#===
#===       A target volume must be available in the same Storage
#==        subsystem as the source volume.
#====================================================================#


>>> volumes_set_1
TARGET_VOLUME 75924811291 7592481137D 10737418240_Bytes
TARGET_VOLUME 75924811292 7592481137E 10737418240_Bytes
TARGET_VOLUME 75924811293 7592481137F 10737418240_Bytes
TARGET_VOLUME 75924811296 75924811380 10737418240_Bytes
TARGET_VOLUME 75924811299 75924811281 10737418240_Bytes
TARGET_VOLUME 7592481138D 75924811282 10737418240_Bytes
TARGET_VOLUME 7592481138E 75924811283 10737418240_Bytes
TARGET_VOLUME 7592481138F 75924811286 10737418240_Bytes
TARGET_VOLUME 75924811390 75924811289 10737418240_Bytes
<<< volumes_set_1

>>> volumes_set_3
TARGET_VOLUME 75924811177 7592481137D 10737418240_Bytes
TARGET_VOLUME 75924811178 7592481137E 10737418240_Bytes
TARGET_VOLUME 75924811179 7592481137F 10737418240_Bytes
TARGET_VOLUME 75924811180 75924811380 10737418240_Bytes
TARGET_VOLUME 75924811181 75924811281 10737418240_Bytes
TARGET_VOLUME 75924811182 75924811282 10737418240_Bytes
TARGET_VOLUME 75924811183 75924811283 10737418240_Bytes
TARGET_VOLUME 75924811184 75924811286 10737418240_Bytes
TARGET_VOLUME 75924811294 75924811289 10737418240_Bytes
<<< volumes_set_3
```

In above example, two target sets are shown. The second field of the TARGET_VOLUME line is the target volume serial number. The first 7 digits (7592481) of the target volume serial number are the actual serial number of DS8000 or DS6000 storage server (that is, 75-92481) and the next 4 digits are the LUN ID of the target volume. The third field (source volume serial number) and fourth field (source volume size) can be left as "**-**" (hyphen), which will be populated during execution of **splitint**. We have shown it after the fields are populated. You can use the command "**lscfg -vpl <harddisk name>**" to see the serial number of the target volume.

For SVC environment

A sample Data Protection for FlashCopy (mySAP-DB2 UDB) target volume file for an SVC environment is shown in Example C-10. The syntax for Data Protection for FlashCopy (mySAP-Oracle) is the same as for mySAP-DB2, so it is not shown separately.

Example: C-10 Sample Data Protection for FlashCopy (mySAP-DB2) target volume file - SVC environment

```
#====================================================================#
#===                                                          5.3.1.2
#====================================================================#
#===  This file contains setup information about source/target volumes
```

```
#===  as they will be used in a in the FlashCopy function.
#===
#===       The file will be pointed to by the file name specified
#===       in the VOLUMES_FILE parameter of the
#===       'Data Protection for Disk Storage and SAN VC for mySAP' profile
#===       (if standard naming convention have been used then
#===       this would be  /db2/<SID>/dbs/init<SID>.fcs)
#===
#===  It is required to embed the TARGET_VOLUMES  parameter
#===  between the topic start parameter (>>> volume_set_x)
#===  and topic end parameter (<<< volume_set_x) where x should
#===  indicate the TargetVolumeSet you would like to use.
#===  DP for FC supports only <<< volumes_set_1  unless you use
#===  an AIX LVM mirror environment. In such a case you need to add
#===  the topic volumes_set_2 for the second LVM mirror copy
#===  and in each topic the HARDWARE_ID_LVM_MIRROR with the
#===  appropriate Storage Subsystem unit.
#===
#===
#===  Example:
#===  File name      (suggested) :  init<SID>.fct
#===  Directory      (suggested) :  /db2/<SID>/dbs
#===
#===  ATT: on the parameter statement TARGET_VOLUME
#===       1st value  is   target_volume_serial_number
#===       2nd value  is   source_volume_serial_number  or  -
#===       3rd value  is   Size=2.00_GB   or  -
#===
#===       If you specify source volume serial number and size,
#===       you must ensure the target volume size is the same.
#===
#===       A target volume must be available in the same Storage
#==        subsystem as the source volume.
#=====================================================================#


>>> volumes_set_1
TARGET_VOLUME PR1TGT01 PR1SRC01 10737418240_Bytes
TARGET_VOLUME PR1TGT02 PR1SRC02 10737418240_Bytes
TARGET_VOLUME PR1TGT03 PR1SRC03 10737418240_Bytes
TARGET_VOLUME PR1TGT04 PR1SRC04 10737418240_Bytes
TARGET_VOLUME PR1TGT05 PR1SRC05 10737418240_Bytes
TARGET_VOLUME PR1TGT06 PR1SRC06 10737418240_Bytes
TARGET_VOLUME PR1TGT07 PR1SRC07 10737418240_Bytes
TARGET_VOLUME PR1TGT08 PR1SRC08 10737418240_Bytes
TARGET_VOLUME PR1TGT09 PR1SRC09 10737418240_Bytes
<<< volumes_set_1
```

In above example, the second field of TARGET_VOLUME line is the target volume virtual disk name, which is made during creation of the virtual disk in SVC. The third field (source volume virtual disk name) and fourth field (source volume size) can be left as "**-**" (hyphen), which will be populated during execution of splitint. We have shown it after the fields are populated.

DB2 vendor environment file

The DB2 vendor environment file /db2/PR1/dbs/vendor.env is shown in Example C-11.

Example: C-11 Sample DB2 vendor environment file

```
XINT_PROFILE=/db2/PR1/dbs/initPR1.utl
TDP_DIR=/db2/PR1/dbs/tdplog
BACKOM_LOCATION=/usr/tivoli/tsm/tdp_r3/db264/backom
```

Sample Oracle init<SID>.ora file

The sample Oracle initR31.ora in directory /oracle/R31/920_64/dbs directory is shown in Example C-12.

Example: C-12 Sample oracle initR31.ora file

```
###########################################################
#  (c)Copyright SAP AG, Walldorf                          #
###########################################################
###########################################################
# PART I, TUNING PARAMETERS                               #
###########################################################
#### SYSTEM GLOBAL AREA BUFFERS
# Total System Global Area = sum(bytes) of all caches
# Variable Size = shared_pool_size (approx.)
# Database Buffers = db_block_buffers * db_block_size
# Redo Buffers = log_buffer
#
# unit of shared_pool_size: bytes
# unit of db_block_buffers: number of cached blocks
# unit of log_buffer: bytes
shared_pool_size = 463743221
# shared_pool_size = 63743221
# 10% of shared_pool_size
shared_pool_reserved_size = 46374322
# shared_pool_reserved_size = 30374322
log_buffer = 1048576
#### MANAGING SORTS
# A small sort requires sort_area_retained_size in
# memory. Larger sorts are allocating segments in
# PSAPTEMP. They are using sort_area_size in memory.
sort_area_retained_size = 0
sort_area_size = 2097152
# sort_spacemap_size = 512
#### PGA-PARAMETERS
open_cursors = 800
# cursor_space_for_time =  true
#### LOCKS
# dml_locks = processes * 50
dml_locks = 2500
enqueue_resources = 8000
#### CPU-PARAMETERS
# spin_count = 200
# _cpu_count = 4
```

```
#### TUNING ARCHIVING
# log_archive_buffer_size      127
# log_archive_buffers      4
#### USE VECTOR READ
# use_readv = true
#### OTHER TUNING PARAMETERS
# sequence_cache_entries = 100
# sequence_cache_hash_buckets = 89
###########################################################
# PART II, CHANGEABLE PARAMETERS                          #
###########################################################
#### CONTROL-FILES
# the controlfiles should be mirrored to every new
# database mount point @SAPDATA_HOME@/sapdata<#>
#control_files = @SAPDATA1@/cntrl/cntrlR31.dbf @SAPDATA2@/cntrl/cntrlR31.dbf
@SAPDATA3@/cntrl/cntrlR31.dbf
#### AUTOMATICLY STARTED BACKGROUND PROCESSES
log_archive_start  = true
#### MANAGING LOG SWITCHES
# checkpoints occur only when switching logs, if
# log_checkpoint_interval * size of OS blocks > size of
# the actual redo log
log_checkpoint_interval = 0
log_checkpoint_timeout = 0
#### PROCESS-PARAMETERS
# The number of allocated semaphores is equal to the
# number of processes
# sessions = 1.2 * processes
processes = 80
sessions  = 96
#### AUDITING AND STATISTICS
# sql_trace=TRUE
# audit_trail = true
# db_block_lru_extended_statistics = 1000
# db_block_lru_statistics = true
###########################################################
# PART III, STATIC PARAMETERS                             #
###########################################################
#### DB-NAME
db_name = R31
#### DB-BLOCKSIZE
db_block_size = 8192
#### DB-FILES
db_files = 254
#### OPTIMIZER MODE
optimizer_mode = choose
# optimizer_search_limit = 3
#### PATHS / DESTINATIONS / TRACES
# /oracle/R31/saptrace/background: trace files of the background
# processes
# /oracle/R31/saptrace/usertrace:  trace files of the user processes
# log_archive_dest is a destination, not a path.
# The archivefiles get the name
# /oracle/R31/oraarch/R31arch<thread#>_<log#>
background_dump_dest = /oracle/R31/saptrace/background
```

```
user_dump_dest       = /oracle/R31/saptrace/usertrace
core_dump_dest       = /oracle/R31/saptrace/background
log_archive_dest     = /oracle/R31/oraarch/R31arch
# log_archive_format  = %t_%s
#### OTHER
# reduce_alarm only supported on HP
# reduce_alarm = TRUE
#### ORACLE OPS PARAMETER
remote_login_passwordfile='EXCLUSIVE'
remote_os_authent = true
transaction_auditing = FALSE
# retention time for RMAN backup information in control file
control_file_record_keep_time = 30
#see SAP note 124361
db_file_multiblock_read_count = 8
log_checkpoints_to_alert = true
hash_join_enabled = false
#### OPTIMIZER MODE
optimizer_index_cost_adj = 10
#### AUDITING AND STATISTICS
timed_statistics = true
compatible = 9.2.0
optimizer_features_enable = 9.2.0
undo_retention = 43200
undo_tablespace = PSAPUNDO
undo_management = AUTO
pga_aggregate_target = 618324295
workarea_size_policy = AUTO
sga_max_size = 927486443
db_cache_size = 23743221
statistics_level = typical
fast_start_mttr_target = 900
control_files = (/oracle/R31/sapdata1/system_1/cntrl/cntrlR31.dbf,
/oracle/R31/sapdata2/cntrl/cntrlR31.dbf, /oracle/R31/sapdata3/cntrl/cntrlR31.dbf)
```

Oracle tnsnames.ora file

The Oracle tnsnames.ora file in the directory /oracle/R31/920_64/network/admin is shown in Example C-13.

Example: C-13 Sample Oracle tnsnames.ora file

```
################
# Filename......: tnsnames.ora
# Created.......: created by SAP AG, R/3 Rel. >= 6.10
# Name..........:
# Date..........:
################
R31.WORLD=
  (DESCRIPTION =
    (SDU = 32768)
    (ADDRESS_LIST =
        (ADDRESS =
          (COMMUNITY = SAP.WORLD)
```

```
        (PROTOCOL = TCP)
        (HOST = auntmathilda)
        (PORT = 1527)
      )
   )
   (CONNECT_DATA =
      (SID = R31)
      (GLOBAL_NAME = R31.WORLD)
   )
 )
```

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

IBM Redbooks

For information about ordering these publications, see “How to get IBM Redbooks” on page 296. Note that some of the documents referenced here may be available in softcopy only.

- *IBM Tivoli Storage Manager Implementation Guide*, SG24-5416
- *IBM Tivoli Storage Management Concepts*, SG24-4877
- *IBM System Storage DS8000 Series: Copy Services in Open Environments*, SG24-6788
- *IBM System Storage DS6000 Series: Copy Services in Open Environments*, SG24-6783
- *Using ADSM to Back Up Databases*, SG24-4335

Other publications

These publications are also relevant as further information sources:

- *Data Protection for FlashCopy Devices for mySAP Installation and User's Guide for DB2 UDB,* SC33-8208
- *Data Protection for FlashCopy Devices for mySAP Installation and User's Guide for Oracle,* SC33-8207
- *Data Protection for mySAP Installation and User's Guide for DB2 UDB*, SC33-6341
- *Data Protection for mySAP Installation and User's Guide for Oracle*, SC33-6340

Online resources

These Web sites are also relevant as further information sources:

- SVC Web page:

  http://www.ibm.com/servers/storage/software/virtualization/svc/index.html
- DS8000 Web page:

  http://www.ibm.com/servers/storage/disk/ds8000/index.html
- DS6000 Web page:

  http://www.ibm.com/servers/storage/disk/ds6000/index.html
- IBM Tivoli Storage Manager for Advanced Copy Services support page:

  http://www-1.ibm.com/support/docview.wss?rs=3043&context=SSRUS7&uid=swg21231464&l
- IBM Tivoli Storage Manager for ERP, Data Protection for mySAP support page:

  http://www-1.ibm.com/support/docview.wss?rs=667&context=SSZHVN&uid=swg21229233&lo
- SAP Cloning Web page:

  http://www.sapdb.org/7.4/htmhelp/21/692225b246b24f9202cb4433b5d691/content.htm

How to get IBM Redbooks

You can search for, view, or download Redbooks, Redpapers, Hints and Tips, draft publications and Additional materials, as well as order hardcopy Redbooks or CD-ROMs, at this Web site:

ibm.com/redbooks

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services

Index

IBM Tivoli Storage Manager for Advanced Copy Services

(0.5” spine)
0.475”<->0.873”
250 <-> 459 pages

IBM Tivoli Storage Manager for Advanced Copy Services

Near instant backup and recovery of SAP databases

Integrates with hardware copy services

Describes how to plan, install, and configure

Backing up SAP software environments is increasingly challenging in today's 24x7 enterprises. Even more challenging is restoring these environments. Applications and databases grow ever larger, putting increasing strain on the management infrastructure. Using hardware-assisted copy mechanisms to perform fast backups and restores is one way to address these issues.

Tivoli Storage Manager, along with associated products, allows you to leverage FlashCopy to perform fast backups, almost "instant" restores, as well as database cloning for testing and other purposes. These applications are fully integrated with SAP software in DB2 UDB and Oracle environments, providing reliable, intelligent techniques for data protection.

This IBM Redbook will help you plan, configure, and run IBM Tivoli Storage Manager for Advanced Copy Services and associated applications in your SAP software environments.

INTERNATIONAL TECHNICAL SUPPORT ORGANIZATION

BUILDING TECHNICAL INFORMATION BASED ON PRACTICAL EXPERIENCE

IBM Redbooks are developed by the IBM International Technical Support Organization. Experts from IBM, Customers and Partners from around the world create timely technical information based on realistic scenarios. Specific recommendations are provided to help you implement IT solutions more effectively in your environment.

For more information:
ibm.com/redbooks

SG24-7474-00 ISBN 0738494720