# Best Practices Guide for SAP Applications with IBM XIV® Storage System Advanced Features

XIV Snapshots for Backup/Restore using TSM for Advanced Copy Services & Thin Provisioning

A Best Practices Paper

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Abstract

The IBM XIV® Storage System is designed to eliminate the complexity of administration and management of tiered storage. XIV's architecture could be called *clustered* or *multi-controller based* or a *storage grid*. In fact, XIV is built from a grid of standard Intel®/Linux® components connected in an "any-to-any" network topology.

The XIV storage system uses a very unique architecture to balance data and I/O across all physical resources, like disk drives, CPUs, and memories, within the storage system. With the XIV architecture, there are advantages for complex SAP and database environments, e.g the detailed volume layout that is required for other storage systems is not necessary on the XIV system. Furthermore, the XIV system helps to deliver continuous stable IO performance and the ability to create instant snapshots without significant impact to performance for the Backup and Restore of the SAP applications.

This paper focuses on two of the XIV's system features, Snapshots and Thin Provisioning, and describes their usage and best practices in an SAP environment.

Table of Contents

1 Introduction

The IBM XIV® Storage System is a revolutionary, easily manageable, high end open disk system, designed to meet today's ongoing IT challenges.

Its design — a grid of standard Intel®/Linux® components are connected in a any-to-any topology using Gigabit Ethernet — represents the next generation of high-end SAN (Storage Area Networks) systems.

This best practices paper covers the XIV System Advantages for SAP environments. The key benefits and business values covered in this paper for deploying IBM XIV® Storage Systems are:

- Thin-provisioning - Implementing this functionality in an SAP environment will lead to significant storage resource savings. This paper describes how to use an SAP application on an Oracle database on thin-provisioned volumes of the XIV.

- Consistent Snapshots - XIV snapshots produce very little performance impact based on a redirect-on-write relation concept. This paper describes how to use TSM for Advanced Copy Services to backup and restore SAP applications with XIV snapshots.

For a full list of key benefits, please refer to the *Best Practices Guide for SAP Applications on an IBM XIV® Storage System* on the following web page:

http://w3-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101452

2 IBM XIV® Storage System logical architecture and concepts

The IBM XIV Storage System is a next-generation high-end open disk storage system. Part of IBM's broad spectrum of system storage and SAN offerings, IBM XIV is an innovative grid based storage system, utilizing off-the-shelf hardware components. The XIV system storage architecture is designed to provide the highest levels of performance, reliability, and functionality combined with unprecedented ease of management and with exceptionally low TCO. This chapter summarizes the features and benefits of the XIV system. More details about the XIV system features and benefits may be found at the following web sites:

http://www.redbooks.ibm.com/abstracts/sg247659.html?Open
http://www-03.ibm.com/systems/storage/disk/xiv/index.html

2.1 Architectural Overview

System components

The XIV Storage System is comprised of the following components shown in Figure 1: below:

- Up to 6 Host Interface Modules, each containing 12 SATA Disk Drives

- Up to 9 Data Modules, each containing 12 SATA Disk Drives

- An Uninterruptible Power Supply (UPS) module complex made up of three redundant UPS units

- Two Ethernet Switches and an Ethernet Switch Redundant Power Supply (RPS)

- A Maintenance Module

- An Automatic Transfer Switch (ATS) for external power supply redundancy

- A modem, connected to the Maintenance module for externally servicing the system
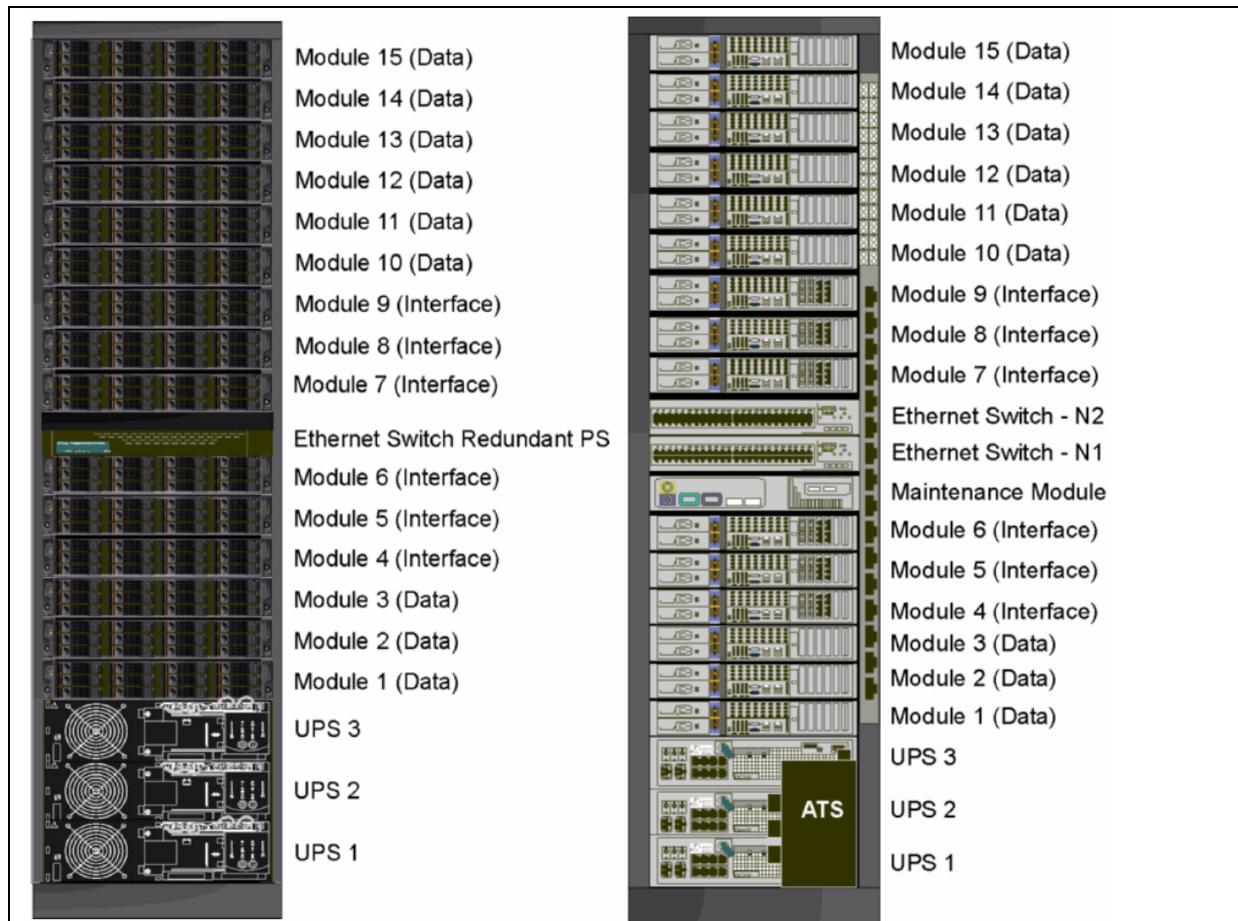
Figure 1: IBM XIV Storage System 2810-A14 components

All of the modules in the system are linked through an internal redundant Gigabit Ethernet network, which enables maximum bandwidth utilization and is resilient to at least any single component failure.

The architecture of the IBM XIV Storage System is depicted below.

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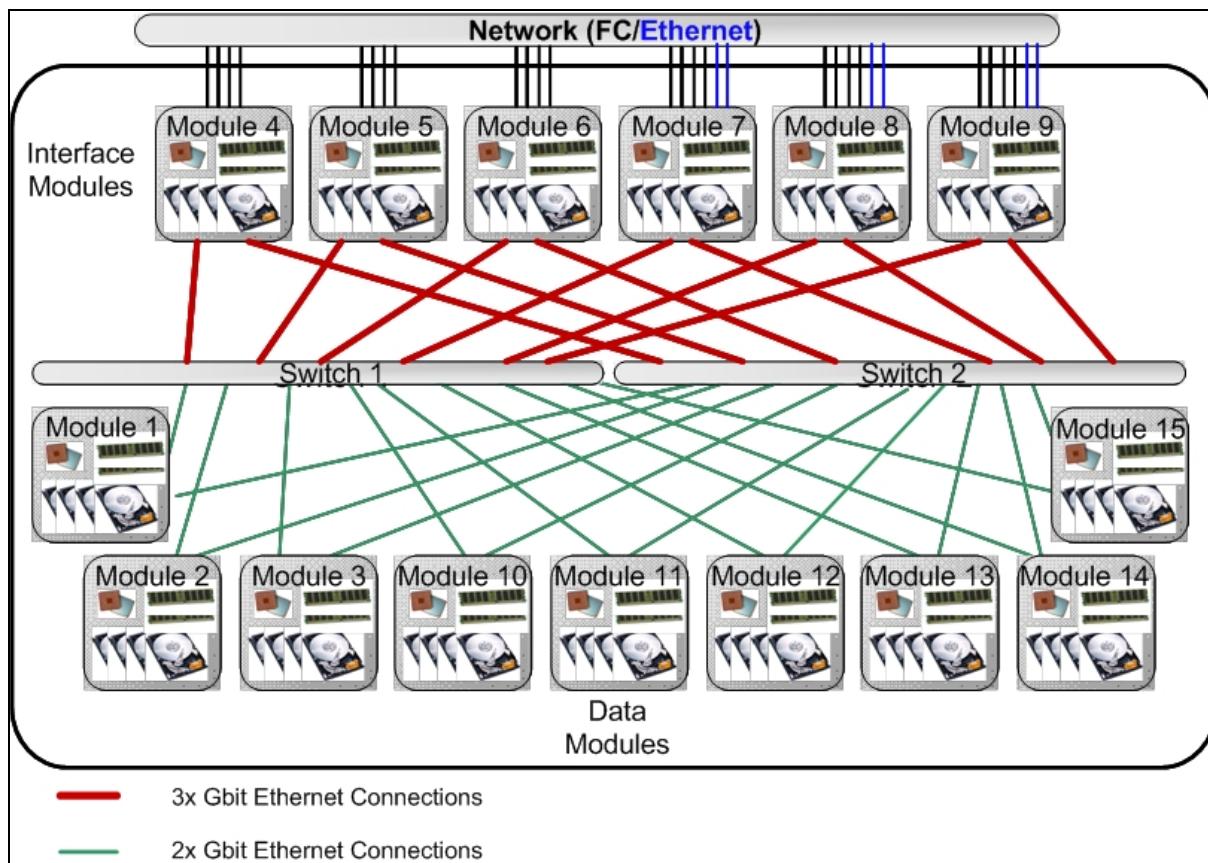
Figure 2:   Architectural Overview

Massive parallelism

The system architecture is designed to fully exploit all system components. Any I/O activity involving a specific logical volume in the system is always inherently handled by all spindles. The system harnesses all storage capacity and all internal bandwidth, and takes advantage of all available processing power. This is true for both host-initiated I/O activity as well as for system-initiated activity, such as rebuild processes and snapshot generation. All disks, CPUs, switches, and other components of the system contribute at all times.

Workload balancing

XIV is designed to evenly distribute each workload over all hardware components at all times. All disks and modules are utilized equally, regardless of access patterns. Despite the fact that applications might access certain volumes more frequently than other volumes, or access certain parts of a volume more frequently than other parts, the load on the disks and modules is optimally balanced.

Pseudo-random distribution ensures consistent load-balancing even after adding, deleting, or resizing volumes, as well as adding or removing hardware. This balancing of all data on all system components eliminates the possibility of creating hot-spots.

Caching

XIV caching management is unique, by dispersing the cache into each Data Module as opposed to a central memory cache. The distributed cache enables each Data Module to concurrently service host I/Os and cache to disk access, as opposed to the central memory caching algorithm of *traditional* storage systems, which implements memory locking algorithms that generate contention between the accesses. The distributed cache and the associated parallel processing enhance the I/O performance of the XIV storage system.

The system has a high Cache-to-Disk Bandwidth. Aggressive pre-fetching is enabled by the fact that cache-to-disk bandwidth is the internal bandwidth of a module, providing dozens of gigabytes per second for the whole system.

The cache design enables the XIV system to read a large cache slot per each disk read, while managing least-recently-used statistics in small cache slots, which increases the cache capacity usable for data. This unique combination helps contribute to the XIV system's huge processing power and high cache-to-disk bandwidth.

Near instant Self-healing

Protection against disk failure is provided by a revolutionary rebuild process that brings the system back to full redundancy in minutes. The XIV system takes self-healing to the next level: it resumes redundancy even after failures in components other than disks.

Virtualization

Unlike other system architectures, storage virtualization is inherent to the basic principles of the XIV Storage System design. Physical drives and their locations are completely hidden from the user, which dramatically simplifies storage configuration, letting the system lay out the user's volume in the optimal way. The automatic layout maximizes the system's performance by leveraging system resources for each volume, regardless of the application's access patterns.

Thin provisioning

The system enables thin provisioning, which is the capability to allocate storage to applications on a just-in-time and as needed basis, allowing significant cost savings compared to traditional provisioning techniques. The savings are achieved by defining a logical capacity that is larger than the physical capacity. This capability allows users to improve storage utilization rates, thereby significantly reducing capital and operational expenses by allocating capacity based on total space consumed, rather than total space allocated.

Snapshots

The snapshot capabilities within the XIV Storage System utilize a metadata, redirect-on-write design that allows snapshots to occur in the millisecond time range with little performance overhead. Up to 16000 full or differential copies can be taken. Any of the snapshots can be made writable, and then snapshots can be taken of the newly writable snapshots. Volumes can even be restored from these writable snapshots. In addition you may take snapshots of Consistency Groups. A Consistency Group is a group of volumes of which a snapshot can be made at the same point in time, thus ensuring a consistent image of all volumes within the group at that time.

The maximum total number of volumes, snapshots and full volume copies together at any one time is 16377.

Mirroring

The Remote Mirror function of the XIV Storage System provides a real-time copy between two or more storage systems supported over Fibre Channel (FC) or iSCSI links. This feature provides a method to protect data from site failures. Remote Mirror is a synchronous copy solution where write operations are completed on both copies before they are considered to be complete.

Asynchronous mirroring and Consistency Groups for Remote Mirroring will be available within the next major releases.

Data Migration

The XIV Storage System includes a Data Migration feature that enables the easy movement of data, from an existing storage system. This feature is supported for most major non-IBM storage systems, as well as for IBM storage systems. For a full list of supported storage systems, contact your IBM

representative. The data migration feature enables the production environment to continue functioning during the transfer of data with very little downtime for business applications. In addition, XIV supports thick-to-thin data migration, which allows the XIV Storage System to reclaim any allocated space that is written with binary zeroes. In other words, it automatically shrinks volumes upon migrating data from a non-XIV system, offering additional power and space savings.

Ease of Use

A simple and intuitive storage management GUI enables administrators to manage and monitor all system aspects easily, with practically no learning curve. The main motivation behind XIV management and its GUI design is the desire to keep the complexities of the system and its internal workings completely hidden from the user. The most important operational challenges, such as overall configuration changes, volume creation or deletion, snapshot definitions, and many more, are achieved with a few clicks. In Figure 3: the XIV GUI system view is shown.

Figure 3:   XIV GUI System View

Volume Layout

With XIV, each volume is divided into 1 MB partitions, and these partitions are distributed randomly and evenly, and duplicated for protection. The result is optimal distribution in and across all modules, which means that for any volume, the physical drive location and data placement are invisible to the user. This method dramatically simplifies storage provisioning, letting the system automatically lay out the user's volume in an optimal way.

At a high level, the data distribution scheme is an amalgam of mirroring and striping. While it is easy to think of this scheme in the context of RAID 1+0 (10) or 0+1, the low-level virtualization implementation precludes the usage of traditional RAID algorithms in the architecture. Conventional RAID

implementations cannot incorporate dynamic, intelligent, and automatic management of data placement based on knowledge of the volume layout, nor is it feasible for a traditional RAID system to span all drives in a subsystem due to the vastly unacceptable rebuild times that can result.

More details about the volume layout for SAP systems may be found at:

http://w3-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101452

Total Cost of Ownership

The XIV system offers numerous direct and indirect cost advantages:

- Power, floor space, and cooling expenses are significantly reduced due to the use of SATA drives as compared to traditional fibre channel systems.

- Ease of management greatly reduces administrator activities and related costs

- Differential snapshots, elimination of orphaned space, and thin provisioning capabilities enable data centers to use less system capacity than traditional systems to achieve the same operational goals

- Investment protection is provided by XIV's grid architecture, which scales from a minimal to maximal configuration and readily supports the ongoing integration of new emerging hardware component technologies as they become available.

2.2 Logical system concepts

The logical structure of the XIV system helps to ensure that there is optimum granularity in the mapping of logical elements to both the modules and the individual physical disks, thereby helping to guarantee an ideal distribution of data across all the physical resources. This section explains the logical "building blocks" of the XIV system.

Partitions

The fundamental "building block" of logical volumes is known as a partition. Partitions have the following characteristics:

- All partitions are 1MB (1024 KB) in size.

- A partition contains either a primary copy or secondary copy of data

- Each partition is mapped to a single physical disk.
  - This mapping is dynamically managed by the system via a proprietary pseudo-random distribution algorithm in order to preserve data redundancy and equilibrium.
  - The storage administrator has no control or knowledge of the specific mapping of partitions to drives.

- Secondary partitions are always placed onto a physical disk that does not contain the primary partition. In addition, secondary partitions are also in a module that does not contain its corresponding primary partition.

Volumes

The XIV Storage System presents logical volumes to hosts in the same manner as conventional sub-systems, however, both the granularity of logical volumes and the mapping of logical volumes to physical disks is fundamentally different.

- As discussed previously, every logical volume is comprised of 1MB (1024KB) pieces of data known as partitions.

- The physical capacity associated with a logical volume is always a multiple of 17GB (decimal). Therefore, while it is possible to present a block-designated logical volume to a host that is not a multiple of 17GB, the maximum physical space that is allocated for the volume will always be the sum of the minimum number of 17GB increments needed to meet the block-designated capacity.

Storage Pools

Storage Pools are purely logical entities that enable storage administrators to manage relationships between volumes and snapshots, and define separate capacity provisioning and snapshot requirements for separate applications and/or departments. Storage Pools are not tied in any way to specific physical resources, nor are they part of the data distribution scheme.

Snapshots

A snapshot represents a point-in-time copy of a Volume. Snapshots are governed by almost all of the principles that apply to Volumes. Unlike Volumes, snapshots incorporate dependent relationships with their source volumes, which can be either logical volumes or other snapshots. Because they are not independent entities, a given snapshot does not necessarily wholly consist of partitions that are unique to that snapshot. Conversely, a snapshot image will not share all of its partitions with its source volume if updates to the source occur after the snapshot was created.

3 Configuration and Setup

This section contains details regarding the test lab configuration and setup for the following best practices sections, covered by this paper:

- Leveraging XIV Snapshots for Backup/Restore with TSM for ACS. This section explains how to setup TSM for ACS to use XIV snapshots to backup and restore SAP applications.

-

Improve Storage Utilization with XIV Thin Provisioning. This section explains the benefits of thin-provisioning and how to use it as your database grows.

3.1 Lab Hardware and Software Configurations

Setup Chart

Figure 4: shows the hardware setup used for the best practices. The set up consists of a LPAR on a System p570 running AIX 6.1 connected via a FC switch to an IBM XIV Storage System.
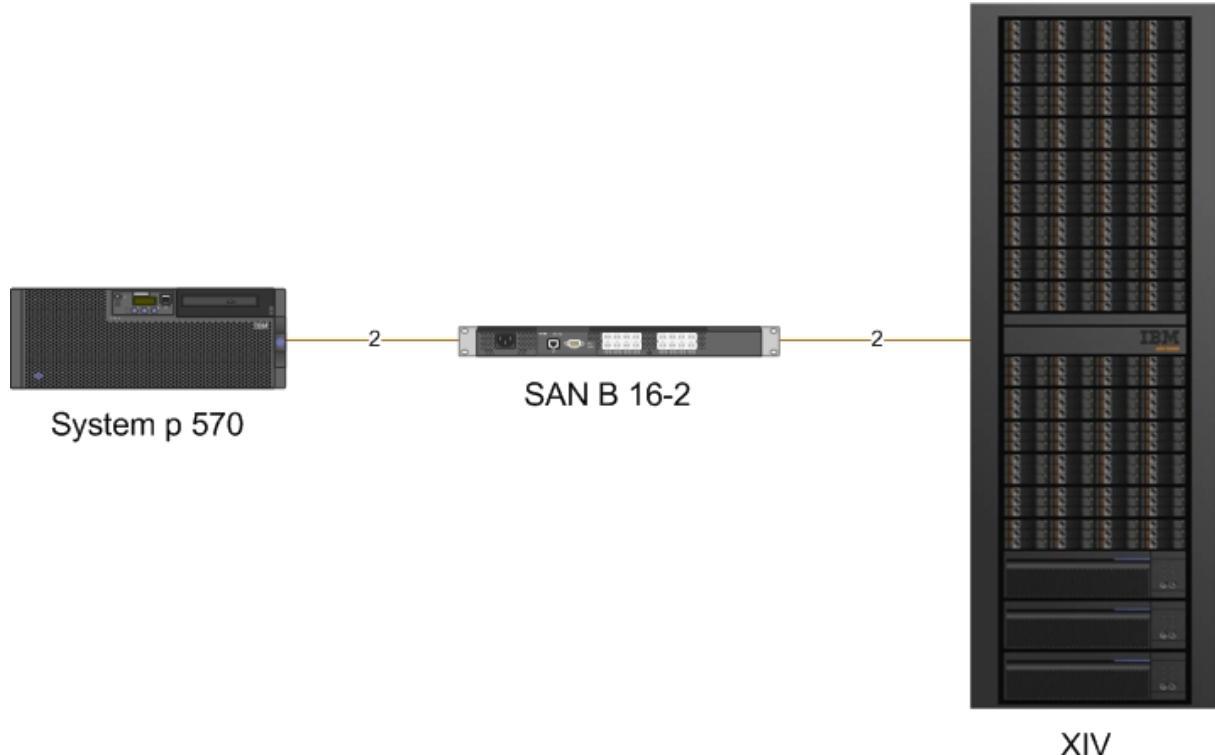

Figure 4:   Setup Chart

SAP host specification

The SAP host used for the best practices is tabulated below.

Server type	System p570
Processor	0.5 Power6 , 4.2 GHz
Memory	4 GB
HBA model	IBM FC 5758
OS	IBM AIX® 6.1
Kernel version	6100-02-02-0849
Multipath software	MPIO
HBA firmware	2.71X4
Oracle software	10.2.0.2
SAP software	NetWeaver 7.00 (2004s)
	BR*Tools 7.10
TSM for ACS/ TSM for ERP/ TSM client software	6.1

Table 2: SAP host

IBM XIV Storage System specification

Table 3 describes the XIV system used for the best practices.

Product	2810
Model	A14
Code	10.0.1.b
Storage Management / xcli	2.3.2.a build1

Table 3: IBM XIV System Storage

IBM XIV Storage System volume layouts

Table 4 shows the volume layout for the Backup and Recovery best practice. All volumes belong to one XIV Regular Storage Pool. Using one Storage Pool logically separates the SAP application from other applications utilizing the same XIV frame and helps define the capacity provisioning and snapshot requirements just for the SAP application. The storage pool definition is completely transparent to the server.

Separating volumes and volume groups for database logs and data files are a prerequisite for TSM for Advanced Copy Services, and create data consistency on the application level. This separation is not XIV specific. The prerequisites for TSM for Advanced Copy Services 6.1 may be found at the following web page:

https://w3.tap.ibm.com/w3ki07/display/ESDev/TSM%20ACS%206.1%20prerequisite%20checklist

Using four XIV volumes for sap data helps optimize the I/O distribution across 4 available FC paths and performs a static load balancing; this step is necessary due to current multi-pathing restriction on AIX. This restriction will be lifted with XIV 10.1 and XIV Host Attachment Package for AIX 1.1. For other operating systems (like Windows, Linux, Solaris, and HP-UX) using one big XIV volume for SAP data is recommended.

Volume Group on SAP host	Volume ID	Volume Name	Capacity [dec. GB]
sapdatavg	2249	p570_sapdata_1	257
	2250	p570_sapdata_2	257
	2251	p570_sapdata_3	257
	2252	p570_sapdata_4	257
saplogvg	2253	p570_origlog_mirrorlog	17
oraarchvg	2248	p570_oraarch	17
ora_sapmt_usrsa	2255	p570_oracle_sapmnt_usr_sap	51
swapvg	2254	p570_SWAP	17

Table 4: IBM XIV System Storage volume layout for Backup and Recovery

The volume layout for the thin provisioning scenarios is tabulated below. The same load balancing considerations are applied in this case as in the previous test. The volume soft capacity is the size of the logical volume that is observed by the SAP host. The volume allocated hard capacity reflects the physical space allocated to the volume following host writes to the volume, and is discretely and dynamically provisioned by the XIV. This paper describes two independent best practices, but the volumes for /oracle, /oracle/<SID>/oraarch, /sapmnt, /usr/sap, and swap space are used from the backup and recovery best practice storage pool, as the used space by these volumes is not growing significantly and therefore the volumes are not relevant in showing the benefits of thin-provisioning for databases and the handling of data growth.

Volume Group on SAP host	Volume ID	Volume Name	Volume Soft Capacity [dec. GB]	Storage Pool Name	Pool Capacity Soft/Hard [dec. GB]
thindatavg	2542	p570_thindata_1	257	SAP_on_XIV_thin	549/1099
	2543	p570_thindata_2	257	SAP_on_XIV_thin	549/1099
	2544	p570_thindata_3	257	SAP_on_XIV_thin	549/1099
	2545	p570_thindata_1	257	SAP_on_XIV_thin	549/1099
thinlogvg	2546	p570_thinlog	17	SAP_on_XIV_thin	549/1099
oraarchvg	2248	p570_oraarch	17	SAP_on_XIV	
ora_sapmt_usrsa	2255	p570_oracle_sapmnt_usr_sap	51	SAP_on_XIV	
swapvg	2254	p570_SWAP	17	SAP_on_XIV	

Table 5: IBM XIV System Storage volume layout for Thin-provisioning scenarios

Logical volume allocation on SAP host

The volume allocation on the SAP host for the Backup and Recovery scenarios is tabulated below. The physical partition size used for the Volume Groups is 32 MB.

Volume Group (VG)	Logical Volume (LV)	LV type	LV inter-physical volume allocation policy	LV size [GB]	Mount-point for the jfs2 file system
sapdatavg	sapdata1lv	jfs2	maximum	60	/oracle/SOX/sapdata1
	sapdata2lv	jfs2	maximum	410	/oracle/SOX/sapdata2
	sapdata3lv	jfs2	maximum	410	/oracle/SOX/sapdata3
	sapdata4lv	jfs2	maximum	60	/oracle/SOX/sapdata4
	loglv02	jfs2log	minimum	0.031	
saplogvg	origlogAlv	jfs2	minimum	0.22	/oracle/SOX/origlogA
	origlogBlv	jfs2	minimum	0.22	/oracle/SOX/origlogB
	mirrlogAlv	jfs2	minimum	0.22	/oracle/SOX/mirrlogA
	mirrlogBlv	jfs2	minimum	0.22	/oracle/SOX/mirrlogB
	loglv01	jfs2log	minimum	0.031	
oraarchvg	oraarchlv	Jfs2	minimum	10	/oracle/SOX/oraarch
	loglv04	jfs2log	minimum	0.031	
ora_sapmt_usrsa	oraclelv	jfs2	minimum	30	/oracle
	sapmntlv	jfs2	minimum	5	/sapmnt
	usrsaplv	jfs2	minimum	10	/usr/sap
	loglv00	jfs2log	minimum	0.031	
swapvg	paging00	paging	minimum	16	

Table 6: Logical volume allocation for Backup and Recovery scenarios

The volume allocation on the SAP host for the thin-provisioning scenarios is tabulated below. The physical partition size used for the Volume Groups is 32 MB. The file system jfs2 is used, because jfs2 supports thin provisioning (i.e. jfs does not). For thin provisioning support of other file systems on other operating systems, please refer to the operating system manuals

Volume Group (VG)	Logical Volume (LV)	LV type	LV inter-physical volume allocation policy	LV size [GB]	Mount-point for the jfs2 file system
thindatavg	thindata1lv	jfs2	maximum	60	/oracle/SOX/sapdata1
	thindata2lv	jfs2	maximum	410	/oracle/SOX/sapdata2
	thindata3lv	jfs2	maximum	410	/oracle/SOX/sapdata3
	thindata4lv	jfs2	maximum	60	/oracle/SOX/sapdata4
	loglv03	jfs2log	minimum	0.031	
saplogvg	origlogthinAlv	jfs2	minimum	0.22	/oracle/SOX/origlogA
	origlogthinBlv	jfs2	minimum	0.22	/oracle/SOX/origlogB
	mirrlogthinAlv	jfs2	minimum	0.22	/oracle/SOX/mirrlogA
	mirrlogthinBlv	jfs2	minimum	0.22	/oracle/SOX/mirrlogB
	loglv05	jfs2log	minimum	0.031	
oraarchvg	oraarchlv	Jfs2	minimum	10	/oracle/SOX/oraarch
	loglv04	jfs2log	minimum	0.031	
ora_sapmt_usrsa	oraclelv	jfs2	minimum	30	/oracle
	sapmntlv	jfs2	minimum	5	/sapmnt
	usrsaplv	jfs2	minimum	10	/usr/sap
	loglv00	jfs2log	minimum	0.031	
swapvg	paging00	paging	minimum	16	

Table 7: Logical volume allocation for thin-provisioning scenarios

4 SAP Backup/Restore options with XIV storage system

IBM/Tivoli offers a range of products for backup and restore of databases and SAP systems. Products that leverage storage system features like Snapshot or FlashCopy help to reduce the backup window and to speed up the restore process.

In the following overview of the IBM/Tivoli solution stack for the SAP backup and restore, both solution types are discussed as "pure" server-based solutions and those that integrate into the storage system features.

4.1 Tivoli Storage Manager Products

Tivoli Storage Manager (TSM) is IBM/Tivoli's central backup/restore solution for almost every operating system e.g. UNIX, LINUX, Microsoft Windows, Apple. TSM includes very powerful storage management functionality: all data are stored in storage pools, according to policies. Storage pools can be any type of disk, Optical, or tape.

Tivoli Storage Manager (TSM) for Databases provides backup and restore utilities for Microsoft SQL and Oracle databases on Windows, Linux and UNIX operating systems (e.g. AIX, HP-UX, and Solaris). Backup/restore functionality with Oracle Recovery Manager (RMAN) is included. "TSM4DB" is independent of any storage-related feature.

TSM for ERP Systems integrates SAP's Backup/Restore tools (BR*Tools) with Tivoli Store Manager. More technically, "TSM for ERP" links BR*Tools and the TSM Client leveraging SAP's "backint" interface. Without such an interface SAP's BR*Tools only support backup to and restore from disk or tape devices that are locally attached to the SAP server. Other vendors of backup/restore software offer similar "backint" implementations. "TSM for ERP" is independent of any storage-related feature.

TSM for Advanced Copy Services integrates SAP's BR*Tools with a storage system's Snapshot or FlashCopy technology. "TSM for ACS" initiates a point-in-time copy of the volumes that hold the database. The copies might be mounted on a secondary server and backed up to TSM.

TSM for ACS backup features:
- No load on production server by the backup process
- Short database backup window
- Supports disk and/or tape media
- Balancing of tape workload

TSM for ACS restore features:
- Restore from Snapshot/FlashCopy on disk or from TSM
- Database recovery starts immediately after Snapshot/Flash Restore
- Consistent process and user interface for tape/disk restore

TSM for Advanced Copy Services support for XIV is available for TSM version 6.1 and later versions.

For more details on Tivoli backup/restore solutions see http://www.ibm.com/software/tivoli/sw-atoz/indexS.html
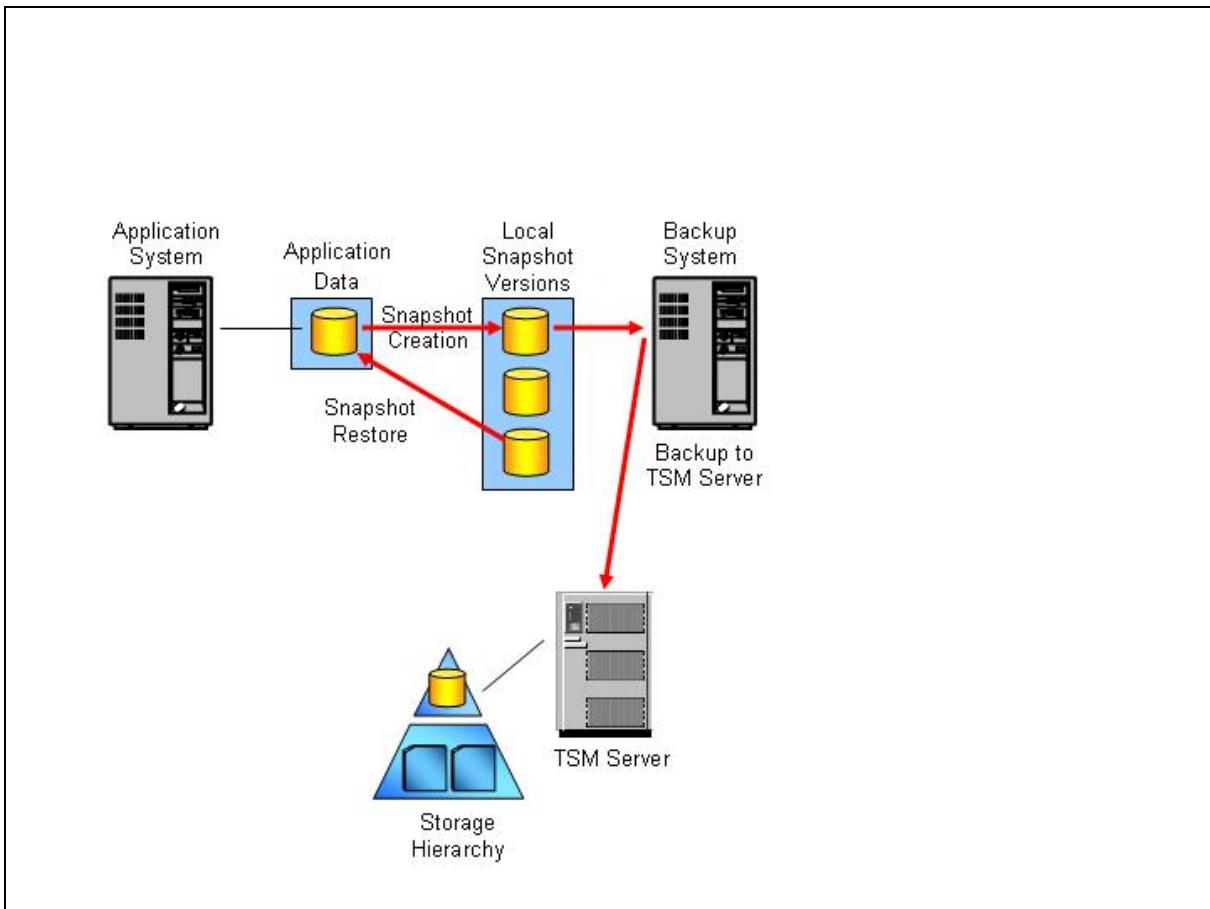
Figure 5:   *Integration of TSM backup and snapshot technology*

4.2 Data consistency

When creating a backup of the database, it is important to synchronize the data all the way to the storage devices to make sure it is consistent on the database level as well. If the data is inconsistent, a database restore will not be possible, because the log and the data are different and therefore, part of the data may be lost.

Even without an appropriate product for the backup of a SAP database (like TSM for ACS) it is possible to create a consistent snapshot of the database. Consistency must be created on several layers: database, file systems and storage. The processes to create consistency in an XIV environment are outlined below. Without consistent data you may not be able to successfully restore your SAP application data.

An XIV Consistency Group pools multiple volumes together so that a snapshot can be taken of all the volumes at the same moment in time. This action creates a consistent snapshot of all the volumes and is well-suited for applications that span multiple volumes, for example, a database application that contains the transaction logs on one set of volumes and the database on another set of volumes.

If XIV's consistency groups and snapshots are used to back up the database, database consistency can be established without shutting-down the application by following the steps in the procedure outlined below:

1. Suspend database I/O. In case of Oracle, an I/O suspend is not required if the backup mode is enabled. Oracle handles the resulting inconsistencies during database recovery

2. If the database resides in file systems, write all modified file system data back to the storage

system and thus *flush* the file systems buffers before creating the snapshots i.e. to perform a so-called "file system sync".

3. Optionally perform file system freeze/thaw operations (JFS2 only) before/after the snapshots. If "file system freezes" are omitted, file system checks will be required before mounting the file systems allocated on the snapshots copies.

4. Use snapshot-specific consistency groups.

5. Create snapshots of the data files.

6. Switch the database log file.

7. Create snapshots of the database logs..

4.3 Restore

A full database restore will require a downtime. The database must be shutdown, in case the file systems must be un-mounted and the volume groups deactivated (if file system or a volume manager are used on the operating system level).

Some databases support online restores which are possible at a filegroup (Microsoft SQL Server) or tablespace (Oracle, DB2) level. Partial restores of single tablespaces or databases files are possible with SAP databases, but combining partial restores with storage-based snapshots may require an exact mapping of tablespaces or database files with storage volumes. The creation and maintenance of such an IT infrastructure may cause immense effort and is nearly impractical. Therefore in this paper only full database restores are discussed with regard to storage-based snapshots.

Following is a high-level description of the tasks required to perform a full database restore from a storage-based snapshot. The mounting of the file systems and the recovery of the database can start immediately after issuing the restore of the XIV snapshots, there is no need to wait for the synchronization to finish:

1. Stop application and shutdown database
2. Un-mount file systems (if applicable) and deactivate volume group(s)
3. Restore the XIV snapshots
4. Activate volume groups and mount file systems
5. Recover database (complete recovery or incomplete recover to a certain point in time)
6. Start database and application

4.4 Leveraging XIV Snapshots for Backup/Restore with TSM for ACS

This section describes how to use the XIV snapshots together with TSM for ACS Data Protection for Snapshot Devices to backup and restore an SAP application. XIV snapshots use a metadata, redirect-on-write design that allows snapshots to occur in the millisecond time range with little performance overhead. Figure 6: shows the integration of TSM for ACS with XIV and TSM for ERP in an SAP environment.

Following is a step by step installation and configuration guide for TSM for ACS on XIV and TSM for ERP. These steps are not covered by the *Data Protection for Snapshot Devices Installation and User's Guide*, which may be found on the following web page:

http://publib.boulder.ibm.com/infocenter/tsminfo/v6/topic/com.ibm.itsm.acs.doc/b_dp_acs_snap_guide.pdf
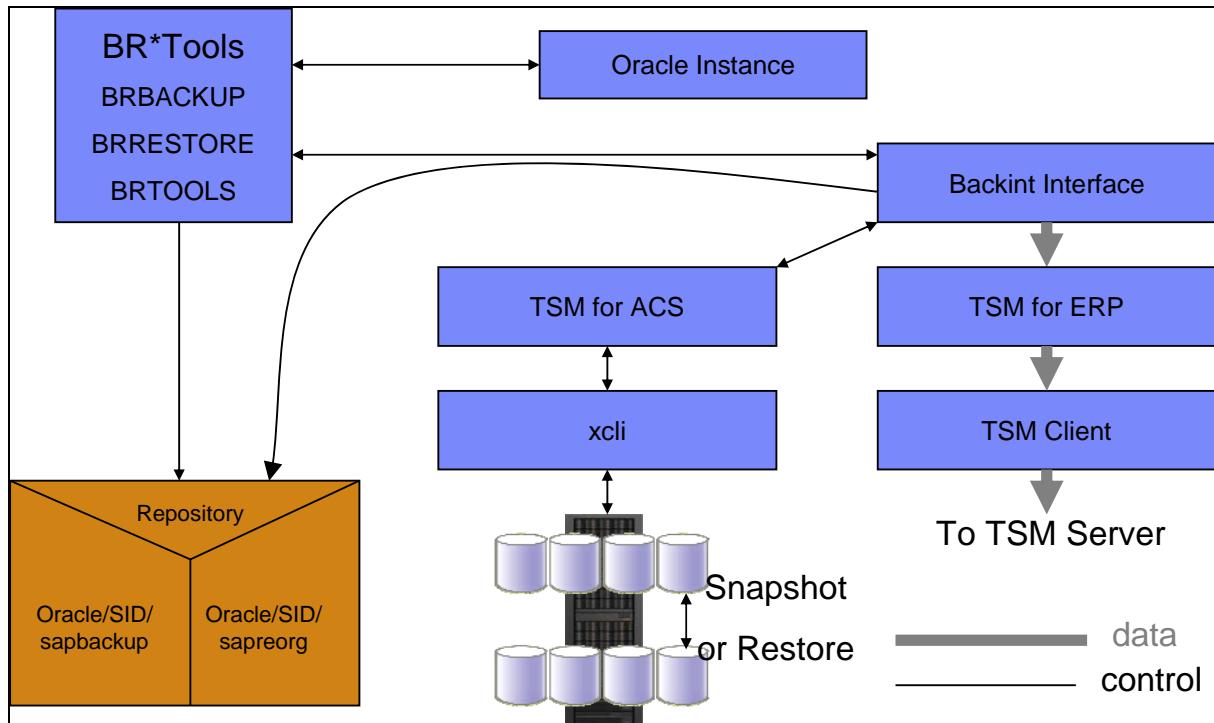
Figure 6:   Integration of TSM for ACS and TSM for ERP and Snapshots for a Backup of SAP

Installation and Configuration of TSM for Advanced Copy Services

The installation of TSM for ACS must be done on the SAP database server. The initial installation of TSM for ACS is done by executing the installer file and following the instructions of the InstallAnywhere screens. During the Installation, choose *Tivoli Data Protection for Snapshot Devices (SAP ® with Oracle)* and enter the *home directory of the instance owner*, in our case */oracle/SOX*. After TSM for ACS has been installed, a post-installation procedure must be started. This is done by executing the script *setup_sapora.sh*, which copies the configuration files to the final location and creates links to the TSM for ACS executables.

To start the *setup_sapora.sh* script the following information is required:

- the location of the profile init<SID>.utl

- the location of the ACS repository

- the location of the xcli

- one IP address of the XIV

- the xcli user and password

Here is an example of the configuration: for the password of the device section Standard and the ACS daemon, use the password for your xcli user (in this example: oracle, as shown below).

Note: Ignore the errors for acsnnas, acsnsan, and acscim, as these programs are used either for N Series or for DS8000, DS6000, and SVC.

% ./setup_sapora.sh

checking /oracle/SOX/acs/acsnnas ...

exec(): 0509-036 Cannot load program /oracle/SOX/acs/acsnnas because of the following errors:

0509-150   Dependent module libgcc_s.a(shr.o) could not be loaded.

0509-022 Cannot load module libgcc_s.a(shr.o).

0509-026 System error: A file or directory in the path name does not exist.

checking /oracle/SOX/acs/acsnsan ...

exec(): 0509-036 Cannot load program /oracle/SOX/acs/acsnsan because of the following errors:

0509-150   Dependent module libgcc_s.a(shr.o) could not be loaded.

0509-022 Cannot load module libgcc_s.a(shr.o).

0509-026 System error: A file or directory in the path name does not exist.

checking /oracle/SOX/acs/acscim ...

exec(): 0509-036 Cannot load program /oracle/SOX/acs/acscim because of the following errors:

0509-150   Dependent module libpegcommon.so could not be loaded.

0509-022 Cannot load module libpegcommon.so.

0509-026 System error: A file or directory in the path name does not exist.

checking /oracle/SOX/acs/acsxiv ...

OK

Do you want to install TSM for ACS on the production system? [Y/N]

Answer "no" if you want to install a backup server.

y

Going to install on production server

Please enter the directory where the profile will be stored: [/oracle/SOX/acs]

/oracle/SOX/acs

selected profile path: /oracle/SOX/acs

Deactivating TSM ACS management daemon.

****** Profile parameters for section GLOBAL: ******

*ACS_DIR [/oracle/SOX/acs]   **/oracle/SOX/acs***

*ACSD   [p570saplpar1 57328]   **p570saplpar1 57328***

TRACE   [NO]

****** Profile parameters for section OFFLOAD: ******

BACKUP_METHOD   [BACKINT]

*PROFILE *mandatory parameter* **/oracle/SOX/102_64/dbs/initSOX.utl***

****** Profile parameters for section ACSD: ******

*ACS_REPOSITORY   *mandatory parameter* **/oracle/SOX/acs/acsrepository***

ADMIN_ASSISTANT [NO]

REPOSITORY_LABEL   [TSM]

****** Profile parameters for section STANDARD: ******

```
COPYSERVICES_HARDWARE_TYPE     *mandatory parameter* XIV

PATH_TO_XCLI    *mandatory parameter* /opt/xiv/XIVGUI

COPYSERVICES_SERVERNAME  *mandatory parameter* 9.155.53.250

COPYSERVICES_USERNAME   [superuser]   oracle

BACKUP_HOST_NAME      [p570saplpar1]

RECON_INTERVAL   [12]

GRACE_PERIOD    [24]



============================================================


The profile has been successfully created.

Do you want to continue by specifying passwords for the defined devices? [y/n]

y

Please enter the password for device section STANDARD:


Please enter the password for authentication with the ACS daemon:


Creating password file at /oracle/SOX/acs/shared/pwd.acsd.

A copy of this file needs to be available to all components that connect to acsd.


BKI1555I: Profile successfully created. Performing additional checks. Make sure to restart all ACS components to reload the profile.

ACSD p570saplpar1 57328

Please configure the TSM for ERP profile initSOX.utl appropriately.
```

If you want to use TSM for ACS also for the DS8000, DS6000, and SVC you have to install the CIM client. In order for the CIM Client to run, (even if TSM for ACS will run in non-SSL mode), the OpenSSL rpm file must be installed. To determine if it has been installed on the system, run the following command:

> *lslpp -l |grep ssl*

If the openssl-0.9.8.XXX package (where XXX indicates the build level) is found, then OpenSSL is currently installed on the system. Otherwise OpenSSL has to be installed before installing the CIM Client.

To download OpenSSL use the link:
https://www14.software.ibm.com/webapp/iwm/web/reg/download.do?source=aixbp&S_PKG=openssl&lang=en_US

(After registering with this site, the user will be directed to the page 'AIX Web Download Pack Programs' to select the proper OpenSSL version for download)

Use the following link to download the CIM Client software:
https://www14.software.ibm.com/webapp/iwm/web/reg/download.do?source=aixpegcim&S_PKG=dl&lang=en_US

(After login to this site, the user will be directed to the page 'AIX Pegasus CIM server and providers' to select the proper version for download)

If using TSM for ACS for N Series, create the following link, before running *setup_ora.sh*:

> *ln -s /opt/freeware/lib/gcc/powerpc-ibm-aix6.1.0.0/4.2.0/libgcc_s.a /usr/lib/libgcc_s.a*

The next step is to configure the *BR*Tools* configuration profile *init<SID>.sap* and change the following parameters and values, to use snapshots for the data and log files with BR*Tools:

> *backup_mode = full*
>
> *restore_mode = full*
>
> *backup_type = online*
>
> *backup_dev_type = util_vol_online*
>
> *util_vol_unit = all_data*
>
> *util_vol_access = mount*
>
> *util_vol_nlist = no_check*
>
> *util_par_file = /oracle/SOX/102_64/dbs/initSOX.utl*

Create a symbolic link to backint (which was created during the TSM for ACS installation) in */sapmnt/<SID>/exe* and change the owner of the symbolic link, as shown in the following example:

> *ln -s /oracle/SOX/acs/backint /sapmnt/SOX/exe/backint*
> *chown -h orasox:dba /sapmnt/SOX/exe/backint*

For the backup and restore of the control file and the configuration files with *BR*Tools*, install *TSM for ERP* and the *TSM client* on the SAP system and have a connection to a TSM server.

Installation and Configuration of TSM for Enterprise Resource Planning

Install the required TSM client file sets on your SAP server, the filesets are listed below:

> *tivoli.tsm.client.api.32bit*
>
> *tivoli.tsm.client.api.64bit*
>
> *tivoli.tsm.client.ba.64bit.base*
>
> *tivoli.tsm.client.ba.64bit.common*
>
> *tivoli.tsm.client.ba.64bit.hdw*
>
> *tivoli.tsm.client.ba.64bit.image*
>
> *tivoli.tsm.client.ba.64bit.nas*
>
> *tivoli.tsm.client.ba.64bit.snphdw*
>
> *tivoli.tsm.client.ba.64bit.web*

Adapt the TSM client configuration file, so that the client will be able to perform a backup of the control file and the configuration files on the TSM server, following is an example of the *dsm.sys* and the *dsm.opt* files, located in the */usr/tivoli/tsm/client/ba/bin64*. Additionally create symbolic links in the

/usr/tivoli/tsm/client/api/bin64 for dsm.sys and *dsm.opt.*

```
bash-3.00# cat dsm.sys
**************************************************************************
* Tivoli Storage Manager                          *
*                                                 *
* Sample Client System Options file for AIX and SunOS (dsm.sys.smp)    *
**************************************************************************
*  This file contains the minimum options required to get started
*  using TSM.  Copy dsm.sys.smp to dsm.sys.  In the dsm.sys file,
*  enter the appropriate values for each option listed below and
*  remove the leading asterisk (*) for each one.


*  If your client node communicates with multiple TSM servers, be
*  sure to add a stanza, beginning with the SERVERNAME option, for
*  each additional server.


**************************************************************************


SErvername   TSM_server
  COMMMethod        TCPip
  TCPPort          1500
  TCPServeraddress   9.155.50.90
  Nodename          sapxiv
  errorlogname        /tmp/dsmerror.log


bash-3.00# cat dsm.opt
**************************************************************************
* Tivoli Storage Manager                          *
*                                                 *
* Sample Client User Options file for AIX and SunOS (dsm.opt.smp)     *
**************************************************************************


*  This file contains an option you can use to specify the TSM
*  server to contact if more than one is defined in your client
*  system options file (dsm.sys).  Copy dsm.opt.smp to dsm.opt.
*  If you enter a server name for the option below, remove the
*  leading asterisk (*).


**************************************************************************
SErvername      TSM_server
```

> *bash-3.00# cd /usr/tivoli/tsm/client/api/bin64*
>
> *bash-3.00# ln -s /usr/tivoli/tsm/client/ba/bin64/dsm.sys dsm.sys*
>
> *bash-3.00# ln -s /usr/tivoli/tsm/client/ba/bin64/dsm.opt dsm.opt*

To install TSM for ERP the following information is required:

- the Oracle SID

- connection and login information for the TSM server

- the location of the *BR*Tools*

- the location of the *init<SID>.sap*

Below is an example of the TSM for ERP installation with only the important screens shown. The Oracle SID is depicted below.
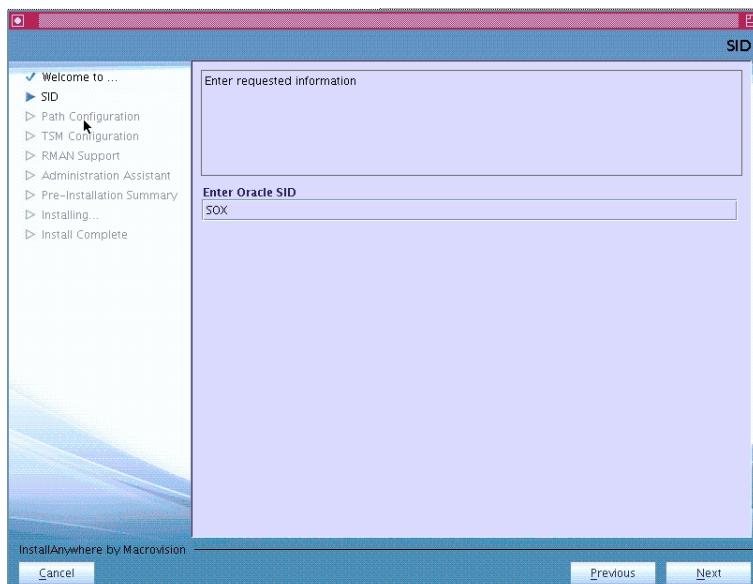
Figure 7:   TSM for ERP installation Oracle SID

The location of the init<SID>.sap and the BR*Tools is displayed below.
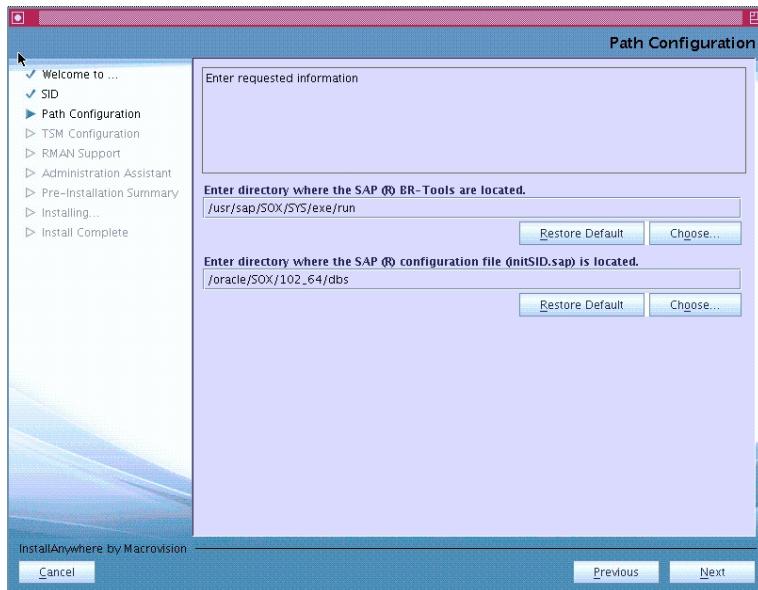
Figure 8:   TSM for ERP installation Path Configuration

The connection and login information for the TSM server is displayed below.
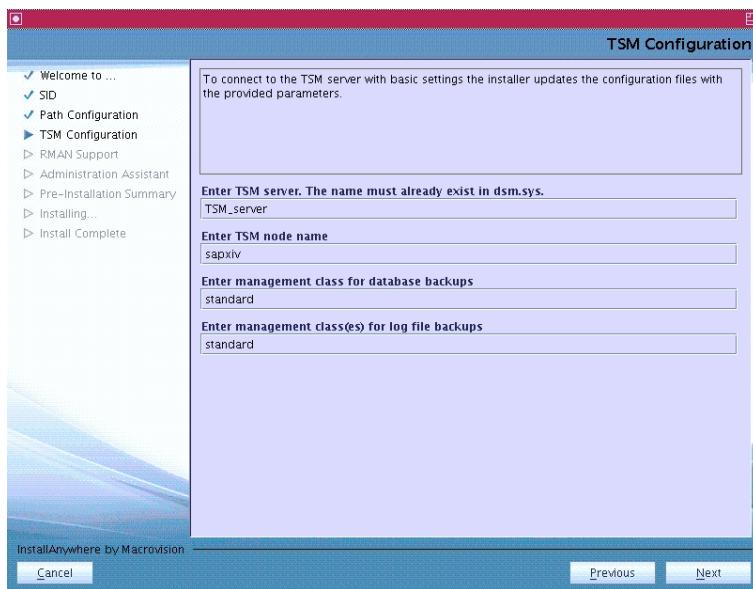
Figure 9:   *TSM for ERP installation TSM configuration*

After the installation, configure the SAP backint profile (*init<SID>.utl)* for TSM for ACS and insert the following parameters and values into the profile*:*

> *ACS_DIR /oracle/SOX/acs/*
>
> *ACSD p570saplpar1 57328*
>
> *TSM_BACKUP_FROM_SNAPSHOT NO #YES*
>
> *MAX_SNAPSHOT_VERSIONS ADAPTIVE*
>
> *DEVICE_CLASS STANDARD*
>
> *LVM_FREEZE_THAW 30*
>
> *TARGET_DATABASE_SUSPEND YES*

Managing snapshot space on the XIV System

To prevent XIV snapshots created by TSM for ACS from automatic deletion, ensure that the storage pool has enough snapshot space available. To check the available snapshot space at the XIV Storage Management GUI go to Storage Pools in the menu and view the Storage Pool used by the SAP application shown below. The snapshot space is 309 GB and the used capacity by snapshots is 17 GB. That means 292 GB left over, which is enough for the example. If the snapshot space is not enough, just a resize of the snapshot space in the Storage Pool is necessary. The resize has no impact to the SAP application or to the other volumes in the pool. The optimum size of the snapshot space depends on the size of the volumes, on the data change rate, and the number of snapshots to keep.
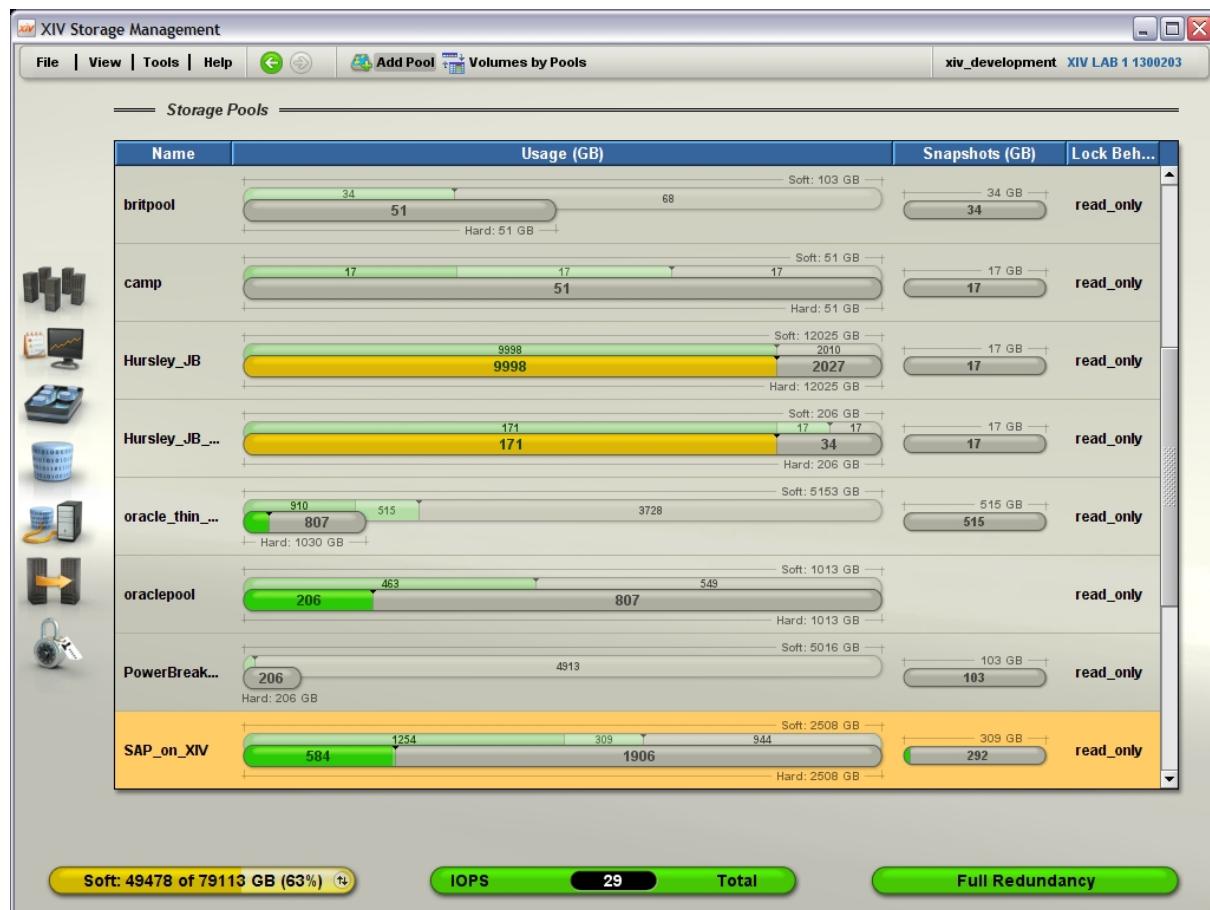
Figure 10:   Snapshot Space on Storage Pool

Backup and Restore of the SAP application

In order to create an online backup with snapshot devices set the *FILESYSTEMIO_OPTIONS* in *init<SID>.ora* to *asynch*. For more details about Oracle running on jfs2 file system refer to the following web page:

http://www-01.ibm.com/support/docview.wss?uid=swg21244385

To create an online backup, execute the *brbackup* command shown below. A listing of the detailed output is shown in Appendix A – BR*Tools Commands Output:

      % ./brbackup -c -u system/saptsm01

The XIV Snapshots of Sap data from TSM for ACS are shown below.
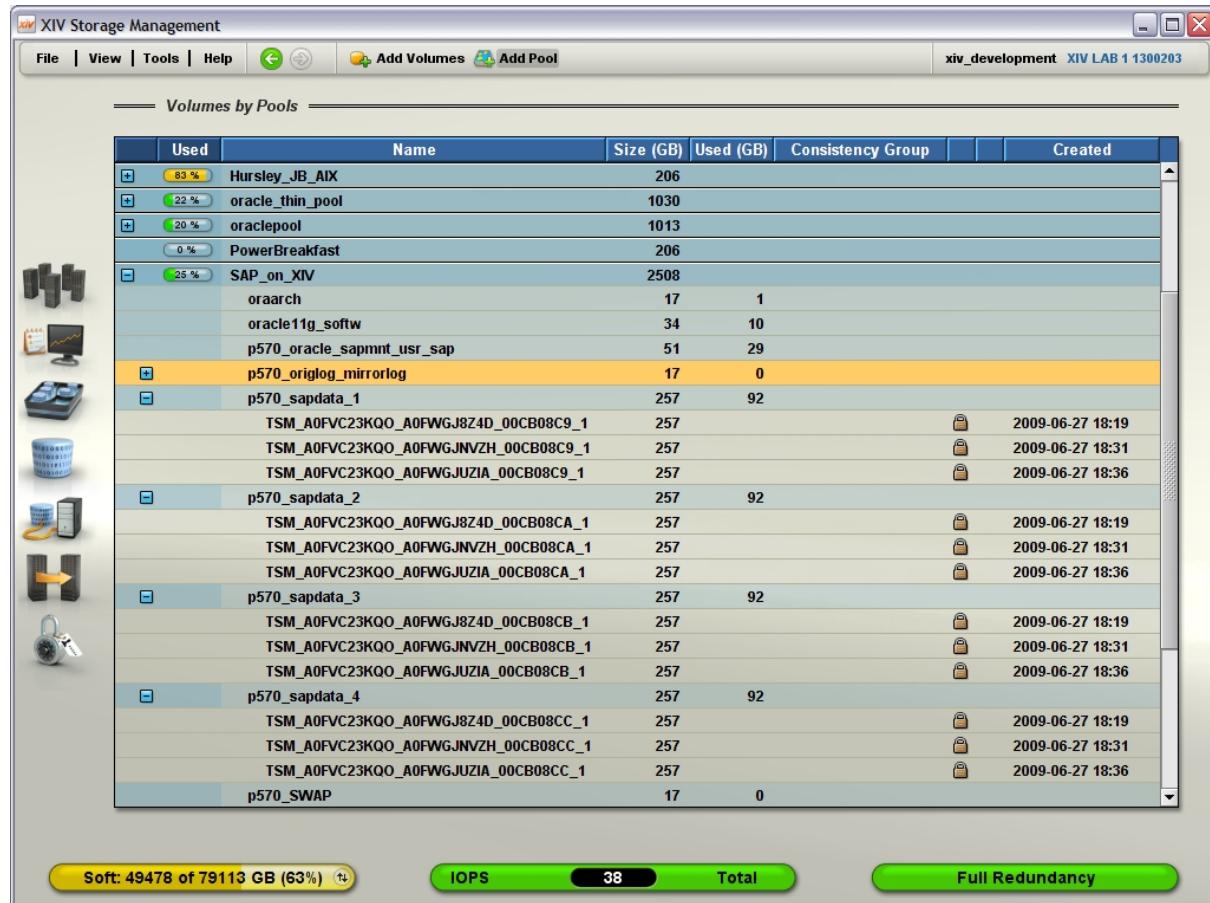
Figure 11:   Snapshots

To restore the backup from the snapshot devices shutdown the SAP instance, shutdown the database, and execute the *brrestore* command shown below. A listing of the detailed output is shown in Appendix A – BR*Tools Commands Output:

>   *% ./brrestore -d util_vol -c -u system/saptsm01*

After the restore a database recovery is necessary.

For verification and a list of the backups execute the *brtools* command shown below. A listing of the detailed output is shown in 0Appendix A – BR*Tools Commands Output:

>   *% ./brtools*

5 Provisioning Storage to SAP in the XIV environment

5.1 IBM XIV Storage System Thin Provisioning

Thin provisioning is the practice of allocating storage on a "just-in-time" and "as needed" basis by defining a logical, (or soft), capacity that is larger than the physical (or hard), capacity. This enables XIV Storage System administrators to manage capacity based on the total space actually consumed rather than just the space allocated. The benefits when using XIV Thin Provisioning are listed below:

- Less storage initially needed, only buy additional storage as needed

- Increase disk utilization of the XIV

- Reduce management tasks for Provisioning, like create new volumes or expand volumes if more space is needed for the application

- Reclaim unused space by using the XIV zero scrubbing feature

Thin provisioning on the XIV is specified at the Storage Pool level. Each thin provisioned pool has its own hard capacity (which limits the actual disk space that can be effectively consumed) and soft capacity (which limits the total logical size of volumes defined). In other words:

- Hard Pool size:
  Represents the physical storage capacity allocated to volumes and snapshots in the Storage Pool. The hard size of the Storage Pool limits the total of the hard volume sizes of all volumes in the Storage Pool and the total of all storage consumed by snapshots.

- Soft Pool size:
  This is the limit on the total soft sizes of all the volumes in the Storage Pool. The pool's soft size has no effect on snapshots

.

The hard and soft pool size for a thin-provisioned Storage Pool and the capacity consumptions for both sizes are shown below.
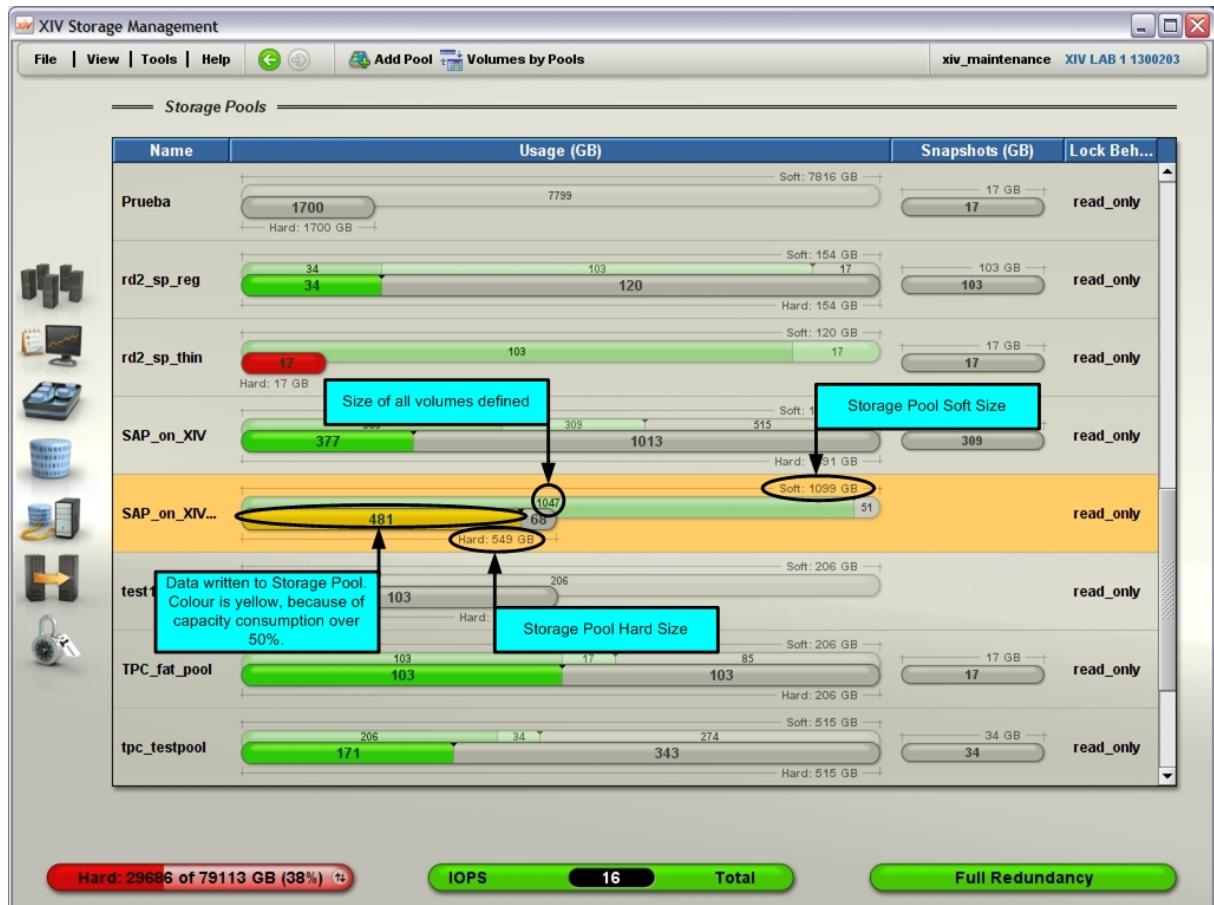
Figure 12:   Thin-provisioned Storage Pool

5.2 Improve Storage Utilization with XIV Thin Provisioning

This best practice describes how to use XIV Thin Provisioning and to manage the growth of data in a thin-provisioned Storage Pool.

As described in chapter 3.1 Lab Hardware and Software Configurations, initially the pool pre-allocated soft capacity is 1099 GB and the hard capacity is 549 GB. As depicted in Figure 13: the used capacity for the volumes is 212 GB (4* 53 GB) and the pre-allocated capacity for the volumes is 50% of 549 GB, which means 274 GB.
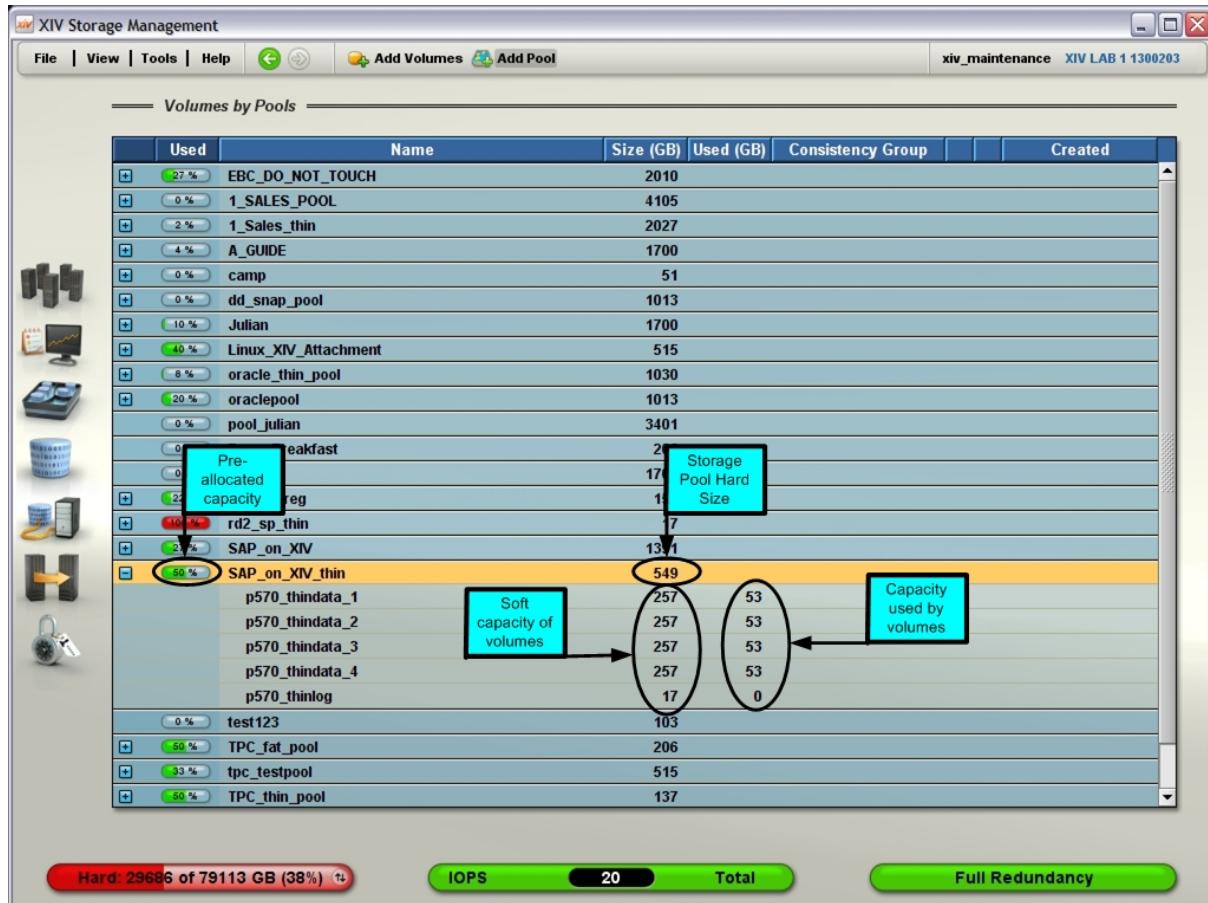
Figure 13:   Thin-provisioned Storage Pool and Volume at beginning

Increase Storage Utilization by resizing the data files

There are several ways to manage the space of the Oracle database in SAP environments, by managing either the tablespaces or data files. More details about managing the space of an Oracle DB with BR*Tools may be found at the following web site:

http://help.sap.com/saphelp_nw04/helpdata/en/42/51b3144a1211d182b80000e829fbfe/frameset.htm

The three ways to manage the data files with BR*Tools are:

1. Resize the file, usually to prevent overflow

2. Turn on the Oracle AUTOEXTEND option to avoid data file overflow.

3. Move the data file, for example, after adding new disk storage to the system and using it for existing data files.

To simulate the growth of the database and associated space allocation, the following examples are done by resizing the data files. A resize of the data files is the fastest way to increase the space utilization by the database.

The following example shows the file system usage for the sapdata file systems (command *df –g | grep sapdata*) and for the data files (command *brtools*) initally:

Filesystem   GB blocks   Free %Used   Iused %Iused Mounted on

/dev/thindata1lv   60.00   26.69 56%   14   1% /oracle/SOX/sapdata1

/dev/thindata2lv   410.00   301.94 27%   12   1% /oracle/SOX/sapdata2

/dev/thindata3lv   410.00   301.94 27%   12   1% /oracle/SOX/sapdata3

/dev/thindata4lv   60.00   48.99 19%   6   1% /oracle/SOX/sapdata4

List of database data files

Pos. Tablespace   Status Type File

Id.   Size[KB]   Device Back. AuExt. MaxSize[KB] IncrSize[KB]

1 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_1/sr3.data1

4   28311552   2621442 NO   YES   10240000   20480

2 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_2/sr3.data2

5   28311552   2621442 NO   YES   10240000   20480

3 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_3/sr3.data3

6   28311552   2621442 NO   YES   10240000   20480

4 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_4/sr3.data4

7   28311552   2621442 NO   YES   10240000   20480

5 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_1/sr3700.data1

8   28311552   2621443 NO   YES   10240000   20480

6 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_2/sr3700.data2

9   28311552   2621443 NO   YES   10240000   20480

7 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_3/sr3700.data3

10   28311552   2621443 NO   YES   10240000   20480

8 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_4/sr3700.data4

11   28311552   2621443 NO   YES   10240000   20480

9 - PSAPSR3USR   ONLINE FILE /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1

12   11534336   2621444 NO   YES   10240000   20480

10 - PSAPTEMP   ONLINE FILE /oracle/SOX/sapdata1/temp_1/temp.data1

-1   11534336   2621441 NO   YES   10240000   20480

11 - PSAPUNDO   ONLINE FILE /oracle/SOX/sapdata1/undo_1/undo.data1

2   11534336   2621441 NO   YES   10240000   20480

12 - SYSAUX   ONLINE FILE /oracle/SOX/sapdata1/sysaux_1/sysaux.data1

3   11534336   2621441 NO   YES   10240000   20480

13 - SYSTEM   SYSTEM FILE /oracle/SOX/sapdata1/system_1/system.data1

1   11534336   2621441 NO   YES   10240000   20480

Appendix A – BR*Tools Commands Output shows the detailed output of the *brtools* command to display the data files.

To resize the data files execute the *brspace* command: the syntax for the brspace command to resize a data file is shown below, the detailed command and output is depicted in Appendix A – BR*Tools Commands Output.

./brspace -f dfalter -a resize -f <data file> -s <new size>

After resizing the data files, the file system usage and the size of the data files changes to:

Filesystem   GB blocks   Free %Used   Iused %Iused Mounted on

/dev/thindata1lv   60.00   20.69 66%   14   1% /oracle/SOX/sapdata1

/dev/thindata2lv   410.00   281.94 32%   12   1% /oracle/SOX/sapdata2

/dev/thindata3lv   410.00   281.94 32%   12   1% /oracle/SOX/sapdata3

/dev/thindata4lv   60.00   27.99 54%   6   1% /oracle/SOX/sapdata4

List of database data files

Pos. Tablespace   Status Type File

Id.   Size[KB]   Device Back. AuExt. MaxSize[KB] IncrSize[KB]

1 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_1/sr3.data1

4   33553408   2621442 NO   YES   10240000   20480

2 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_2/sr3.data2

5   33553408   2621442 NO   YES   10240000   20480

3 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_3/sr3.data3

6   33553408   2621442 NO   YES   10240000   20480

4 - PSAPSR3   ONLINE FILE /oracle/SOX/sapdata2/sr3_4/sr3.data4

7   33553408   2621442 NO   YES   10240000   20480

5 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_1/sr3700.data1

8   33553408   2621443 NO   YES   10240000   20480

6 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_2/sr3700.data2

9   33553408   2621443 NO   YES   10240000   20480

7 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_3/sr3700.data3

10   33553408   2621443 NO   YES   10240000   20480

8 - PSAPSR3700   ONLINE FILE /oracle/SOX/sapdata3/sr3700_4/sr3700.data4

11   33553408   2621443 NO   YES   10240000   20480

9 - PSAPSR3USR   ONLINE FILE /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1

```
          12   33553408   2621444 NO    YES      10240000       20480

    10 - PSAPTEMP       ONLINE  FILE  /oracle/SOX/sapdata1/temp_1/temp.data1

        -1   17825792   2621441 NO    YES      10240000       20480

    11 - PSAPUNDO       ONLINE  FILE  /oracle/SOX/sapdata1/undo_1/undo.data1

         2   17825792   2621441 NO    YES      10240000       20480

    12 - SYSAUX         ONLINE  FILE  /oracle/SOX/sapdata1/sysaux_1/sysaux.data1

         3   11534336   2621441 NO    YES      10240000       20480

    13 - SYSTEM         SYSTEM  FILE  /oracle/SOX/sapdata1/system_1/system.data1

         1   11534336   2621441 NO    YES      10240000       20480
```

Increase Storage Pool Hard Capacity

The pre-allocated capacity on the Storage Pool *SAP_on XIV_thin* reaches 88%, as visible below.

Figure 14:   Thin-provisioned Storage Pool and Volume after resize of data files

In XIV's event log, view warnings whenever storage utilization has reached a predefined watermark, as shown in Figure 15: . For example a minor events warning is issued when storage utilization reaches 50%,60%,70%, 80%, and 90%, major events when 95% utilization is reached, and when 100% are utilized, IOs to the LUNs will be either blocked or enabled only for reads. To receive the events on your Management Station, define notifications via email, SMS or SNMP.
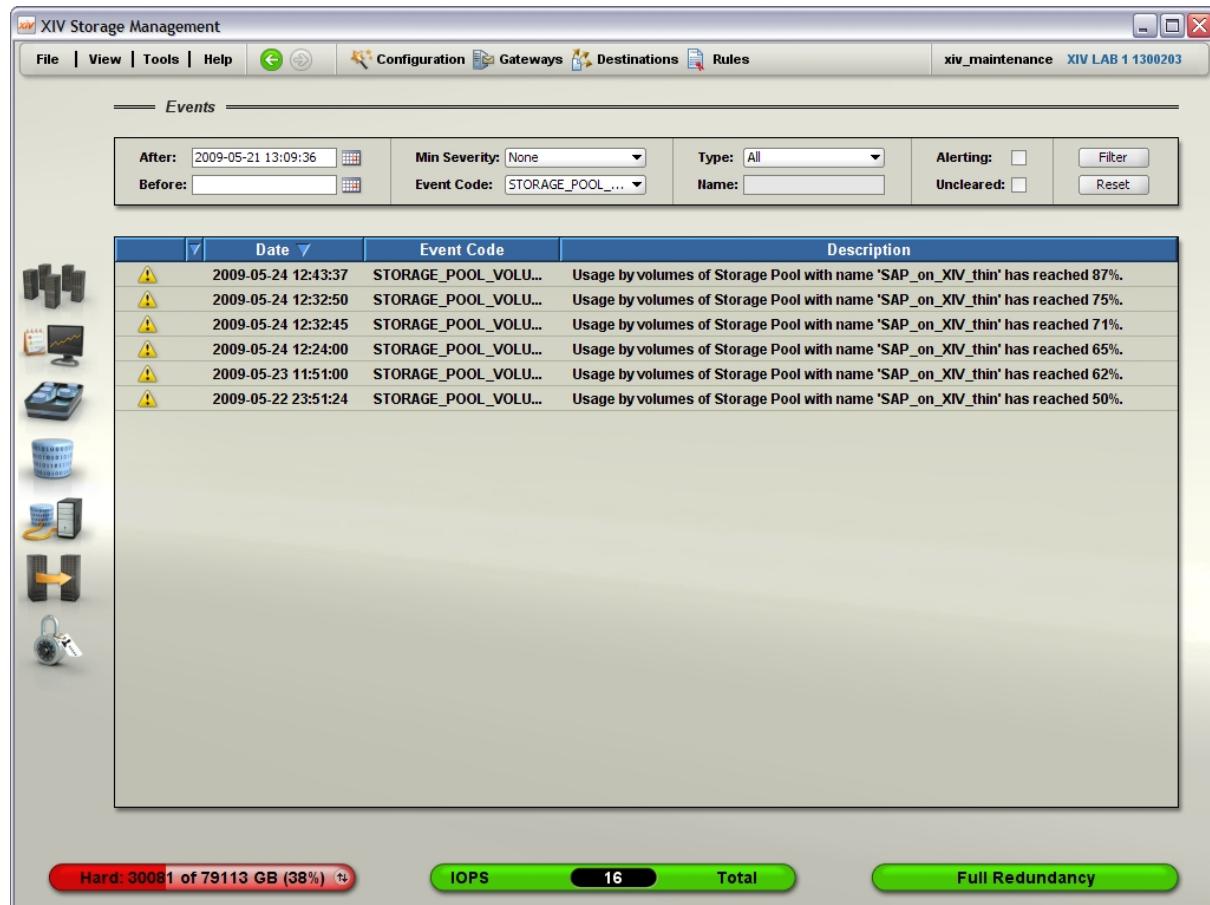
Figure 15: Event Log, Warnings for Storage Pool has reached watermarks

To prevent application down time, assuming the additional extra hard capacity is available on the array, simply add additional hard capacity to the Storage Pool. Storage Pool hard size is increased to 944 GB as shown below.
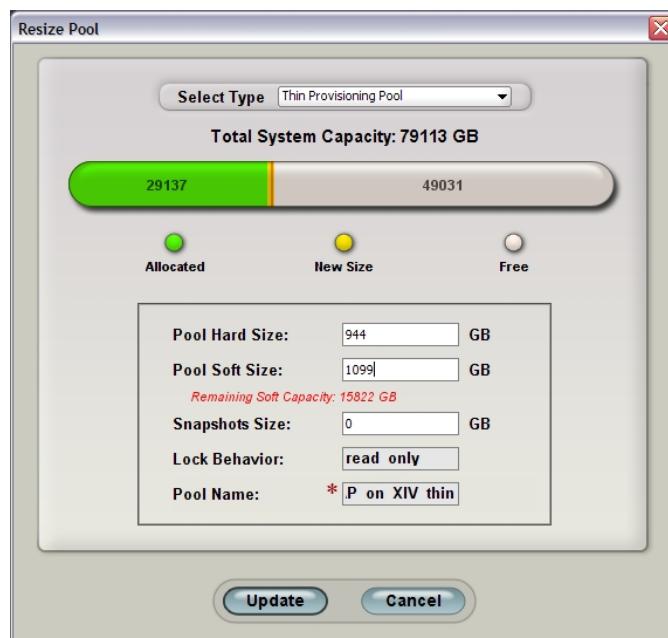
Figure 16: Adding hard capacity to Thin Provisioning Pool

 Version: 1.6 (2009-07-03)

As shown below, after the resize of the Storage Pool, the pre-allocated capacity is reduced to a lower value of 51% and the database may grow again until nearly 90% before another Storage Pool resize is necessary. The resize of the Storage Pool does not impact the SAP application.

	Used	Name	Size (GB)	Used (GB)	Consistency Group			Created
+	27 %	EBC_DO_NOT_TOUCH	2010					
+	0 %	1_SALES_POOL	4105					
+	2 %	1_Sales_thin	2027					
+	4 %	A_GUIDE	1700					
+	0 %	camp	51					
+	0 %	dd_snap_pool	1013					
+	10 %	Julian	1700					
+	40 %	Linux_XIV_Attachment	515					
+	8 %	oracle_thin_pool	1030					
+	20 %	oraclepool	1013					
	0 %	pool_julian	3401					
	0 %	PowerBreakfast	206					
	0 %	Prueba	1700					
+	22 %	rd2_sp_reg	154					
+	100 %	rd2_sp_thin	17					
+	27 %	SAP_on_XIV	1391					
−	51 %	SAP_on_XIV_thin	944					
		p570_thindata_1	257	88				
		p570_thindata_2	257	88				
		p570_thindata_3	257	88				
		p570_thindata_4	257	88				
		p570_thinlog	17	0				
	0 %	test123	103					
+	50 %	TPC_fat_pool	206					
+	33 %	tpc_testpool	515					
+	50 %	TPC_thin_pool	137					

Hard: 30081 of 79113 GB (38%)   IOPS 16 Total   Full Redundancy

Figure 17:   Thin-provisioned Storage Pool and Volume after Storage Pool resize

     Version: 1.6 (2009-07-03)

6 Summary

As demonstrated in this best practices paper, the Thin Provisioning feature of the IBM XIV Storage System helps lower management costs for storage provisioning, storage administration, and SAP database administration. Furthermore Thin Provisioning helps increase storage utilization.

The snapshot feature of the XIV together with TSM for ACS helps create easy backups of SAP applications with very short backup windows.

Appendix A – BR*Tools Commands Output

This section provides the detailed output of commands invoked by *brbackup*, *brrestore*, *brtools* and *brspace*, as well as the flow of executable activities from the respective commands.

brbackup

% ./brbackup -c -u system/saptsm01

BR0051I BRBACKUP 7.10 (22)

BR0055I Start of database backup: beawwytn.fnv 2009-06-27 18.26.19

BR0484I BRBACKUP log file: /oracle/SOX/sapbackup/beawwytn.fnv

BR1304W Checking SAP license failed at location BrLicCheck-108

BR0602W No valid SAP license found - please contact SAP

BR0280I BRBACKUP time stamp: 2009-06-27 18.26.21

BR0057I Backup of database: SOX

BR0058I BRBACKUP action ID: beawwytn

BR0059I BRBACKUP function ID: fnv

BR0110I Backup mode: FULL

BR0077I Database files for backup:

/oracle/SOX/sapdata1/temp_1/temp.data1

/oracle/SOX/sapbackup/cntrlSOX.dbf

BR0061I 14 files found for backup, total size 352256.055 MB

BR0143I Backup type: online

BR0130I Backup device type: util_vol_online

BR1501I Files will be saved by backup utility at volume level

BR0142I Files will be switched to backup status during the backup

BR0126I Unattended mode active - no operator confirmation required

BR0280I BRBACKUP time stamp: 2009-06-27 18.26.21

BR0229I Calling backup utility with function 'backup'...

BR0278I Command output of '/usr/sap/SOX/SYS/exe/run/backint -u SOX -f backup -i /oracle/SOX/sapbackup/.beawwytn.lst -t volume_online -p /oracle/SOX/102_64/dbs/initSOX.utl -n no_check -c':

Data Protection for SAP(R)

Interface between BR*Tools and Tivoli Storage Manager

- Version 6, Release 1, Modification 0.0 for AIX LF 64-bit -

Build: 358 compiled on Nov 4 2008

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Interface between BR*Tools and Tivoli Storage Manager

- Version 6, Release 1, Modification 0.0 for AIX LF 64-bit -

Build: 367P compiled on Mar 5 2009

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BKI8300I: tsmACSInitialize() returned with code 0.

BKI8300I: tsmACSBeginOperation() returned with code 0.

BKI1553I: acsd is logging to p570saplpar1:/oracle/SOX/acs/logs/acsd.20090627.log

BKI8300I: tsmACSPartition() returned with code 0.

BKI8300I: tsmACSPrepare() returned with code 0.

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.06

#BEGIN /oracle/SOX/sapdata2/sr3_1/sr3.data1

#BEGIN /oracle/SOX/sapdata2/sr3_2/sr3.data2

#BEGIN /oracle/SOX/sapdata2/sr3_3/sr3.data3

#BEGIN /oracle/SOX/sapdata2/sr3_4/sr3.data4

#BEGIN /oracle/SOX/sapdata3/sr3700_1/sr3700.data1

#BEGIN /oracle/SOX/sapdata3/sr3700_2/sr3700.data2

#BEGIN /oracle/SOX/sapdata3/sr3700_3/sr3700.data3

#BEGIN /oracle/SOX/sapdata3/sr3700_4/sr3700.data4

#BEGIN /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1

#BEGIN /oracle/SOX/sapdata1/temp_1/temp.data1

#BEGIN /oracle/SOX/sapdata1/undo_1/undo.data1

#BEGIN /oracle/SOX/sapdata1/sysaux_1/sysaux.data1

#BEGIN /oracle/SOX/sapdata1/system_1/system.data1

BR0315I 'Alter tablespace PSAPSR3 begin backup' successful

BR0315I 'Alter tablespace PSAPSR3700 begin backup' successful

BR0315I 'Alter tablespace PSAPSR3USR begin backup' successful

BR0315I 'Alter tablespace PSAPUNDO begin backup' successful

BR0315I 'Alter tablespace SYSAUX begin backup' successful

BR0315I 'Alter tablespace SYSTEM begin backup' successful

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.10

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.12

#SUSPEND DATABASE

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.12

BR0623I Database system suspended successfully

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.12

BKI8300I: tsmACSSnapshot() returned with code 0.

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.26

#RESUME DATABASE

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.26
BR0625I Database system resumed successfully
BR0280I BRCONNECT time stamp: 2009-06-27 18.28.26

BR0280I BRCONNECT time stamp: 2009-06-27 18.28.28
#END /oracle/SOX/sapdata3/sr3700_3/sr3700.data3
#END /oracle/SOX/sapdata1/temp_1/temp.data1
#END /oracle/SOX/sapdata2/sr3_1/sr3.data1
#END /oracle/SOX/sapdata1/undo_1/undo.data1
#END /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1
#END /oracle/SOX/sapdata3/sr3700_2/sr3700.data2
#END /oracle/SOX/sapdata2/sr3_3/sr3.data3
#END /oracle/SOX/sapdata1/sysaux_1/sysaux.data1
#END /oracle/SOX/sapdata2/sr3_2/sr3.data2
#END /oracle/SOX/sapdata3/sr3700_1/sr3700.data1
#END /oracle/SOX/sapdata3/sr3700_4/sr3700.data4
#END /oracle/SOX/sapdata1/system_1/system.data1
#END /oracle/SOX/sapdata2/sr3_4/sr3.data4
BR0317I 'Alter tablespace PSAPSR3 end backup' successful
BR0317I 'Alter tablespace PSAPSR3700 end backup' successful
BR0317I 'Alter tablespace PSAPSR3USR end backup' successful
BR0317I 'Alter tablespace PSAPUNDO end backup' successful
BR0317I 'Alter tablespace SYSAUX end backup' successful
BR0317I 'Alter tablespace SYSTEM end backup' successful
BR0280I BRCONNECT time stamp: 2009-06-27 18.28.28

BKI8300I: tsmACSVerify() returned with code 0.
BKI8300I: tsmACSStoreMetaData() returned with code 0.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata2/sr3_1/sr3.data1
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata2/sr3_2/sr3.data2
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata2/sr3_3/sr3.data3
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata2/sr3_4/sr3.data4
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata3/sr3700_1/sr3700.data1
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata3/sr3700_2/sr3700.data2
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata3/sr3700_3/sr3700.data3
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata3/sr3700_4/sr3700.data4
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata1/temp_1/temp.data1
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata1/undo_1/undo.data1
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata1/sysaux_1/sysaux.data1
#SAVED.... SOX___A0FWGJNVZH

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30
#FILE..... /oracle/SOX/sapdata1/system_1/system.data1
#SAVED.... SOX___A0FWGJNVZH
BKI8300I: tsmACSEndOperation() returned with code 0.
BKI8300I: tsmACSTerminate() returned with code 0.
BKI0405I: TDP waited 18 sec. for BRBACKUP in util_file_online communication.

     Version: 1.6 (2009-07-03)

BKI0020I: End of program at: Sat Jun 27 18:28:30 2009 .

BKI0021I: Elapsed time: 02 min 09 sec .

BKI0024I: Return code is: 0.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.30

BR0232I 13 of 13 files saved by backup utility

BR0230I Backup utility called successfully

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.32

BR0530I Cataloging backups of all database files...

BR0522I 12 of 12 files/save sets processed by RMAN

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.34

BR0531I Backups of all database files cataloged successfully

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.34

BR0340I Switching to next online redo log file for database instance SOX ...

BR0321I Switch to next online redo log file for database instance SOX successful

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.34

BR0319I Control file copy created: /oracle/SOX/sapbackup/cntrlSOX.dbf 9388032

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.34

BR0229I Calling backup utility with function 'backup'...

BR0278I Command output of '/usr/sap/SOX/SYS/exe/run/backint -u   SOX   -f   backup   -i /oracle/SOX/sapbackup/.beawwytn.lst -t file -p /oracle/SOX/102_64/dbs/initSOX.utl -c':

                  Data Protection for SAP(R)

        Interface between BR*Tools and Tivoli Storage Manager

      - Version 6, Release 1, Modification 0.0 for AIX LF 64-bit -

        Build: 358 compiled on Nov 4 2008

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BKI2027I: Using TSM-API version 6.1.0.0 (compiled with 5.3.0.0).

BKI2000I: Successfully connected to ProLE on port tdpr3ora64.

BKI0005I: Start of program at: Sat Jun 27 18:28:34 2009 .

 -- Parameters --

Input File   : /oracle/SOX/sapbackup/.beawwytn.lst

Profile   : /oracle/SOX/102_64/dbs/initSOX.utl

Configfile   : /oracle/SOX/102_64/dbs/initSOX.bki

Manual sorting file   : disabled

Tracefile   : disabled

Traceflags   : disabled

Parallel sessions   : 1

Multiplexed files   : 1

RL compression   : 0

Exit on error   : disabled

BATCH   : enabled

Buffer size   : 131072

Buffer Copy Mode   : SIMPLE

Redologcopies   : disabled

Versioning   : disabled

Backup Type   : file

TSM log server   : disabled

TSM server   : TSM_SERVER with 2 sessions configured, using 1 session

 TSM client node   : SAPXIV

 Days for backup   : Sun Mon Tue Wed Thu Fri Sat

 Backup mgmt class   : STANDARD

 Archiv mgmt class   : STANDARD

BKI2017I: Blocksize is set to 131072 bytes

BKI5016I: Time: 06/27/09 18:28:36 New TSM session created: MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER, type: SIMPLE

BKI0027I: Time: 06/27/09 18:28:36 Object: 1 of 1 in process: /oracle/SOX/sapbackup/cntrlSOX.dbf Size: 9168.000 KB, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:36 Done: 9168.000 KB (100.0 %) of 9168.000 KB. Estimated end time: 06/27/09 18:28:36.

BKI0053I: Time: 06/27/09 18:28:36 Object: 1 of 1 done: /oracle/SOX/sapbackup/cntrlSOX.dbf with: 9168.000 KB saved with description SOX___A0FWGJQQVS.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.36

#FILE..... /oracle/SOX/sapbackup/cntrlSOX.dbf

#SAVED.... SOX___A0FWGJQQVS

BKI1215I: Average transmission rate was 31.475 GB/h (8.953 MB/sec).

BKI1227I: Average compression factor was 1.000.

BKI0020I: End of program at: Sat Jun 27 18:28:36 2009 .

BKI0021I: Elapsed time: 02 sec .

BKI0024I: Return code is: 0.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.36

BR0232I 1 of 1 file saved by backup utility

BR0230I Backup utility called successfully

              Version: 1.6 (2009-07-03)

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.36

BR0229I Calling backup utility with function 'backup'...

BR0278I Command output of '/usr/sap/SOX/SYS/exe/run/backint -u SOX -f backup -i /oracle/SOX/sapbackup/.beawwytn.lst -t file -p /oracle/SOX/102_64/dbs/initSOX.utl -c':

Data Protection for SAP(R)

Interface between BR*Tools and Tivoli Storage Manager

- Version 6, Release 1, Modification 0.0 for AIX LF 64-bit -

Build: 358 compiled on Nov 4 2008

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BKI2027I: Using TSM-API version 6.1.0.0 (compiled with 5.3.0.0).

BKI2000I: Successfully connected to ProLE on port tdpr3ora64.

BKI0005I: Start of program at: Sat Jun 27 18:28:36 2009 .

-- Parameters --

Input File   : /oracle/SOX/sapbackup/.beawwytn.lst

Profile   : /oracle/SOX/102_64/dbs/initSOX.utl

Configfile   : /oracle/SOX/102_64/dbs/initSOX.bki

Manual sorting file   : disabled

Tracefile   : disabled

Traceflags   : disabled

Parallel sessions   : 1

Multiplexed files   : 1

RL compression   : 0

Exit on error   : disabled

BATCH   : enabled

Buffer size   : 131072

Buffer Copy Mode   : SIMPLE

Redologcopies   : disabled

Versioning   : disabled

Backup Type   : file

TSM log server   : disabled

TSM server   : TSM_SERVER with 2 sessions configured, using 1 session

TSM client node   : SAPXIV

Days for backup   : Sun Mon Tue Wed Thu Fri Sat

Backup mgmt class   : STANDARD

Archiv mgmt class   : STANDARD

BKI2017I: Blocksize is set to 131072 bytes

BKI5016I: Time: 06/27/09 18:28:38 New TSM session created: MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER, type: SIMPLE

BKI0027I: Time: 06/27/09 18:28:38 Object: 1 of 7 in process: /oracle/SOX/102_64/dbs/initSOX.sap Size: 21.258 KB, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:38 Done: 21.258 KB (27.2 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:40.

BKI0053I: Time: 06/27/09 18:28:38 Object: 1 of 7 done: /oracle/SOX/102_64/dbs/initSOX.sap with: 21.258 KB saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.38

#PFLOG.... /oracle/SOX/102_64/dbs/initSOX.sap

#SAVED.... SOX___A0FWGJQSNP

BKI0027I: Time: 06/27/09 18:28:38 Object: 2 of 7 in process: /oracle/SOX/sapbackup/beawwytn.fnv Size: 16.418 KB, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:38 Done: 37.676 KB (48.3 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:39.

BKI0053I: Time: 06/27/09 18:28:38 Object: 2 of 7 done: /oracle/SOX/sapbackup/beawwytn.fnv with: 17.930 KB saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.38

#PFLOG.... /oracle/SOX/sapbackup/beawwytn.fnv

#SAVED.... SOX___A0FWGJQSNP

BKI0027I: Time: 06/27/09 18:28:38 Object: 3 of 7 in process: /oracle/SOX/102_64/dbs/initSOX.utl Size: 14.380 KB, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:38 Done: 52.056 KB (66.7 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:38.

BKI0053I: Time: 06/27/09 18:28:38 Object: 3 of 7 done: /oracle/SOX/102_64/dbs/initSOX.utl with: 14.380 KB saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.38

#PFLOG.... /oracle/SOX/102_64/dbs/initSOX.utl

#SAVED.... SOX___A0FWGJQSNP

BKI0027I: Time: 06/27/09 18:28:38 Object: 4 of 7 in process: /oracle/SOX/sapbackup/backSOX.log Size: 12.592 KB, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:39 Done: 64.647 KB (82.8 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:39.

BKI0053I: Time: 06/27/09 18:28:39 Object: 4 of 7 done: /oracle/SOX/sapbackup/backSOX.log with: 12.592 KB saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.39

#PFLOG.... /oracle/SOX/sapbackup/backSOX.log

#SAVED.... SOX___A0FWGJQSNP

BKI0027I: Time: 06/27/09 18:28:39 Object: 5 of 7 in process: /oracle/SOX/sapreorg/strucSOX.log Size: 7482 Bytes, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:39 Done: 71.954 KB (92.2 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:39.

BKI0053I: Time: 06/27/09 18:28:39 Object: 5 of 7 done: /oracle/SOX/sapreorg/strucSOX.log with: 7482 Bytes saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.39

#PFLOG.... /oracle/SOX/sapreorg/strucSOX.log

#SAVED.... SOX___A0FWGJQSNP

BKI0027I: Time: 06/27/09 18:28:39 Object: 6 of 7 in process: /oracle/SOX/sapreorg/spaceSOX.log Size: 4277 Bytes, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:39 Done: 76.131 KB (97.6 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:39.

BKI0053I: Time: 06/27/09 18:28:39 Object: 6 of 7 done: /oracle/SOX/sapreorg/spaceSOX.log with: 4277 Bytes saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.39

#PFLOG.... /oracle/SOX/sapreorg/spaceSOX.log

#SAVED.... SOX___A0FWGJQSNP

BKI0027I: Time: 06/27/09 18:28:39 Object: 7 of 7 in process: /oracle/SOX/102_64/dbs/initSOX.ora Size: 1946 Bytes, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:28:39 Done: 78.031 KB (100.0 %) of 78.031 KB. Estimated end time: 06/27/09 18:28:39.

BKI0053I: Time: 06/27/09 18:28:39 Object: 7 of 7 done: /oracle/SOX/102_64/dbs/initSOX.ora with: 1946 Bytes saved with description SOX___A0FWGJQSNP.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.39

#PFLOG.... /oracle/SOX/102_64/dbs/initSOX.ora

#SAVED.... SOX___A0FWGJQSNP

BKI1215I: Average transmission rate was 0.136 GB/h (0.038 MB/sec).

BKI1227I: Average compression factor was 0.980.

BKI0020I: End of program at: Sat Jun 27 18:28:40 2009 .

BKI0021I: Elapsed time: 04 sec .

BKI0024I: Return code is: 0.

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.40

BR0232I 7 of 7 files saved by backup utility

BR0230I Backup utility called successfully

BR0056I End of database backup: beawwytn.fnv 2009-06-27 18.28.40

BR0280I BRBACKUP time stamp: 2009-06-27 18.28.40

BR0053I BRBACKUP completed successfully with warnings

brrestore

% ./brrestore -d util_vol -c -u system/saptsm01

BR0401I BRRESTORE 7.10 (22)

BR0405I Start of file restore: reawxbbh.rsb 2009-06-27 18.52.13

BR0484I BRRESTORE log file: /oracle/SOX/sapbackup/reawxbbh.rsb

BR0428W File /oracle/SOX/sapdata2/sr3_1/sr3.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata2/sr3_2/sr3.data2 will be overwritten

BR0428W File /oracle/SOX/sapdata2/sr3_3/sr3.data3 will be overwritten

BR0428W File /oracle/SOX/sapdata2/sr3_4/sr3.data4 will be overwritten

BR0428W File /oracle/SOX/sapdata3/sr3700_1/sr3700.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata3/sr3700_2/sr3700.data2 will be overwritten

BR0428W File /oracle/SOX/sapdata3/sr3700_3/sr3700.data3 will be overwritten

BR0428W File /oracle/SOX/sapdata3/sr3700_4/sr3700.data4 will be overwritten

BR0428W File /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata1/temp_1/temp.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata1/undo_1/undo.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata1/sysaux_1/sysaux.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata1/system_1/system.data1 will be overwritten

BR0428W File /oracle/SOX/sapdata3/cntrl/cntrlSOX.dbf will be overwritten

BR0428W File /oracle/SOX/sapdata2/cntrl/cntrlSOX.dbf will be overwritten

BR0428W File /oracle/SOX/sapdata1/cntrl/cntrlSOX.dbf will be overwritten

BR0280I BRRESTORE time stamp: 2009-06-27 18.52.13

BR0256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:

c

BR0280I BRRESTORE time stamp: 2009-06-27 18.53.21

BR0257I Your reply: 'c'

BR0259I Program execution will be continued...

BR0456I Probably the database must be recovered due to restore from online backup

BR0280I BRRESTORE time stamp: 2009-06-27 18.53.21

BR0407I Restore of database: SOX

BR0408I BRRESTORE action ID: reawxbbh

BR0409I BRRESTORE function ID: rsb

BR0449I Restore mode: FULL

BR0411I Database files for restore:

/oracle/SOX/sapdata1/temp_1/temp.data1

/oracle/SOX/sapdata3/cntrl/cntrlSOX.dbf

/oracle/SOX/sapdata2/cntrl/cntrlSOX.dbf

/oracle/SOX/sapdata1/cntrl/cntrlSOX.dbf

BR0419I Files will be restored from backup: beawwzgh.fnv 2009-06-27 18.31.51

BR0416I 14 files found to restore, total size 352256.055 MB

BR0421I Restore device type: util_vol

BR0280I BRRESTORE time stamp: 2009-06-27 18.53.21

BR0256I Enter 'c[ont]' to continue, 's[top]' to cancel BRRESTORE:

c

BR0280I BRRESTORE time stamp: 2009-06-27 18.53.40

BR0257I Your reply: 'c'

BR0259I Program execution will be continued...

BR0126I Unattended mode active - no operator confirmation required

BR0280I BRRESTORE time stamp: 2009-06-27 18.53.45

BR0229I Calling backup utility with function 'restore'...

BR0278I   Command   output   of   '/usr/sap/SOX/SYS/exe/run/backint   -u   SOX   -f   restore   -i /oracle/SOX/sapbackup/.reawxbbh.lst -t volume -p /oracle/SOX/102_64/dbs/initSOX.utl -n no_check -c':

Data Protection for SAP(R)

Interface between BR*Tools and Tivoli Storage Manager

- Version 6, Release 1, Modification 0.0 for AIX LF 64-bit -

Build: 358 compiled on Nov 4 2008

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Data Protection for SAP(R)

Interface between BR*Tools and Tivoli Storage Manager

- Version 6, Release 1, Modification 0.0 for AIX LF 64-bit -

Build: 367P compiled on Mar 5 2009

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BKI8300I: tsmACSInitialize() returned with code 0.

BKI1553I: acsd is logging to p570saplpar1:/oracle/SOX/acs/logs/acsd.20090627.log

BKI8300I: tsmACSBeginQuery() returned with code 0.

BKI8300I: tsmACSGetNextObject() returned with code 21 (More data available).

BKI8300I: tsmACSGetNextObject() returned with code 14 (End of data reached).

BKI8300I: tsmACSEndQuery() returned with code 0.

BKI8300I: tsmACSBeginOperation() returned with code 0.

BKI6233I: Restoring backup with ID SOX___A0FWGJUZIA.

BKI1553I: acsd is logging to p570saplpar1:/oracle/SOX/acs/logs/acsd.20090627.log

BKI8300I: tsmACSBeginQuery() returned with code 0.

BKI8300I: tsmACSGetNextObject() returned with code 21 (More data available).

BKI8300I: tsmACSRetrieveMetaData() returned with code 0.

BKI8300I: tsmACSGetNextObject() returned with code 14 (End of data reached).

BKI8300I: tsmACSEndQuery() returned with code 0.

BKI8300I: tsmACSSnapshot() returned with code 0.

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04

#FILE..... /oracle/SOX/sapdata2/sr3_1/sr3.data1

#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04

#FILE..... /oracle/SOX/sapdata2/sr3_2/sr3.data2

#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata2/sr3_3/sr3.data3
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata2/sr3_4/sr3.data4
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata3/sr3700_1/sr3700.data1
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata3/sr3700_2/sr3700.data2
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata3/sr3700_3/sr3700.data3
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata3/sr3700_4/sr3700.data4
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata1/temp_1/temp.data1
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata1/undo_1/undo.data1
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata1/sysaux_1/sysaux.data1
#RESTORED. SOX___A0FWGJUZIA

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.04
#FILE..... /oracle/SOX/sapdata1/system_1/system.data1

#RESTORED. SOX___A0FWGJUZIA

BKI8300I: tsmACSEndOperation() returned with code 0.

BKI8300I: tsmACSTerminate() returned with code 0.

BKI0020I: End of program at: Sat Jun 27 18:57:04 2009 .

BKI0021I: Elapsed time: 03 min 19 sec .

BKI0024I: Return code is: 1.

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.05

BR0374I 13 of 13 files restored by backup utility

BR0230I Backup utility called successfully

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.05

BR0229I Calling backup utility with function 'restore'...

BR0278I   Command   output   of   '/usr/sap/SOX/SYS/exe/run/backint   -u   SOX   -f   restore   -i
/oracle/SOX/sapbackup/.reawxbbh.lst -t file -p /oracle/SOX/102_64/dbs/initSOX.utl -c':

Data Protection for SAP(R)

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BKI2027I: Using TSM-API version 6.1.0.0 (compiled with 5.3.0.0).

BKI2000I: Successfully connected to ProLE on port tdpr3ora64.

BKI0005I: Start of program at: Sat Jun 27 18:57:05 2009 .

-- Parameters --

Input File   : /oracle/SOX/sapbackup/.reawxbbh.lst

Profile   : /oracle/SOX/102_64/dbs/initSOX.utl

Configfile   : /oracle/SOX/102_64/dbs/initSOX.bki

Manual sorting file   : disabled

Tracefile   : disabled

Traceflags   : disabled

Parallel sessions   : 1

Multiplexed files   : disabled

RL compression   : disabled

Exit on error   : disabled

BATCH   : enabled

Buffer size   : 131072

Buffer Copy Mode   : SIMPLE

Redologcopies   : disabled

Versioning   : disabled

Backup Type   : unknown

TSM log server   : disabled

TSM server   : TSM_SERVER with 2 sessions configured

TSM client node   : SAPXIV

Days for backup   : Sun Mon Tue Wed Thu Fri Sat

Backup mgmt class   : STANDARD

Archiv mgmt class   : STANDARD

BKI5016I: Time: 06/27/09 18:57:07 New TSM session created: MGMNT-CLASS: , TSM-Server: TSM_SERVER, type: SIMPLE

BKI0027I: Time: 06/27/09 18:57:07 Object: 1 of 1 in process: /oracle/SOX/sapbackup/cntrlSOX.dbf Size: 9168.000 KB, MGMNT-CLASS: STANDARD, TSM-Server: TSM_SERVER .

BKI0023I: Time: 06/27/09 18:57:07 Done: 9168.000 KB (100.0 %) of 9168.000 KB. Estimated end time: 06/27/09 18:57:07.

BKI0054I: Time: 06/27/09 18:57:07 Object: 1 of 1 done: /oracle/SOX/sapbackup/cntrlSOX.dbf with: 9168.000 KB restored with description SOX___A0FWGJXRIH .

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.07

#FILE..... /oracle/SOX/sapbackup/cntrlSOX.dbf

#RESTORED. SOX___A0FWGJXRIH

BKI1215I: Average transmission rate was 15.737 GB/h (4.476 MB/sec).

BKI0020I: End of program at: Sat Jun 27 18:57:08 2009 .

BKI0021I: Elapsed time: 03 sec .

BKI0024I: Return code is: 0.

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.08

BR0374I 1 of 1 file restored by backup utility

BR0230I Backup utility called successfully

BR0351I Restoring /oracle/SOX/sapdata3/cntrl/cntrlSOX.dbf

BR0355I from /oracle/SOX/sapbackup/cntrlSOX.dbf ...

BR0351I Restoring /oracle/SOX/sapdata2/cntrl/cntrlSOX.dbf

BR0355I from /oracle/SOX/sapbackup/cntrlSOX.dbf ...

BR0351I Restoring /oracle/SOX/sapdata1/cntrl/cntrlSOX.dbf

BR0355I from /oracle/SOX/sapbackup/cntrlSOX.dbf ...

BR0406I End of file restore: reawxbbh.rsb 2009-06-27 18.57.08

BR0280I BRRESTORE time stamp: 2009-06-27 18.57.08

BR0403I BRRESTORE completed successfully with warnings

brtools (backup verification)

```
% ./brtools
BR0651I BRTOOLS 7.10 (22)


BR0280I BRTOOLS time stamp: 2009-06-27 19.09.04
BR0656I Choice menu 1 - please make a selection
--------------------------------------------------------------------------------
BR*Tools main menu


 1 = Instance management
 2 - Space management
 3 - Segment management
 4 - Backup and database copy
 5 - Restore and recovery
 6 - Check and verification
 7 - Database statistics
 8 - Additional functions
 9 - Exit program


Standard keys: c - cont, b - back, s - stop, r - refr, h - help
--------------------------------------------------------------------------------
BR0662I Enter your choice:
4
BR0280I BRTOOLS time stamp: 2009-06-27 19.09.08
BR0663I Your choice: '4'


BR0280I BRTOOLS time stamp: 2009-06-27 19.09.08
BR0656I Choice menu 9 - please make a selection
--------------------------------------------------------------------------------
Backup and database copy


 1 = Database backup
 2 - Archivelog backup
 3 - Database copy
 4 - Non-database backup
 5 - Backup of database disk backup
 6 - Verification of database backup
 7 - Verification of archivelog backup
 8 - Additional functions
 9 - Reset program status


Standard keys: c - cont, b - back, s - stop, r - refr, h - help
--------------------------------------------------------------------------------
BR0662I Enter your choice:
```

6

BR0280I BRTOOLS time stamp: 2009-06-27 19.09.33

BR0663I Your choice: '6'

BR0699I Reading log file /oracle/SOX/sapbackup/backSOX.log ...

BR0280I BRTOOLS time stamp: 2009-06-27 19.09.33

BR0658I List menu 20 - please select one entry

BRBACKUP database backups for verification

Pos.	Log	Start	Type	Files	Device	Rc
1 =	beawwzgh.fnv	2009-06-27 18.31.51	online	13/13	util_vonl	1
2 -	beawwytn.fnv	2009-06-27 18.26.19	online	13/13	util_vonl	1
3 -	beawwxrp.ffv	2009-06-27 18.14.13	offline	13/13	util_vol	1

Standard keys: c - cont, b - back, s - stop, r - refr, h - help

----

BR0662I Enter your selection:

brtools (show data files)

% ./brtools
BR0651I BRTOOLS 7.10 (22)

BR0280I BRTOOLS time stamp: 2009-05-24 12.55.45
BR0656I Choice menu 1 - please make a selection
--
BR*Tools main menu

1 = Instance management
2 - Space management
3 - Segment management
4 - Backup and database copy
5 - Restore and recovery
6 - Check and verification
7 - Database statistics
8 - Additional functions
9 - Exit program

Standard keys: c - cont, b - back, s - stop, r - refr, h - help
--
BR0662I Enter your choice:
2
BR0280I BRTOOLS time stamp: 2009-05-24 12.55.48

BR0663I Your choice: '2'

BR0280I BRTOOLS time stamp: 2009-05-24 12.55.48

BR0656I Choice menu 5 - please make a selection

Database space management

1 = Extend tablespace

2 - Create tablespace

3 - Drop tablespace

4 - Alter tablespace

5 - Alter data file

6 - Move data file

7 - Additional space functions

8 - Reset program status

Standard keys: c - cont, b - back, s - stop, r - refr, h - help

----

BR0662I Enter your choice:

7

BR0280I BRTOOLS time stamp: 2009-05-24 12.55.52

BR0663I Your choice: '7'

BR0280I BRTOOLS time stamp: 2009-05-24 12.55.52

BR0656I Choice menu 6 - please make a selection

Additional database space functions

1 = Show tablespaces

2 - Show data files

3 - Show redolog files

4 - Show control files

5 - Show disk volumes

Standard keys: c - cont, b - back, s - stop, r - refr, h - help

----

BR0662I Enter your choice:

2

BR0280I BRTOOLS time stamp: 2009-05-24 12.55.54

BR0663I Your choice: '2'

BR0280I BRTOOLS time stamp: 2009-05-24 12.55.54

BR0657I Input menu 75 - please enter/check input values

BRSPACE options for showing database information

1 - BRSPACE profile (profile) .... [initSOX.sap]

2 - Database user/password (user) .... [/]

3 # Database instance (instance) ..... []

4 # Database parameter (parameter) ... []

5 ~ Database tablespace (tablespace) . []

6 ~ Database file (file) .... []

7 # Database owner (owner) .... []

8 # Database table (table) .... []

9 # Database index (index) .... []

10 - Create log file (log) .... [no]

11 - Confirmation mode (confirm) ...... [yes]

12 # Extended output (output) .... [no]

13 - Scrolling line count (scroll) .... [20]

14 - Message language (language) ...... [E]

15 - BRSPACE command line (command) ... [-p initSOX.sap -s 20 -l E -f dbshow -c dfinfo]

Standard keys: c - cont, b - back, s - stop, r - refr, h - help

---

BR0662I Enter your choice:

c

BR0280I BRTOOLS time stamp: 2009-05-24 12.56.02

BR0663I Your choice: 'c'

BR0259I Program execution will be continued...

BR0291I BRSPACE will be started with options '-p initSOX.sap -s 20 -l E -f dbshow -c dfinfo'

BR0280I BRTOOLS time stamp: 2009-05-24 12.56.02

BR0670I Enter 'c[ont]' to continue, 'b[ack]' to go back, 's[top]' to abort:

c

BR0280I BRTOOLS time stamp: 2009-05-24 12.56.07

BR0257I Your reply: 'c'

BR0259I Program execution will be continued...

###

BR1001I BRSPACE 7.10 (22)

BR1002I Start of BRSPACE processing: seaqkrwx.dbw 2009-05-24 12.56.07

BR1304W Checking SAP license failed at location BrLicCheck-108

BR0602W No valid SAP license found - please contact SAP

BR0101I Parameters

Name   Value

oracle_sid   SOX

oracle_home   /oracle/SOX/102_64

oracle_profile   /oracle/SOX/102_64/dbs/initSOX.ora

sapdata_home   /oracle/SOX

```
sap_profile              /oracle/SOX/102_64/dbs/initSOX.sap
space_function           dbshow
space_copy_dir            /oracle/SOX/sapreorg
scroll_lines             20
system_info               orasox/orasox p570saplpar1 AIX 1 6 00CC6DE14C00
oracle_info               SOX 10.2.0.2.0 8192 262 2776593 p570saplpar1 UTF8 UTF8 2221998327
sap_info                 700 SAPSR3 SOX TEMPLICENSE R3_ORA INITIAL
make_info                 rs6000_64 OCI_102 Apr  4 2009
command_line             /usr/sap/SOX/SYS/exe/run/brspace -p initSOX.sap -s 20 -l E -U -f dbshow -c dfinfo
```

BR0280I BRSPACE time stamp: 2009-05-24 12.56.08

BR1009I Name of database instance: SOX

BR1010I BRSPACE action ID: seaqkrwx

BR1011I BRSPACE function ID: dbw

BR1012I BRSPACE function: dbshow

BR1036I Class of information to be shown: dfinfo

BR0280I BRSPACE time stamp: 2009-05-24 12.56.08

BR0659I List menu 261 + you can select one or more entries

List of database data files


```
 Pos. Tablespace    Status  Type  File
     Id.   Size[KB]    Device  Back.  AuExt.  MaxSize[KB]  IncrSize[KB]


  1 - PSAPSR3        ONLINE  FILE  /oracle/SOX/sapdata2/sr3_1/sr3.data1
      4   33553408    2621442 NO    YES     10240000     20480
  2 - PSAPSR3        ONLINE  FILE  /oracle/SOX/sapdata2/sr3_2/sr3.data2
      5   33553408    2621442 NO    YES     10240000     20480
  3 - PSAPSR3        ONLINE  FILE  /oracle/SOX/sapdata2/sr3_3/sr3.data3
      6   33553408    2621442 NO    YES     10240000     20480
  4 - PSAPSR3        ONLINE  FILE  /oracle/SOX/sapdata2/sr3_4/sr3.data4
      7   33553408    2621442 NO    YES     10240000     20480
  5 - PSAPSR3700     ONLINE  FILE  /oracle/SOX/sapdata3/sr3700_1/sr3700.data1
      8   33553408    2621443 NO    YES     10240000     20480
  6 - PSAPSR3700     ONLINE  FILE  /oracle/SOX/sapdata3/sr3700_2/sr3700.data2
      9   33553408    2621443 NO    YES     10240000     20480
  7 - PSAPSR3700     ONLINE  FILE  /oracle/SOX/sapdata3/sr3700_3/sr3700.data3
     10   33553408    2621443 NO    YES     10240000     20480
  8 - PSAPSR3700     ONLINE  FILE  /oracle/SOX/sapdata3/sr3700_4/sr3700.data4
     11   33553408    2621443 NO    YES     10240000     20480
  9 - PSAPSR3USR     ONLINE  FILE  /oracle/SOX/sapdata4/sr3usr_1/sr3usr.data1
     12   33553408    2621444 NO    YES     10240000     20480
 10 - PSAPTEMP       ONLINE  FILE  /oracle/SOX/sapdata1/temp_1/temp.data1
     -1   17825792    2621441 NO    YES     10240000     20480
 11 - PSAPUNDO       ONLINE  FILE  /oracle/SOX/sapdata1/undo_1/undo.data1
      2   17825792    2621441 NO    YES     10240000     20480
```

12 - SYSAUX   ONLINE FILE /oracle/SOX/sapdata1/sysaux_1/sysaux.data1

* 3   11534336   2621441 NO   YES   10240000   20480*

13 - SYSTEM   SYSTEM FILE /oracle/SOX/sapdata1/system_1/system.data1

* 1   11534336   2621441 NO   YES   10240000   20480*

Standard keys: c - cont, b - back, s - stop, r - refr, h - help

---

brspace

% ./brspace -f dfalter -a resize -f /oracle/SOX/sapdata2/sr3_2/sr3.data2 -s 32767

BR1001I BRSPACE 7.10 (22)

BR1002I Start of BRSPACE processing: seaqknpp.dfa 2009-05-24 12.07.53

BR0484I BRSPACE log file: /oracle/SOX/sapreorg/seaqknpp.dfa

BR1304W Checking SAP license failed at location BrLicCheck-108

BR0602W No valid SAP license found - please contact SAP

BR0280I BRSPACE time stamp: 2009-05-24 12.07.54

BR1009I Name of database instance: SOX

BR1010I BRSPACE action ID: seaqknpp

BR1011I BRSPACE function ID: dfa

BR1012I BRSPACE function: dfalter

BR0280I BRSPACE time stamp: 2009-05-24 12.07.55

BR0657I Input menu 316 - please enter/check input values

Options for alter of data file /oracle/SOX/sapdata2/sr3_2/sr3.data2

*1 * Current data file status (status) .... [AUTOEXTEND]*

*2 * Current data file size in MB (currsize) . [27648]*

*3 * Alter data file action (action) .... [resize]*

4 # Maximum file size in MB (maxsize) .... [10000]

5 # File increment size in MB (incrsize) .... [20]

6 - New data file size in MB (size) .... [32767]

7 # New data file name (name) .... []

8 # Force data file alter (force) .... [no]

9 - SQL command (command) .... [alter database datafile '/oracle/SOX/sapdata2/sr3_2/sr3.data2' resize 32767M]

Standard keys: c - cont, b - back, s - stop, r - refr, h - help

---

BR0662I Enter your choice:

c

BR0280I BRSPACE time stamp: 2009-05-24 12.08.05

BR0663I Your choice: 'c'

BR0259I Program execution will be continued...

BR0280I BRSPACE time stamp: 2009-05-24 12.08.05

BR0370I Directory /oracle/SOX/sapreorg/seaqknpp created

             Version: 1.6 (2009-07-03)

BR0280I BRSPACE time stamp: 2009-05-24 12.08.05

BR0319I Control file copy created: /oracle/SOX/sapreorg/seaqknpp/cntrlSOX.old 9388032

BR0280I BRSPACE time stamp: 2009-05-24 12.09.39

BR1016I SQL statement 'alter database datafile '/oracle/SOX/sapdata2/sr3_2/sr3.data2' resize 32767M' executed successfully

BR1079I The size of data file /oracle/SOX/sapdata2/sr3_2/sr3.data2 altered successfully from 27648 MB to 32767 MB

BR0280I BRSPACE time stamp: 2009-05-24 12.09.39

BR0340I Switching to next online redo log file for database instance SOX ...

BR0321I Switch to next online redo log file for database instance SOX successful

BR0280I BRSPACE time stamp: 2009-05-24 12.09.39

BR0319I Control file copy created: /oracle/SOX/sapreorg/seaqknpp/cntrlSOX.new 9388032

BR0280I BRSPACE time stamp: 2009-05-24 12.09.39

BR0670I Enter 'c[ont]' to continue, 'b[ack]' to go back, 's[top]' to abort:

c

BR0280I BRSPACE time stamp: 2009-05-24 12.10.34

BR0257I Your reply: 'c'

BR0259I Program execution will be continued...

BR0280I BRSPACE time stamp: 2009-05-24 12.10.34

BR1021I Number of files processed: 1

BR1003I BRSPACE function 'dfalter' completed

BR1008I End of BRSPACE processing: seaqknpp.dfa 2009-05-24 12.10.34

BR0280I BRSPACE time stamp: 2009-05-24 12.10.34

BR1006I BRSPACE completed successfully with warnings