# HP recommended configuration for SAP Backup and Recovery using HP StoreOnce Backup

With SAP ERP6 and Oracle 11gR2 database, HP 3PAR StoreServ Storage, HP StoreEver and HP Data Protector

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Executive summary

SAP Business Suite applications are critical for all organizations running on SAP. Data protection for SAP applications is essential to ensure business continuity. In general, these organizations witness high data growth rates and backup administrators are challenged with ensuring successful backups of large volumes of data within shrinking backup windows. Problems arise when backup resources do not meet current demands and when improper settings trigger resource limitations. By understanding these concerns, IT can stabilize and optimize the infrastructure to build the best data protection solution.

SAP Business Suite is a suite of Enterprise Applications which requires a consistent landscape backup. SAP Landscapes generally consist of DEV (Development), QAS (Quality Assurance) and PROD (Production) instances. The common needs related to backup and restore in an SAP landscape are:

- Meeting the backup window with the ever-growing amount of SAP data
- Shrinking the restore time from hours to minutes
- Implementing consistent point-in-time copy of the SAP landscape with minimal or no downtime

This white paper addresses the above needs and how HP Data Protector 8.10 features integrated for SAP with Oracle database help customers overcome the data protection challenges in an SAP environment. There is no one-size-fits-all solution with data protection and therefore the protection should be treated as a continuum. This white paper provides the procedure on how to use Zero Downtime Backup (ZDB) and Instant Recovery (IR) in an Oracle instance to restore it to any point-in-time or to the latest point-in-time to shorten Recovery Time Objectives (RTO) and accelerate recovery.

The white paper also provides guidance on designing and configuring SAP backups with HP StoreOnce Backup system to improve storage efficiency and increase recovery points with a disk deduplication solution. The integration of HP StoreEver tape provides an economically viable solution for long term retention of SAP backups to meet compliance and regulatory requirements.

Target audience: This document is intended for solution architects, project managers, database and system administrators, and experienced users who wish to learn more about the capabilities of HP Data Protector 8.10 and how it can be used to integrate SAP R/3 and Oracle 11gR2 Backup and Recovery with HP StoreOnce Backup. Knowledge of the underlying storage and server components will be helpful when reading this white paper. The user should also have a good understanding of SAP and Oracle 11gR2 database. Please refer to the For more information section for links to additional information on these topics.

Document purpose: This paper showcases HP Data Protector integration with HP StoreOnce and HP 3PAR StoreServ and how it can be leveraged for SAP backups. It also highlights HP Data Protector features such as Zero Downtime Backup and Instant Recovery for SAP/Oracle environments.

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Introduction

The growing requirement of data protection and security for mission-critical applications, together with the increasing sophistication of Storage Area Network (SAN) environments, has resulted in a rapid expansion in the use of large disk-based storage arrays containing RAID technology. These storage arrays can hold large application databases containing vast amounts of data. By using storage virtualization techniques, HP 3PAR StoreServ storage arrays can be divided into many virtual disks. These can easily be copied within a disk array, perhaps many times depending on the disk array technology and the available storage space. This makes it possible to perform operations on copies of data without any risk to the original data. In particular, it enables effective backup solutions for applications in high-availability and mission-critical areas.

HP Data Protector 8.10 is helping organizations of every size by addressing their data protection challenges with software that offers advanced data protection capabilities such as HP StoreOnce federated deduplication, integrated Oracle/SAP

1 Landscape is like a server system or like a layout of servers or architecture of the servers.
backup, ZDB, IR and mission-critical application recovery point-in-time. With HP Data Protector, users gain better transparency, predictability and business resiliency within their IT environments.

HP Data Protector 8.10 extends IR support to Linux platforms via a native agent completing the snapshot and IR support for file systems, Oracle, SAP and Linux platforms on HP 3PAR StoreServ storage. It offers a seamless and simple way of integrating SAP BRTOOLS for backup and recovery that helps the users to integrate the ZDB/IR configuration with SAP/Oracle components.

HP StoreOnce Backup systems are disk-based backup systems that deliver leading price-performance while deduplicating the server’s backup data. HP StoreOnce Backup systems are ideal for backing up mission critical data from large enterprise servers. For data center environments with remote offices or a disaster recovery site, StoreOnce systems can be used to replicate data to a central data center or remote facility. StoreOnce Backup systems are designed to offer the flexibility of both Virtual Tape Library (VTL) and Network-Attached Storage (NAS) targets for enterprise server backups.

**Overview**

Data protection is no longer a one-size-fits-all solution. The Recovery Point Objectives (RPO) and Recovery Time Objectives (RTO) have to match the business needs and then the appropriate backup solution needs to be designed to match those SLA requirements. To that end, HP recommends considering data protection as a continuum starting with six nines of 3PAR StoreServ availability, followed by instant protection and rapid recovery from HP 3PAR Virtual Copy Software integration with HP Data Protector ZDB and external disk deduplication backup and replication solution. Finally augmenting the solution with HP StoreEver Tape for secure long term retention. This solution leverages HP Server, Storage and Backup technologies to build a robust data protection solution for SAP applications.

Figure 1 shows the solution environment setup. The environment consists of application server, backup server, HP Data Protector management server, HP 3PAR StoreServ storage, HP StoreOnce and HP StoreEver. All the equipment is connected in a SAN network. The application server has SAP with Oracle database running which is a 2-tier configuration. The backup server is responsible for performing the backups of the replicas created in the 3PAR storage array during ZDB backup operation. Configuring backup, device configuration, and user configuration are managed by the Data Protector management server. The HP 3PAR storage array will have replicas created at different intervals as shown t, t0, t1 and t2. The target location of the backup would be HP StoreOnce or HP StoreEver. Restoration of the database can be performed by selecting the time interval and the respective image from the target backup device.

Figure 1. HP Data Protector Environment with StoreOnce, StoreEver, StoreOnce VSA and 3PAR Storage

Application Server
SAP with Oracle database (2-Tier Configuration)

Backup Server
SAP with Oracle database With RMAN configuration

Management Server
HP Data Protector 8.10 mgmt software and 3PAR Storage mgmt server

HP StoreOnce VSA

HP StoreEver

3PAR Storage

SAN

Replicas on disk

Application and database configured in the same server is known as 2-Tier configuration
Going forward the document introduces all solution components, provides guidance on configuring those components and ends with some best practices and recommendations.

**Solution components**

The HP Data Protector 8.10 ZDB environment uses the following key components in this testing:

**Hardware**
- HP BladeSystem c7000 enclosure
- HP Blade server’s
- HP Virtual Connect FlexFabric 10Gb/24 port modules
- HP 3PAR StoreServ 10800
- HP QMH 2562 HBA with driver 8.03.07.07-k
- HP SAN Switch
- HP StoreEver
- HP StoreOnce 4420

**Operating system**
- SLES4SAP-11-SP2 x86_64 platform

**Software**
- SAP NetWeaver 7.3
- SAP ERP6 EHP6
- Oracle 11gR2 database (11.2.0.3)

**Management software**
- HP 3PAR Management Console 4.3
- HP 3PAR OS version 3.1.2 (MU3)
- HP 3PAR CLI 3.12
- HP Data Protector 8.10
- Oracle database management software (dbca, asmca, etc.)
- SAP NetWeaver installation software (sapinst, sapinstgui)
- SAP management GUI (SAP Logon for Microsoft® Windows®)

Figure 2 shows all the solution components except HP 3PAR Storage in rack and Figure 3 shows HP 3PAR StoreServ 10800 storage with controller node pair.
Figure 2. HP recommended configuration showing solution components
**Key point**

Download x86_64 platform with NetWeaver 7.3, Software Provision Manager 1.0 (SWPM), supported kernel, ERP6 EHP6, SL Controller, and Oracle Database 11.2.0.3 and Oracle client software. Use standard SAP installation for systems, software and required licenses.

**HP StoreOnce Backup system**

The HP StoreOnce Backup system is a disk-based storage appliance for backing up host network servers or PCs to target devices on the appliance. These devices are configured as either Network-Attached Storage (NAS) or Virtual Tape Library (VTL) targets for backup applications. The total number of backup targets provided by an HP StoreOnce Backup system is split between VTL and NAS devices and varies according to model. These devices may be all VTL, all NAS or any combination of NAS and VTL devices. All HP StoreOnce devices automatically make use of StoreOnce deduplication, ensuring efficient and cost-effective use of disk space. The architecture and design of the deduplication software makes it portable, scalable, and

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3 To get access to SAP notes, software and some of the technical documentation will require SAP Service Marketplace credentials to log on. Refer to the SAP Support site at [service.sap.com](http://service.sap.com)
able to deliver global deduplication (within and across independent multiple nodes with a single namespace). The implication is that HP StoreOnce deduplication can be deployed in a multiple ways; for example, as a virtual machine instance, integrated with HP Data Protector backup and recovery software.

**Data Deduplication**

HP StoreOnce Technology is a 5-step “inline” data deduplication process (Chunk → Hash → Match → Compress → Store). It uses hash-based chunking technology, which analyzes incoming backup data in “chunks” that average 4K in size. The hashing algorithm generates a unique hash value that identifies each chunk and points to its location in the deduplication store.

Hash values are stored in an index that is referenced when subsequent backups are performed. When data generates a hash value that already exists in the index, the data is not stored a second time, but rather the count is increased showing how many times that hash code has been seen. Unique data generates a new hash code and that is stored on the StoreOnce appliance. Typically about 2% of every new backup is new data that generates new hash codes. With VTL and NAS shares, deduplication always occurs on the StoreOnce Backup system. With Catalyst Stores, deduplication may be configured to occur on the media server or on the StoreOnce Backup system; these are also called low bandwidth mode or high bandwidth mode. See Figure 4 for a comparison of low and high bandwidth modes, where “Target side deduplication” corresponds to “High bandwidth mode” and “Source side deduplication” corresponds to “Low bandwidth mode”.

**Figure 4. Target side vs. source side StoreOnce deduplication**

Low bandwidth mode is also called source side deduplication and it has two main benefits. The first benefit is that it increases the overall throughput available on the HP StoreOnce appliance when receiving data streams that have already been chunked, hashed and compressed. The second benefit is that low bandwidth backups make the process much more bandwidth efficient. Low bandwidth mode enables backups from remote sites to be performed over a WAN as it requires a much reduced network bandwidth from the media server to the HP StoreOnce Backup system.

In high bandwidth mode, backup data is sent directly to the HP StoreOnce Backup system where it is deduplicated; this requires a high bandwidth network. This is also called target side deduplication. In this mode all deduplication steps like chunk, hash, match, compress and store are executed on the target StoreOnce Backup system.

In addition to the benefits of disk-based backup, automation, and consolidation of multi-server backup to a single HP StoreOnce appliance with deduplication, the HP StoreOnce Backup systems also provide the opportunity to:

- Enhance business performance
- Perform fast in-line deduplication performance with innovations from HP Labs including smart data and index layout capabilities that reduce disk utilization and increase I/O efficiency
- Improve backup and recovery times with industry-leading in-line disk-based replication to improve business performance and reduce the impact of explosive data growth
**Key points**
The obvious benefit of in-line deduplication for SAP/Oracle backups is the opportunity to save on actual storage consumption and network bandwidth.

**HP StoreOnce – models for SAP/Oracle environment**
HP StoreOnce Backup has been designed to reduce the amount of backup data you need to store. Designed for quick and efficient storage, the HP StoreOnce Backup offers industry-leading performance and breakthrough architecture. Breakthrough architecture helps to decrease costs by starting small and paying for only what you need with an architecture that grows as you do.

The benefits of breakthrough architecture include:

- Pay as you grow with scale-out architecture
- Gain industry-leading availability with autonomic failover – no single point of failure; this capability provides the highest availability in the industry
- Take advantage of continuous backup. In the case of node failure, the companion node picks up the load without any operator involvement or manual intervention.

Table 1 lists the features of HP StoreOnce models recommended for SAP backup.

<table>
<thead>
<tr>
<th>HP StoreOnce</th>
<th>2700</th>
<th>4500</th>
<th>4700</th>
<th>4900</th>
<th>6500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form factor</td>
<td>1U</td>
<td>2U to 8U scalable</td>
<td>4U scalable</td>
<td>7U to 12U scalable</td>
<td>Provided in 42U rack</td>
</tr>
<tr>
<td>Total capacity (raw)</td>
<td>8TB</td>
<td>Up to 168TB</td>
<td>Up to 192TB</td>
<td>Up to 560TB</td>
<td>Up to 2240TB</td>
</tr>
<tr>
<td>Total capacity (usable)</td>
<td>5.5TB</td>
<td>Up to 124TB</td>
<td>Up to 160TB</td>
<td>Up to 432TB</td>
<td>Up to 1728TB</td>
</tr>
<tr>
<td>Write performance (max)</td>
<td>1.3TB/hour</td>
<td>5.4TB/hour</td>
<td>7.6TB/hour</td>
<td>8.5TB/hour</td>
<td>63.2TB/hour</td>
</tr>
<tr>
<td>Catalyst performance (max)</td>
<td>3.7TB/hour</td>
<td>14TB/hour</td>
<td>22TB/hour</td>
<td>22TB/hour</td>
<td>139TB/hour</td>
</tr>
<tr>
<td>Max fan-in/backup targets</td>
<td>8</td>
<td>24</td>
<td>50</td>
<td>50</td>
<td>384</td>
</tr>
<tr>
<td>Type of license</td>
<td>E-LTU</td>
<td>E-LTU/LTU</td>
<td>E-LTU/LTU</td>
<td>E-LTU/LTU</td>
<td>E-LTU/LTU</td>
</tr>
</tbody>
</table>

**Key Point**
HP StoreOnce Backup systems are built using HP ProLiant servers, hence they share common management tools with HP server products (for example, HP Systems Insight Manager (SIM) and HP Integrated Lights-Out (iLO)) which reduce the time and energy it takes to manage the IT infrastructure.
**HP StoreOnce – Catalyst**

HP StoreOnce Catalyst is an object-based storage target on an HP StoreOnce Backup system that offers client side deduplication for use with backup and recovery applications. HP StoreOnce Catalyst brings the HP StoreOnce vision of a single, integrated enterprise-wide deduplication algorithm a step closer. It allows the seamless movement of deduplicated data across the enterprise to other StoreOnce Catalyst systems without rehydration.

This means that you can benefit from:

- **Simplified management of data movement from a single pane of glass**: Tighter integration with your backup application to centrally manage file replication across the enterprise.

- **Seamless control across complex environments**: Supporting a range of flexible configurations that enable the concurrent movement of data from one site to multiple sites, and the ability to cascade data around the enterprise (sometimes referred to as multi-hop).

- **Enhance performance**: Distributed deduplication processing using HP StoreOnce Catalyst stores on the StoreOnce Backup systems and on multiple servers can balance load and utilization of backup hardware, network links, and backup servers for faster deduplication and backup performance.

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**Key point**

An advantage of using Catalyst stores is that since they work on Ethernet, a customer can save on the cost of setting up a SAN for backups. Although Catalyst will run on both Ethernet and Fibre Channel, the cost advantage of running Catalyst on Ethernet would remain. Figures 5 and 6 show the Oracle ZDB backup and restore operation using HP StoreOnce Catalyst store.

Actual performance is dependent upon configuration data set type, compression levels, number of data streams, number of devices emulated, and number of concurrent tasks, such as housekeeping or replication.

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**Figure 5. ZDB backup using StoreOnce catalyst store**
Figure 6. Restoring Oracle (ZDB) database backup using StoreOnce Catalyst store

HP StoreOnce – VTL

VTL targets appear to the backup application as physical tape devices, with backup and recovery jobs managed in the same manner as with a physical tape device. The primary difference being that there is no physical media that must be managed. They are recommended for customers in Fibre Channel (FC) environments, or where a continued investment in tape hardware and software is a key consideration.

A VTL is emulated out of a storage array of physical disk drives and functions like a physical tape library. It can have one or more tape drives, multiple virtual media and can even emulate a robot. A single HP StoreOnce device can emulate multiple VTLs at the same time. The StoreOnce enables N-port ID virtualization (NPIV) on the front end FC ports, each VTL logs into the fabric with a unique WWN through the front end FC ports.

In this SAP with Oracle database configuration, VTL libraries are created using FC and iSCSI protocols and tested in this environment. For iSCSI configuration, the backup server has to be configured as an initiator and the target (StoreOnce) can be configured with the default port 3260.

Key points

One advantage of having the ability to create multiple VTLs within a single HP StoreOnce is that a library can be dedicated to each application. For example, if there are multiple SAP/Oracle database instances running, their backups can be kept separate by allocating separate VTLs/storage units. VTLs are enablers for high speed backups as compared to tape libraries.

Figure 7 shows the VTL Library (iSCSI) creation using HP StoreOnce 4420 Backup system. This VTL has been configured for HP Data Protector (Backup Application) and SAP/Oracle database (Backup data type).

VTLs provide the flexibility to emulate any specification of drive and media type. LTOx, LTO5 and DLT drives and media can be created within a VTL. For SAP/Oracle, a media type can be emulated so that it can accommodate a complete data backup within a single media. This action will ensure faster backups and restores.

Figures 8 and 9 show the Oracle ZDB backup and restore operation using StoreOnce VTL (iSCSI) device.

VTLs also provide the administrator options to choose the number of drives, media, slots and mail slots within a library. All of these indirectly provide the flexibility to define and use as much capacity as is required for the SAP/Oracle instance backing up to this VTL.

In general, using physical media brings with it some of the issues like media alignment errors, and mounting and unmounting errors. Moreover physical media have a limited life and they have to be discarded/replaced after a limited number of read/writes cycles. Using VTLs can effectively help to avoid these errors and go a long way in ensuring smooth backups for SAP/Oracle.
Figure 7. HP StoreOnce 4420 Backup system – VTL configuration

Figure 8. ZDB backup using StoreOnce VTL with iSCSI configuration

Figure 9. Restoring Oracle database using StoreOnce VTL with iSCSI configuration
**HP StoreOnce – NAS**

NAS appliances provide general disk based file share and protection. HP StoreOnce Backup is designed as target storage for backup applications that need rapid restores and reduced backup windows. The device will present standard NAS protocols over the front-end 10GbE ports of the device, thus providing a LAN backup target (with deduplication) that can be used transparently with qualified enterprise backup applications. Compared with general purpose NAS appliances, HP StoreOnce Backup uniquely offers the following qualities:

- Easier setup and administration of backup
- Data deduplication, allowing more backup data to be retained on disk for longer periods
- Data replication for cost-effective, off-site storage

HP StoreOnce offers two options for NAS shares, i.e., as CIFS interface for Windows servers and as NFS interface for Linux and UNIX® servers. NAS targets are recommended for customers in non-tape environments. NAS targets consist of one or more file shares that appear to the backup application as standard CIFS or NFS shares, while still supporting data deduplication and replication. The StoreOnce Backup systems should not be used for general purpose NAS operations such as file sharing.

Each NAS share created on the StoreOnce system has its own deduplication “store”; that is, any data backed up to a share will be deduplicated against all of the other data in that store. Figures 10 and 11 show Oracle ZBD backup and restore from StoreOnce NFS share.

**Figure 10.** ZDB backup using StoreOnce NFS share
**Key points**

Technically, HP StoreOnce can be used as a NAS to create a storage unit in HP Data Protector and SAP/Oracle backups can also be written to it. NAS devices in general are known to be slower than FC, it may be better to use VTL or Catalyst.

HP StoreOnce can be mounted as a NAS device on the backup server. File backups can be started on these NAS shares. A word of caution here would be to use a separate network interface for mounting a NAS share. If a NAS share is mounted using the data or user network interface, it could cause performance issues when a file backup is initiated. The advantage here is that NAS stores are very easy to set up and they can be handy in case of an emergency.

An advantage of setting up a NAS share for backups would be the opportunity to save on the cost of setting up a separate SAN for backups.

**HP StoreOnce – VSA**

HP StoreOnce Virtual Storage Appliance (VSA) is a hardware-agnostic, software-defined storage solution deployed as a virtual machine on existing industry-standard server infrastructure. It reduces capital expense by up to 65 percent compared to dedicated backup appliances, and is the industry’s most scalable deduplication virtual appliance. Because it runs the same software as the physical HP StoreOnce appliances, the HP StoreOnce VSA shares the same advanced data services including cross-family replication, backup application integration for performance and control, and federated deduplication. This allows customers to maintain efficiency across the enterprise. The addition of this new software-defined data protection solution to the HP Converged Storage portfolio makes HP StoreOnce the only single deduplication technology that can be deployed in four locations – a target appliance, media server, application source, and virtual machine.

Traditionally, StoreOnce has been viewed as a hardware appliance-based solution now offered as a VSA to provide a complete federated deduplication backup and recovery solution. The StoreOnce VSA leverages the same HP deduplication technology and advanced feature options as the hardware appliance and all advanced features are included in the VSA license.

The StoreOnce VSA features:

- Deduplication
- Replication
- Client side deduplication when using HP StoreOnce Catalyst backup targets
- Integrated management

HP StoreOnce VSA backup application compatibility can be found on HP Storage EBS Compatibility Matrix (hp.com/go/BURACompatibility)

Utilizing both VSAs within a VM environment provides a comprehensive feature and functionality set that will help cut overall TCO when deploying a software-defined solution.
For an enterprise tasked with protecting data at its remote sites, the cost and complexity of managing physical backup hardware spread across a large number of locations can be daunting. HP StoreOnce VSA cuts storage costs and reduces complexity by eliminating the need for dedicated backup hardware in small sites, dropping space requirements up to 50 percent and power costs up to 70 percent, when compared to the nearest competing physical backup system.

HP StoreOnce VSA, together with HP StoreOnce Catalyst, eliminates complexity by enabling customers to manage remote backup and replication, as well as local data center backup, from a centralized location. Unlike competing software-based backup solutions, the HP StoreOnce VSA works with a wide array of independent software vendors (ISVs) and can easily restore data from the local VSA backup or across the network from the disaster recovery site.

**Key point**

HP StoreOnce VSA runs the same software as the physical HP StoreOnce appliances. It can be deployed in VMware ESX servers and Microsoft Hyper-V servers; by doing this the capital expenses are reduced. SAP/Oracle backup and restore can be performed using HP StoreOnce VSA which has VTL, NAS and Catalyst Stores. HP StoreOnce VSA requires a license. The StoreOnce VSA license includes HP StoreOnce Catalyst for optimized movement of deduplicated backups offsite. When used in conjunction with a Catalyst capable backup application all data movement can be controlled through the backup application for a “single pane of glass” management experience. Figure 12 shows HP StoreOnce VSA with created Catalyst Stores. The same share can be presented to the backup server and can be configured as backup device for SAP/Oracle backup.

**Figure 12. HP StoreOnce VSA – Created Catalyst store**

**HP StoreOnce – Replication**

HP StoreOnce replication, as shown in Figure 13, enables customers to replicate their VTL, NAS or Catalyst Stores to another HP StoreOnce located at a remote site. This ensures that backups are available at the Disaster Recovery (DR) site in case the primary site is down. While the replication for VTL and NAS are configured with the StoreOnce web interface, the replication of data between Catalyst Stores can be configured and managed within the HP Data Protector software. Replication can take place between multi-node and single-node StoreOnce Backup systems.

Replication provides a point-in-time “mirror” of the data on the source StoreOnce device at a target StoreOnce Backup system on another site, which enables quick recovery from a disaster that has resulted in the loss of both the original and backup versions of the data on the source site.

Replication can also be configured to occur at specific times via configurable blackout windows in order to optimize bandwidth usage and not affect other applications that might be sharing the same WAN link. VTL replication allows multiple source libraries to replicate into a single target library; NAS mappings however are 1:1 and one replication target share may only receive data from a single replication source share.

Another benefit of replication is that in case a virtual media is not available at the source site or has expired, it is possible to copy a virtual media from a secondary site to the primary site, providing an important backup source in the event of an emergency.
Figure 13. HP StoreOnce architecture and concepts

Key points
HP StoreOnce replication can be an alternative for tape backups. The positive side of having this kind of a replication in place would be faster restore from disks, thus a lower RTO.

If the source and target StoreOnce devices are at remote sites, the WAN bandwidth needs to be considered for replication to be effective and would depend on how much of a change (delta) on a regular basis.

HP StoreOnce offers the capability to restrict bandwidth usage for replication; this is useful when the copy is going across WAN links such that the backup/replication traffic does not starve the other data traffic over WAN. Furthermore, blackout windows can be defined during which no replication jobs can run.

HP StoreOnce Enterprise Manager
HP StoreOnce Enterprise Manager is a standalone software application that provides basic management capabilities in a replication environment and provides an easy way for customers to manage up to 400 StoreOnce devices that are being replicated across multiple sites. Using StoreOnce Enterprise Manager, administrators can create, manage, and remove groups of devices; and, establish and control user and administrator access to the groups and devices. StoreOnce Enterprise Manager allows administrators and users to review the status of the groups and devices to which they have access, either to ensure that replication is happening successfully and on schedule, or to respond when there are replication operation errors. StoreOnce Enterprise Manager also provides the ability to monitor disk usage and deduplication ratios for the devices. This allows administrators the ability to identify devices that may need additional capacity. Trend analysis is also available to look at disk capacity changes that occur on devices over a pre-determined period. It also provides command line interface (CLI), AD-enabled security and a topology viewer for the devices showing relationships and health.

The HP StoreOnce Enterprise Manager provides the following functionality for administrators and users:

- Create, manage, and remove logical groupings of devices (administrators only).
- Access and manage devices and device groups through Active Directory authentication.
- Manage and monitor replication processes.
- Monitor disk usage and deduplication ratios for the devices for capacity planning.
- Trend analysis of disk capacity changes over a period of time.
- View a graphical display of devices in the topology viewer.
- Send information digests through email with a summary of information about devices.
The user will also be able to monitor disk usage and deduplication ratios for the devices for capacity planning:

- Trend analysis of disk capacity changes over a period of time.
- View a graphical display of devices in the topology viewer.
- Send information digests through email with a summary of information about devices.

The HP StoreOnce Enterprise Manager is a centralized console that enhances the customer experience by monitoring all HP StoreOnce backup appliances, physical and virtual. This enables administrators to view current backup performance, capacity utilization and deduplication ratios, as well as the historical performance of backup and replication jobs via a single interface.

**Key point**

HP StoreOnce Enterprise Manager has a great management ability for StoreOnce devices. HP StoreOnce VSA also can be managed using this management software. It gives the graphical view of the devices in the form of capacity utilization of created VTL, NAS and Catalyst Store. Figures 14 and 15 show the HP StoreOnce VSA and HP StoreOnce 4420 backup device configured in SAP/Oracle backup environment. SAP/Oracle Backup and Restore solution has been tested using HP StoreOnce VSA environment.

---

**Figure 14.** HP StoreOnce Enterprise Manager with available device (StoreOnce 4420 and VSA)

**Figure 15.** HP StoreOnce Enterprise Manager with available device status (VTL, NAS, and Catalyst store)
**HP StoreEver tape**

Tape is still the most cost effective solution for long term data retention. If there is a need to keep data for years or even decades, tape is the answer. LTO tape media is specified with a 30 year shelf life in normal ambient conditions. HP has a complete range of tape-based backup products ranging from direct attached single drives to large enterprise class libraries that can have up to 96 tape drives and nearly 12000 media slots. While all of these libraries are compatible with HP Data Protector Backup and any of these can be used for SAP/Oracle tape backups, an HP StoreEver MSL Tape Library was selected for this solution considering the backup data size and backup frequency. Table 2 provides details of the HP StoreEver MSL models and their respective features.

HP StoreEver Midrange Storage Libraries (MSL) Tape Libraries meet the demanding data storage needs including unattended backup, archive, and disaster recovery for a wide range of businesses. The MSL Tape Libraries offer a choice of storage capacity including LTO-6, LTO-5, or LTO-4 Ultrium tape drives.

They are easy to manage and use, providing the following benefits:

- Offer wide range of capacity points from 9.6TB to 3.5PB of compressed capacity (2.5:1) in a variety of rack ready form factors.
- Manage, configure and use the library from across the room or across the globe with the HP web-based remote management and diagnostics.
- Monitor drive and media utilization, operational performance, life and health information of drive and media proactively with TapeAssure.
- Manage your media both in and out of the tape library with a standard bar code reader and configurable removable magazines.

**Protection and flexibility**

Native encryption on LTO-6, LTO-5, and LTO-4 tape drives deliver a high level of security for data backup, protecting confidential information and addressing compliance regulations. The MSL Encryption Kit provides up to 100 encryption keys to protect your backup independent of ISV support. For enterprise encryption key management the MSL tape libraries offer support with HP Enterprise Secure Manager (ESKM) and other third-party KMIP compliant key managers.

- MSL Tape Libraries can easily help increase capacity and performance with tool-free drive kits.
- Take advantage of the investment in an MSL2024, MSL4048 Tape Library leveraging the same MSL drive kits in the MSL6480 for even greater investment protection and scalability.
- MSL Tape Libraries offer various interface options for installing the tape library into a SAS or FC SAN environment.
Proven reliability
MSL Tape Libraries work with industry-leading server, operating systems, and backup software including HP Data Protector software. To find more information visit hp.com/go/BURACompatibility.

Table 2. HP StoreEver MSL Tape Library models

<table>
<thead>
<tr>
<th>Tape library</th>
<th>MSL 2024</th>
<th>MSL 4048</th>
<th>MSL 6480 scalable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum drives per library</td>
<td>2-LTO-6 Ultium 6250</td>
<td>4-LTO-6 Ultium 6250</td>
<td>1-42 LTO-6 Ultium 6250</td>
</tr>
<tr>
<td></td>
<td>1-LTO-5 Ultium 3280</td>
<td>2-LTO-5 Ultium 3280</td>
<td>1-42 LTO-5 Ultium 3000</td>
</tr>
<tr>
<td></td>
<td>2-LTO-5 Ultium 3000</td>
<td>4-LTO-5 Ultium 3000</td>
<td>1-42 LTO-4 Ultium 1760</td>
</tr>
<tr>
<td></td>
<td>1-LTO-4 Ultium 1840</td>
<td>2-LTO-4 Ultium 1840</td>
<td>1-24 LTO-5 Ultium 3280</td>
</tr>
<tr>
<td></td>
<td>2-LTO-4 Ultium 1760</td>
<td>4-LTO-4 Ultium 1760</td>
<td>1-24 LTO-4 Ultium 1840</td>
</tr>
</tbody>
</table>

| No of cartridge slots | 24 | 48 | 80-560 |
| | | | 80 slots (base module) |
| | | | 80 slots (expansion module) |
| | | | Can add up to 6 max configuration; |
| | | | 560 slots (7 modules) |

| Host interface | 8Gb Fibre Channel | 8Gb Fibre Channel | 8Gb Fibre Channel |
| | 4Gb Fibre Channel | 4Gb Fibre Channel | 4Gb Fibre Channel |
| | 3Gb/sec SAS | 3Gb/sec SAS | 3Gb/sec SAS |

| Maximum capacity | 150TB (LTO-6) | 300TB (LTO-6) | 3.5PB (Ultrium 6250) |
| | 72TB (LTO-5) | 144TB (LTO-5) | 1.6PB (Ultrium 3000) |
| | 38.4TB (LTO-4) | 76.8TB (LTO-4) | |

| Encryption capability | AES 256-bit | AES 256-bit | AES 256-bit |
| | Note: For Ultrium 6250, 3280, 3000, 1840, and 1760 Drives only | Note: For Ultrium 6250, 3280, 3000, 1840, and 1760 Drives only | Note: For Ultrium 6250, 3000, 1840, and 1760 Drives only |

| Form factor | 2U | 4U | 6U base Module |
| | | | 6U Expansion Module |
| | | | up to 6 in a full library |

Figure 16. HP StoreEver – Available drive information
To verify the connectivity between the host and the StoreEver tape library. Install the HP Library and Tape Tools Diagnostic/Installation Check Utility, available at [hp.com/support/TapeTools](http://hp.com/support/TapeTools), onto the host server. This utility verifies that the unit is connected and communicating with the host server. It also verifies that the device is functioning and provides diagnostic information. Run the HP Library and Tape Tools Installation Check from the programs menu to verify your connections.

**Key point**

While a customer may do routine disk-based SAP/Oracle database backups using HP StoreOnce, there may still be a need to move the backup images from a virtual media to a physical media for off-site/vaulting purposes. In some countries it is a statutory requirement to store critical data at an alternate location.

SAP/Oracle databases are home to the most critical business data for many organizations. When vaulting backup media to an alternate site there is a chance of media getting lost or stolen during transit, and vital company information could be compromised. HP StoreEver encryption is a very useful feature that can protect vital information from leaking even if media is lost. Encryption should be enabled on all media that is moving in and out of the company premises.

Partitioning allows each partitioned library to be presented to the host as an independent library, separate from other partitions in the library. Hosts for each partition can own independent sets of media. For SAP/Oracle this capability allows for the provisioning of separate partitions for production and non-production instances, thereby enabling maximum flexibility and utilization of the MSL library.

As mentioned above there is also the option to merge two physical libraries into one logical library. If the SAP/Oracle environment has grown to a size that the existing capacity is no longer sufficient, the existing library can be scaled up by adding more drives if there are free slots available or by extending the existing library, by adding another tape library.

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**HP 3PAR StoreServ Storage**

HP 3PAR StoreServ is designed to deliver the agility and efficiency demanded by virtual data centers integrating SAP products. The HP 3PAR StoreServ 7000 family consists of the 7200, 7400, and 7450 (all SSD based storage) systems and the HP 3PAR StoreServ 10000 family consisting of the 10400 and 10800 systems. All HP 3PAR models are targeted towards the most demanding SAP customers for their SAP production systems and landscapes; they are simple to use, yet powerful and autonomicallly-tiered, and multi-tenant storage arrays. They are supported by a powerful suite of software products that provide ease of management, efficient storage utilization through thin technologies, autonomic storage tiering and leading availability features such as persistent cache and full-mesh interconnect.

Large SAP customers tend to consolidate their IT infrastructure, particularly their storage facilities, to achieve greater efficiency. The HP 3PAR StoreServ excels at centralizing data stored on several large legacy storage arrays into one high-performance, highly-available next generation storage system that allows multiple SAP systems to share the same storage system. As a result, customers can consolidate common administration and high-availability processes across their SAP landscapes and achieve greater agility through dynamic assignment of storage capacity according to business needs. The features of HP 3PAR StoreServ are ideally suited for integration with SAP systems that rely on a robust, scalable, and efficient storage solution.

**HP 3PAR StoreServ Storage – models for SAP**

All HP 3PAR StoreServ arrays, ranging from entry level 7200 to enterprise class 10800, come with the same 3PAR OS. So customer can choose a 3PAR storage as per their storage space requirement. Although the solution testing for this paper has been done using 10800, for the purpose of building this kind of a solution any of the 3PAR models listed in Table 3 can be used.
Table 3. HP 3PAR StoreServ models for SAP

<table>
<thead>
<tr>
<th></th>
<th>7200</th>
<th>7400</th>
<th>7450</th>
<th>10400</th>
<th>10800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description and use</td>
<td>HP 3PAR StoreServ 7000 built for virtualization, consolidation and ease of use. Spans entry-range to mid-range, provides the performance and features offered by enterprise class storage.</td>
<td>HP 3PAR StoreServ 10000 establishes a new benchmark for tier 1 storage performance in virtual and cloud data centers. Designed to deliver consolidation of thousands of virtual machines and ensure that applications never lose access to data.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controller nodes</td>
<td>2</td>
<td>2 or 4</td>
<td>2 or 4</td>
<td>2 or 4</td>
<td>2, 4, 6 or 8</td>
</tr>
<tr>
<td>Fibre Channel host ports</td>
<td>4-12</td>
<td>4-24</td>
<td>4-24</td>
<td>0-96</td>
<td>0-192</td>
</tr>
<tr>
<td>10Gb/s iSCSI Host Ports</td>
<td>0-4</td>
<td>0-8</td>
<td>0-8</td>
<td>0-16</td>
<td>0-32</td>
</tr>
<tr>
<td>Drive types (mixable)</td>
<td>SAS (Fast Class), SSD (Solid State Drives), Nearline(^4) (Enterprise SAS)</td>
<td>SSD (Solid State Drives)</td>
<td>FC (Fibre channel), Nearline (Enterprise SATA), SSD (Solid State Drives)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max raw capacity (approximate)</td>
<td>1.2 – 400TB</td>
<td>1.2 – 1200TB</td>
<td>0.8 – 460TB</td>
<td>800TB</td>
<td>3200TB</td>
</tr>
</tbody>
</table>

**HP 3PAR StoreServ Storage – Virtual Copy**

HP 3PAR Virtual Copy Software helps create, manage and configure local replication data mirroring and snapshot capabilities of 3PAR storage systems. 3PAR Virtual Copy Software is a reservation-free, non-duplicative, copy on-write product that consumes capacity only for changed data, in fine-grained increments, and without duplicating changed data within a snapshot tree. This service enables snapshots and mirroring to facilitate data restores, minimize downtime for backups, perform application testing, and support data mining use with decision-support tools.

**Key point**

In the context of this solution HP Data Protector reads these snapshots and writes them to HP StoreOnce or HP StoreEver. So HP 3PAR Virtual Copy are enablers for Data Protector Zero Downtime Backup and Instant Recovery.

**HP Data Protector**

HP Data Protector is a backup solution that provides reliable data protection and high availability for your fast growing business data. Data Protector offers comprehensive backup and restore functionality specifically tailored for enterprise-wide and distributed environments. The following list describes major Data Protector features:

**Scalable and highly flexible architecture**

Data Protector can be used in environments ranging from a single system to thousands of systems on several sites. Due to the network component concept of Data Protector, elements of the backup infrastructure can be placed in the topology according to user requirements. The numerous backup options and alternatives to setting up a backup infrastructure allow the implementation of virtually any configuration you want. Data Protector also integrates seamlessly with HP StoreOnce and HP StoreEver backup appliances.

**Easy central administration**

Through its easy-to-use graphical user interface (GUI), Data Protector allows you to administer your complete backup environment from a single system. To ease operation, the GUI can be installed on several systems to allow multiple administrators to access Data Protector via their locally installed consoles. Even multiple backup environments can be managed from a single system. The Data Protector command-line interface (CLI) allows you to manage Data Protector using scripts.

\(^4\) NL drives are 7200 RPM Enterprise SAS drives.
High-performance backup
Data Protector enables you to perform backup to several hundred backup devices simultaneously. It supports high-end devices in very large libraries. Various backup possibilities, such as local backup, network backup, online backup, disk image backup, synthetic backup, backup with object mirroring, and built-in support for parallel data streams allow you to tune your backups to best fit your requirements.

HP Data Protector architecture

Cell Manager
An HP Data Protector cell is a set of systems with a common backup policy existing on the same LAN/SAN. The Cell Manager is the main system that is the central point for managing this network environment. It contains the HP Data Protector internal database (IDB) and runs core HP Data Protector software and session managers. The internal database keeps track of backed up files and the cell configuration.

Data Protector client
A host system becomes an HP Data Protector client when one or more of the HP Data Protector software components are installed on the system. Client systems with disks that need to be backed up must have an appropriate Data Protector Disk Agent component installed. The Disk Agent enables you to back up data from the client disk or restore it. Client systems that are connected to a backup device must have a media agent component installed. This software manages backup devices and media.

Figure 17. HP Data Protector Architecture.

HP Data Protector – Zero Downtime Backup (ZDB)

HP Data Protector ZDB technology is designed to improve backup strategies by simplifying the integration of Oracle Database and SAP R/3 (Real-time data processing/3 tier architecture) Objects. Conventional methods of backing up to tape are not well suited for large database applications; either the database has to be taken offline or, if the application allows it, put into “hot-backup mode” while data in it is streamed to tape. While the first choice can cause major disruption to the application’s operation, the second can produce many large transaction log files and place extra load on the SAP application system.

ZDB uses disk array technology to minimize the disruption. In very general terms, a copy or replica of the data is created or maintained on the HP 3PAR StoreServ 10800 storage. This is very fast and has little impact on the application performance.

The replica can itself form the backup, or it can be streamed to tape without further interruption to the application’s use of the source database. Depending on the hardware and software with which it is created, a replica may be an exact duplicate (mirror, snapclone), or a virtual copy (snapshot) of the data being backed up.
**HP Data Protector – Instant Recovery (IR)**

IR can recover the data in mere seconds, automating the entire process to meet even the most demanding recovery time objectives (RTOs). Instant Recovery requires a replica to exist on the same HP 3PAR StoreServ storage array to which the data is to be restored. Application and backup systems are disabled and the contents of the replica are restored directly to their original locations. During IR, a data copy operation is performed in which data located on the source virtual volume in HP 3PAR StoreServ storage array is replaced by the data located on the target virtual volumes. This operation is performed internally within the disk array, involving no other backup medium or device. This makes the Instant Recovery process very fast.

After the recovery is completed, the sections of the database are returned to the state at the time the replica was created. Depending on the application or database concerned, this may be all that is required. In some cases additional action, such as applying archived transaction log files that have been backed up separately, is required for full Oracle 11gR2 Database recovery. With IR, lost or corrupt data is replaced with known good data, which was previously created as a replica. This mechanism is completely implemented at the virtual volume level on HP 3PAR StoreServ storage.

**HP Data Protector integration with Oracle database**

HP Data Protector offers offline as well as online backup of the Oracle databases. In order to enable Oracle database recovery from an online backup, the respective Oracle database instance must operate in the ARCHIVELOG mode. The online backup concept is widely accepted as it addresses the business requirements of high application availability, as opposed to the offline concept. During an online backup, a database remains available for use; while during an offline backup, the database cannot be used by an SAP application.

**Definitions**

- The Data Protector Session Manager (SM) provides the backup Session Manager during backup and restore.
- The Database Library provides a set of Data Protector Executables that enable data transfer between the Oracle database server and Data Protector. It is only required if Oracle data files are backed up in the recovery manager (RMAN) mode.
- The Data Protector General Media Agent (MA) reads and writes data from and to media devices.
- Data Protector executes the `ob2rman.pl` command on the backup system. This command retrieves a list of files or raw disks to be backed up from the Oracle database on the application system and starts the resolving process. The list is used only to determine the source volumes to be replicated.

The Data Protector Oracle integration agent (`ob2rman.pl`) works with RMAN to manage all aspects of the following operations on the Oracle target database:

- Backups (backup and copy)
- Recovery (restore, recovery, and duplication)

For backup operation, `ob2rman.pl` uses the Oracle target database views to get information of which logical (tablespaces) and physical (datafiles) target database objects are available for backup. For restore operation, `ob2rman.pl` uses current control file or recovery catalog, if appropriate, to get information about which objects are available to restore. Using the HP Data Protector integration with Oracle RMAN, the user can back up and restore the Oracle control files, datafiles, and archived redo logs.

The interface from the Oracle server processes to Data Protector is provided by the Data Protector Oracle integration Media Management Library (MML), which is a set of routines that allows the reading and writing of data to General Media Agents. Besides handling direct interaction with the media devices, Data Protector provides scheduling, media management, network backups, monitoring, and interactive backup. Figure 18 illustrates the concept of Oracle database integration, data and the control flow.
A backup that includes all the datafiles and current control files belonging to an Oracle database instance is known as a whole database backup. Data Protector ZDB can be used for online or offline backup of the Oracle target database. However, the user must ensure that the backup objects (such as tablespaces) are switched into the appropriate state before and after a backup session. For online backups, the Oracle database instance must operate in the ARCHIVELOG mode; whereas for offline backups, backup objects need to be prepared for backup using the Pre-exec and Post-exec options in the HP Data Protector backup specification. The Data Protector backup specification contains information about backup options, commands for RMAN, Pre-exec and Post-exec commands, media and devices.

The Data Protector Oracle integration links the Oracle database management software with Data Protector. From the Oracle database point of view, Data Protector represents a media management software. On the other hand, the Oracle database management system can be seen as a data source for backup, using media controlled by Data Protector.

**HP Data Protector integration with SAP R/3**

This section describes concepts and methods for backing up and restoring the data files, control files, online redo logs, offline archived redo logs and SAP R/3 database environment. Data Protector supports offline and online backups. During an online backup, the SAP R/3 application is actively used. Figure 19 shows the SAP R/3 integration with HP Data Protector 8.10. Figure 19 illustrates the concept of SAP R/3 integration, data and the control flow.

The Data Protector integration links SAP backup and restore tools (BR*Tools) with Data Protector. Because the SAP R/3 application runs on top of Oracle databases, the SAP R/3 backup objects are very similar to those of Oracle database objects. The main difference between these two types of backup objects is that SAP backup utilities hide the database from Data Protector, which sees those objects as plain files.

SAP tools can be started using the Data Protector interface or the SAP BRTOOLS interface with the following required details:

- **Backup specification** – A list of objects to be backed up, backup devices, and options to be used.
- **IDB** – The HP Data Protector Internal Database.
- **Backint** – Backup interface between Data Protector and SAP R/3 application. It is started by SAP tools: BRBACKUP or BRARCHIVE uses BACKINT to pass a backup request to Data Protector. BRRESTORE uses BACKINT to trigger Data Protector to restore the requested files.
- **Sapback/saprest** – Program that performs the actual backup/restore of files.
- **omnisap.exe** – Data Protector program that starts the SAP backup tools.
Oracle datafiles backup can be performed in two ways in SAP R/3 integration:

- **Backint** – Data is backed up using the Data Protector SAP R/3 integration.
- **RMAN** – Data is backed up using the Oracle Recovery Manager (RMAN). The main benefit of the RMAN mode is that the user can back up the Oracle database incrementally.

**Figure 19.** Data Protector 8.10 SAP R/3 integration

**SAP backup and restore utilities**

- **BRBACKUP** – Backs up Oracle database control files, data files, and online redo log files. Additionally, saves the profiles and logs relevant for a particular backup session.
- **BRARCHIVE** – Backs up offline (archived) redo logs, written by Oracle database to the archiving directory.
- **BRRESTORE** – Restores data backed up with BRBACKUP and BRARCHIVE.

**Configuration guidance**

This section describes the setup used in Data Protector 8.10 ZDB/IR solution for Oracle database and SAP using:

- **ZDB Backup/Instant Recovery**
- **ZDB/IR snapshot** Oracle Integration.
- **SAP R/3 Backup and restore integration**
The following actions are required on HP 3PAR StoreServ Storage to set up the filesystem:

- Add hosts.
- Create required virtual volumes for Application server and Cell Manager server.
- Export the virtual volumes to Application server and Cell Manager server respectively.
- Use only these virtual volumes as user repository during the SAP/Oracle installation.

The following are the required filesystems for SAP with Oracle database installation:

```
/dev/mapper/USRSAP   /usr/sap  → For SAP installation
/dev/mapper/SMNT     /sapmnt
/dev/mapper/ORADB    /oracle  → For Oracle installation
```

- Ensure that the CIM (Common Interface Module) is enabled in the 3PAR StoreServ and the same will be available on ports 5988 and 5989.

**Windows management server configuration**

The Microsoft Windows Server 2008 R2 Management server is a centralized server that manages all the resources. It integrates disk agents, media agents and Oracle/Data Protector integration. It serves as a management station for HP 3PAR StoreServ 10800 Storage and as a management station for HP Data Protector 8.10 GUI. Microsoft Windows Server 2008 R2 Management server also manages adding clients, auto configuring devices and initiating backup and restore tasks.

HP 3PAR SMI-S agent is configured on the management server and 3PAR CLI is installed to configure Common Information Model (CIM), which enables the communication between servers and the HP 3PAR StoreServ 10800 Storage.

In order to enable the CIM configuration among the Cell Manager server, the application server and HP 3PAR StoreServ 10800 Storage, the following has to be considered:

- Refer to the “ZDB configuration guide for HP 3PAR StoreServ Storage.”
- Install SAP logon for Windows to manage the SAP systems.
**HP Data Protector Cell Manager server configuration**

- This is the SUSE Linux Enterprise Server (SLES) for SAP-installed server with x86_64 platform supported.
- Data Protector Cell Manager server is configured as a backup server.

**Note**
Create a file system for Oracle database and SAP installation.
For example,

```
/oracle  (for Oracle database installation)
/usr/sap  (for SAP installation)
/sapmnt  (for SAP installation)
```

- The Cell Manager server and Application server should have the same Oracle directory structure such as ORACLE_HOME, /oracle/<SID>/112_64, SAP Installation directory, /usr/sap/SAP<SID> or /sapmnt/<SAPSID> as Application server.
- Install SAP NetWeaver 7.3, ERP6 EH6P, Oracle Database 11.2.0.3, supported kernel and Oracle client software, and complete the installation.
- Configure RMAN Catalog database in this Cell Manager server. Each application server’s database should be registered under catalog database for ZDB backup.
- Make sure the application server database "tnsnames" has been added in the Cell Manager server’s /oracle/<DBSID>/112_64/network/admin/tnsnames.ora file.
- Application database should be able to login from the Cell Manager server using "sqlplus sys/sys@<DBSID> as sysdba" credentials.
- Make sure the application database is accessible by the Cell Manager server. Make sure the tnsnames.ora files are the same in both the application server and backup server.
- Install HP Data Protector 8.10 with options “Installation Server (IS)” and “Cell Manager server (CM)”.
- Add SAP Application server as a client.

**Note**
Configure HP 3PAR StoreServ (SMI-S) for ZDB configuration as shown below.
For example,

```
Cell_Manager_Server:~ omnidbzdb --diskarray 3PAR --ompasswd --add <3PAR_Array_IP>
--user <user_name> --passwd <password>
```

Verify the HP 3PAR StoreServ connectivity status from the Application server as shown below.

```
Cell_Manager_Server:~ omnidbzdb --diskarray 3PAR --ompasswd --check
```

**SAP Application and Oracle database server configuration**

The application server and database server are both a 2-tier configuration in this setup.

Create a file system for Oracle database and SAP installation. For example,

```
/oracle  (for Oracle database installation)
/usr/sap  (for SAP installation)
/sapmnt  (for SAP installation)
```

- The server has SAP NetWeaver 7.3, ERP6 EH6P and Oracle 11gR2 database (11.2.0.3).
- Install supported kernel and Oracle database client software.
- The Application server should have the same Oracle directory structure such as ORACLE_HOME /oracle/<SID>/112_64 and SAP installation directory /usr/sap/SAP<SID>/CRS_HOME as the Cell Manager server.
- Ensure that the Oracle database is enabled in 'archive log' mode. For HP Data Protector ZDB configuration, the Oracle database (client) should be enabled with 'archive log' mode.
- Cell Manager server’s RMAN catalog database should be able to login from the Application server using “sqlplus sys/sys@DBSID as sysdba” credentials. Ensure that the Cell Manager server’s RMAN catalog database is accessible by the
Application server. Ensure that the tnsnames.ora file has Application server database and Backup server database entries.

**Note**

Configure HP 3PAR StoreServ (SMI-S Agent) for ZDB configuration as shown below:

```
Application_Server:# omnidbzdb --diskarray 3PAR --ompasswd --add
```

Verify the HP 3PAR StoreServ 10800 Storage connectivity status from the Application server as shown below:

```
Application_Server:# omnidbzdb --diskarray 3PAR --ompasswd --check --host
```

**Example of tnsnames.ora file**

```
KBB.WORLD= (Where KBB is Cell Manager server’s database SID)
KDESCRIPTION =
ADDRESS_LIST =
ADDRESS =
(COMMUNITY = SAP.WORLD)
(PROTOCOL = TCP)
(HOST = Backup_server)
(PORT = 1521)
)
CONNECT_DATA =
(SID = KBB)
(GLOBAL_NAME = KBB.WORLD)
)

SML.WORLD= (Where SML is Application server’s database SID)
DESCRIPTION =
ADDRESS_LIST =
ADDRESS =
(COMMUNITY = SAP.WORLD)
(PROTOCOL = TCP)
(HOST = Application_server)
(PORT = 1521)
)
CONNECT_DATA =
(SID = SML)
(GLOBAL_NAME = SML.WORLD)
)
```

**Key point**

Create Application server’s “orasID” user in Cell Manager server. Also, create Cell Manager server’s “orasID” in Application server. For Instant Recovery (IR), the Application server’s database SID directory must be available in the Cell Manager server and vice-versa. Once the Oracle database SID directory is copied across, set the “orasid” and “group” respectively. See the examples below.

**Application server**

```
Application_Server# cd /oracle
Application_Server# 11
```

```
 Application server’s ORASID directory
```

```
Application_Server# 21 orakbb dba 4096 Jun 2 04:51 KBB
```

```
Cell Manager server’s ORASID directory.
```

```
Application_Server# 22 orasml dba 4096 May 28 00:17 SML
```

The username and group has been maintained the same as in the Cell Manager server.
Cell Manager server

Cell_Manager_Server# cd /oracle
Cell_Manager_Server# ll

```
  drwxr-xr-x  22 orasml dba 4096 May 28 00:17 SML  ← Cell Manager server’s ORASID directory.
  drwxr-xr-x  21 orakbb dba 4096 Jun  2 04:51 KBB  ← Application server’s ORASID directory.
```

The username and group has been maintained the same as in the Application server.

The above configuration is mandatory for Instant Recovery (IR).

**HP Data Protector 8.10 configuration**

This section describes the HP Data Protector GUI configuration.

- Connect the “Cell Manager server” by providing the Hostname/IP Address in the HP Data Protector GUI.
- Create users by selecting “HP Data Protector Manager → Users” to add new users and groups of HP Data Protector clients as shown in Figure 2.1. Refer to “HP Data Protector Operations Guide” for user configuration.

**Figure 2.1. HP Data Protector User administration**

- Add new clients (Application/Database Server’s) by selecting “HP Data Protector Manager → Clients” to add new clients.
- Configure Devices by selecting “HP Data Protector Manager → Devices.”
- Select “Auto Configure devices/Add devices” options to discover the HP StoreOnce, StoreEver and File Library (File library is a local repository).

**Zero Downtime Backup and Instant Recovery configuration**

This section describes the ZDB configuration in the Application server and Cell Manager server.

**Application server**

To configure ZDB backup using the command line, execute `util_oracle8.pl` in the Application server as shown below.

```
/opt/omni/lbin ./util_oracle8.pl -config -dbname <DBSID> -orahome
/oracle/<DBSID>/112_64 -prmuser username -prmpasswd password -rcuser rman_user
-rcpasswd rmanpassword -rcservice rman_DB -zdb_method BACKUP_SET -bkphost
<Cell_Manager_Server>
```

The same configuration can be performed using HP Data Protector GUI, where:

```
<DBSID> - Application server’s Oracle database SID
```
On successful ZDB configuration, the return value of the above command would be 0. The configuration files would be returned to Cell Manager server’s /etc/opt/omi/server/integ/config/Oracle8 location, as shown in the below example:

```
Cell_Manager_Server:/cat /etc/opt/omi/server/integ/config/Oracle8
-rw------- 1 root root 341 Nov 28 00:12 Cell_Manager_Server%initDBSID_bckp.ora
-rw------- 1 root root 870 Nov 28 00:12 Cell_Manager_Server%OB2_GLOBAL
-rw------- 1 root root 258 Nov 28 00:12 Cell_Manager_Server%DBSID
-rw------- 1 root root 61 Nov 28 00:13 Application_Server%OB2_GLOBAL
-rw------- 1 root root 282 Nov 28 00:13 Application_Server%DBSID
```

**ZDB configuration using Data Protector GUI**

This section describes how to configure the ZDB for Oracle databases using HP Data Protector 8.10.

- Open the HP Data Protector GUI and select Backup window.
- Select the “Oracle Server”, right click on it and select “Add Backup”.
- Select the new Backup type and Sub type as shown below in Figure 22.

**Figure 22. Creating a new ZDB backup**

![Create New Backup GUI](image-url)
- Enter the details of the Application system and Backup system in “Client systems”, as shown in Figure 23.
- Select the options as shown below to perform the ZDB backup and IR.

**Figure 23. Selecting application system, backup system with IR options**

<table>
<thead>
<tr>
<th>Application system</th>
<th>Backup system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Server</td>
<td>Cell Manager Server</td>
</tr>
</tbody>
</table>

- **Recovery management options**
  - Keep the schedule for the backup
  - Number of replicas rotated: 1
  - Track the replica for instant recovery

- **Snapshots management options**
  - Snapshot type: Virtual copy

- **Application system options**
  - Detach the filesystem on the application system before replica generation
  - Stop and/or access the application command line
  - Restart the application command line

- **Backup system options**
  - Use the same mountpoints as on the application system
  - Root of the mount path on the backup system:
    - /mnt
  - Add directories to the mount path
    - Hostname and session ID
  - Automatically mount the filesystem at destination mountpoints
  - Leave the backup system enabled
  - Enable the backup system in read/write mode
• Specify the “client” as “application server name/IP Address” and the name of the database SID in the “Application database” field. (Figure 24)

• Provide the Oracle database user and group name in the “Username” and “Group/Domain name” fields as shown in Figure 24.

• Proceed further to the next screen.

**Figure 24.** Application server, database and Oracle user/group information

---

The below Figures 25A – 25E show the configuration parameters to set up ZDB.

• Figure 25A shows the ZDB configuration of the Application server. Select the Application server and right-click, then select the “Configure” option. This screen (shown in Figure 25B) will show the Oracle configurations, including the General, Primary, Catalog, Standby and ZDB tabs.

• In the General tab shown in Figure 25B, provide the required inputs of client name, Oracle database name and Oracle server home directory.

• In the Primary tab shown in Figure 25C, provide the required inputs of username, password of Oracle database and Oracle database SID.

• In the Catalog tab shown in Figure 25D, provide the Oracle RMAN catalog database details of Oracle user, RMAN password and RMAN database name.

• In the ZDB tab shown in Figure 25E, select the ZDB method as “BACKUP_SET”. After providing all the inputs, click OK to proceed.

**Figure 25A.** Selecting ZDB configuration components of Application server

---

---
**Figure 25B.** Application server, Database and Oracle home directory details

![Configure Oracle](image1)

**Figure 25C.** Primary database and its credentials

![Configure Oracle](image2)
Figure 25D. Oracle RMAN catalog database details

Figure 25E. ZDB backup method
Figure 26 shows the selection for the Oracle database and its files to be backed-up.

- Select “DATABASE” to perform the complete database backup. Note that ZDB backup doesn’t take “ARCHIVELOG” mode of backup.

**Figure 26. Selection of Oracle database components**

- Select the available device for backup and proceed as shown in Figure 27. It shows that the StoreOnce device, StoreEver devices, and File Library are available.
- Choose the device for user backup.

**Figure 27. Selection of target backup device**

- Proceed with the rest of the screens which provide backup options for all the objects in the application.
- Define the Backup schedule.
- Complete the backup.
SAP R/3 backup
- After the successful ZDB backup, select the SAP backup method to perform SAP R/3 backup using HP Data Protector GUI.
- Open the HP Data Protector GUI. Select “SAP R/3”, right-click and select “Add backup” as shown in Figure 28.

**Figure 28.** Creating a new SAP R/3 backup

![Add Backup](image)

- Select “Brbackup_RMAN_Online” and select the “Backup Type” as “Snapshot or split mirror backup” and “Sub type” as “HP 3PAR” as shown in Figure 29.
- Click OK to proceed.

**Figure 29.** SAP backup type and backup options

![Create New Backup](image)
Figure 30 shows the “SAP configuration” window.

- Provide the “Oracle_Server home directory”, “SAP_data home directory”, and Oracle login information to connect the target Oracle database.
- Provide the “Backup and restore executables directory” information as shown.

**Figure 30. SAP backup configuration parameters**
• Enter the details of the “Application system” and “Backup system” in the “Client systems” field, as shown in Figure 31.
• Select the file options to perform the IR, also shown in Figure 32.

**Figure 31.** Selecting application system, backup system with IR options

![Figure 31](image1.png)

Figure 32 shows the selection for the database and its files for backup.

**Figure 32.** Selecting files for backup

![Figure 32](image2.png)
• Select the available device for backup and proceed further as shown in Figure 33. In this screen StoreOnce and StoreEver devices are available.
• Choose the device for user backup.

**Figure 33. Selection of target backup device**

![Selection of target backup device](image1)

• Proceed with the rest of the screens which provide backup options for all objects in the application.
• Define the Backup schedule.
• Complete the backup.

After the successful SAP backup configuration, the configuration files are created in the Cell Manager server’s `/etc/opt/omni/server/integ/config/SAP` location. For example,

```
Cell_Manager_Server:/cat /etc/opt/omni/server/integ/config/SAP
-rw------- 1 root 24 Nov 28 00:12 Application_Server%SAP<SID>
-rw------- 1 root root 258 Nov 28 00:12 Application_Server%DB<SID>
-rw------- 1 root root 61 Nov 28 00:13 APPlication_Server%_OB2_GLOBAL
```

**Instant Recovery**

Instant Recovery restores the Oracle database from the “snapshot” which is mounted in the Cell Manager server. During IR, the server unmounts and remounts the `/oracle` filesystem in the Application server where the database resides.

Before the IR operation, perform the following steps in the Application server:

• Reboot the Application server.
• Make sure the `/oracle` mount point is not mounted.
• Re-mount the `/oracle` mount point.
• Start the database with mount option “startup mount”. During IR, the database should not be in the “open” state.
• Start the IR operation.
• After successful recovery, start the database.
• Select the successful backup for Instant Recovery as shown in Figure 34.

**Figure 34. Instant Recovery window**

![Instant Recovery window](image2)
• From the “Source” tab, select the Application server’s database and select the option “Check the data configuration consistency” as shown in Figure 35.

**Figure 35. Instant Recovery options**

<table>
<thead>
<tr>
<th>Source</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Instant Recovery" /></td>
<td></td>
</tr>
</tbody>
</table>

Specify objects and options for restore. Click Restore or Preview when you are ready.

**Restore Objects**

- Application Server
- /Database

**Restore Options**

- **Restore method**: Copy replica data to the source location
- **Wait for data copy to complete**: [ ]
  - Wait up to [ ] minutes
- [ ] Retain source for forensics
- **Check the data configuration consistency**: [ ]
- [ ] Force the removal of all replica presentations
• From the "Options" tab, select the options "Recovery" and "Open database after recovery" as shown in Figure 36. Always perform the "Start Preview Session" first to verify any errors. Once the "Start Preview Session" completes, start the restore by selecting "Start Restore Session".

**Figure 36.** Instant Recovery options with Oracle user/group details

<table>
<thead>
<tr>
<th>Source</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image-url" alt="Instant Recovery: Oracle Server options" /></td>
<td>Modify Oracle Server options on this page. Click Restore or Preview when you are ready</td>
</tr>
</tbody>
</table>

- **Recovery**
  - User name: ora\hkm
  - User group: dba
  - Parallelism: 1
  - Recovery until: Now

- **Open database after recovery**

- **Reset logs**

**Warning:** It is highly recommended to preview the session before the restore.

*If you already did so or you feel confident enough, you can immediately start the restore.*

<table>
<thead>
<tr>
<th>Start/Preview Session Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image-url" alt="Start restore session" /></td>
</tr>
<tr>
<td><img src="image-url" alt="Start preview session" /></td>
</tr>
</tbody>
</table>

Note that upon successful restoration, the snapshot can be unmounted from the "Cell Manager server" (optional). The Reset logs option can be selected only after the "control files" are restored.

**Analysis and recommendations**

- This setup was tested with a 2-tier configuration (SAP Application server and Oracle database reside in the same server).
- Application server/Database server and Cell Manager server should be able to access the HP 3PAR StoreServ.
- Make sure the servers have enough swap memory before starting the SAP installation. Refer to the SAP installation guides for swap memory.
- HP 3PAR StoreServ CIM agent should be running on port numbers 5988 and 5989. This is required for SMIS-A configuration in the Application server and Cell Manager server using the omnidbzd command.
- After the HP Data Protector 8.10 installation, the omnirc.TMPL file will be created under the /opt/omni directory. Create an omnirc file from omnirc.TMPL in the same directory. This file has the ZDB, IR and SMIS agent parameters and the same can be used according to the setup. Read the HP Data Protector 8.10 installation guide for reference.
- Make sure all the PATH variables are set properly after the successful installation of SAP with Oracle database. Login with ora\<SID> user and check the PATH variables using the env command. Login with sap\<SID> user and verify the PATH variables using the env command.
- To ensure that the HP StoreOnce and HP StoreEver Backup system is discovered successfully, install these on the same subnet as the host machines accessing it. Typical installations have the HP StoreOnce and HP StoreEver Backup system connected to the same Gigabit Ethernet switch as the host machines that are carrying out the backups in order to gain optimum performance.
• Expiry and retention of the RMAN Backup sets are performed manually by an Oracle DB Admin – but this is “the norm” with Oracle RMAN backups.

• HP StoreOnce Catalyst is a licensable feature on HP StoreOnce Backup Appliances.

• The inline nature of the deduplication process means that it is a very processor and memory intensive task. HP StoreOnce appliances have been designed with appropriate processing power and memory to minimize the backup performance impact of deduplication. Best performance will be obtained by configuring a larger number of libraries/shares/Catalyst Stores with multiple backup streams to each device, although this has a trade off with overall deduplication ratio. For SAP with Oracle database separate VTLs or Catalyst Stores may be created for each instance.

• If servers with very similar data are to be backed up, a higher deduplication ratio can be achieved by backing them all up to the same library/share/Catalyst Store, even if this means directing different media servers to the same data type device configured on the StoreOnce appliance.

• The best backup performance to a device configured on a StoreOnce appliance is achieved using less than the maximum number of streams per device (the maximum number of streams varies between models).

• When restoring data from a deduplicating device, it must reconstruct the original un-deduplicated data stream from all of the data chunks contained in the deduplication stores. This can result in lower performance than that of the backup process (typically 80%). Restores also typically use only a single stream.

• Full backup jobs will result in higher deduplication ratios and better restore performance.

• StoreOnce does not implement any selective virtual device presentation, and so each virtual library will be visible to all hosts connected to the same fabric. It is recommended that each virtual library is zoned to be visible to only the hosts that require access.

• HP StoreOnce deduplication is the technology enabler for HP StoreOnce replication which allows fully automated replication without rehydration. This optimized replication works over low bandwidth links to a disaster recovery (DR) site, giving ROBO and small data centers a cost effective DR solution for the first time.

• This setup is not tested with Oracle database online redo log and archive log backup and recovery.

### Key point

• Virtual library devices are assigned to an individual interface. Therefore, for best performance, configure both FC ports and balance the virtual devices across both interfaces to ensure that one link is not saturated while the other is idle.

• Backup data to a local HP StoreOnce target and use low bandwidth replication to copy the backup to an off-site service provider such as HP StoreOnce VSA.

Refer to [hp.com/go/BURACompatibility](http://hp.com/go/BURACompatibility) for the compatibility matrix for HP StoreOnce and HP StoreEver.

### Summary

Backup and restore is critical to ensure business continuity. To address this criticality, SAP environments need a best in class backup solution. SAP Business Suite applications commonly run on Oracle databases, and for these applications customers demand the highest efficiency and performance in their SAP with Oracle environment, while minimizing cost (both CapEx and OpEx), and minimizing risk of data loss.

HP StoreOnce comes with highly efficient deduplication algorithms that can help customers keep their storage utilization and costs under control. HP StoreEver provides long term data protection and also complements HP StoreOnce. HP StoreOnce backup solutions integrate with HP Data Protector and HP StoreOnce appliances to deliver deduplication anywhere – application source, backup server, and target device (software store or dedupe appliance). This flexibility helps customers to easily integrate StoreOnce in their existing IT environments.

This white paper addresses the common needs related to backup and restore by integrating HP Data Protector features with SAP/Oracle databases. It shows that Zero Downtime Backup and Instant Recovery can restore an SAP instance to any point-in-time thereby reducing Recovery Time Objectives. As described throughout this document all of these components work together seamlessly to provide an HP backup and recovery solution for SAP with Oracle database to deliver return on investment and add to profitability.

### Implementing a proof-of-concept

As a matter of best practice for all deployments, HP recommends implementing a proof-of-concept using a test environment that matches as closely as possible the planned production environment. In this way, appropriate performance and scalability characterizations can be obtained. For help with a proof-of-concept, contact an HP Services representative at [hp.com/large/contact/enterprise/index.html](http://hp.com/large/contact/enterprise/index.html) or your HP partner.
Appendix A: Disclaimers

- Source volumes presented as the 3PAR volume set are not supported.
- Source volumes presented using the HostSet and Port-Present presentation types are not supported.
- On Linux, only two host configurations are supported, that is, application and backup servers must not be the same host.
- The target volumes from which the copy back needs to happen should not be presented to any host.
- No support for “Retain source for forensics”.

Glossary

- Application_Server – Application server with Oracle database (2-tier configuration)
- Cell_Manager_Server – Backup server
- CIM – Common Interface Module
- DA – Disk Agent
- EHP – Enhancement Packages
- ERP – Enterprise Resource Planning
- GUI – Graphical User Interface
- HP StoreEver – Tape Library
- HP StoreOnce – HP Disk to Disk appliance
- IR – Instant Recovery
- MA – Media Agent
- NAS – Network Attached Storage
- OCP – Operator Control Panel
- RTO – Recovery Time Object
- SAP R/3 – Real-time data processing/3 tier architecture
- SMI-S – Storage Management Initiative Specification agent
- VTL – Virtual Tape Library
- VSA – Virtual Storage Appliance
- ZDB – Zero Downtime Backup
For more information

Data Protector guides
After successful installation of HP Data Protector 8.10 Manager, the guides can be obtained from Data Protector Manager GUI interface. Refer to the documents before ZDB configuration. (Ensure Adobe® Reader is installed in the server.)

- HP Data Protector Manager ➔ Help ➔ guides
- Zero Downtime Backup Concepts Guide
- Zero Downtime Backup Administrators’ Guide
- Zero Downtime Backup Integration Guide

For more information on the HP BladeSystem c7000 enclosure, refer to: hp.com/go/bladesystem/enclosures
For detailed information on HP Data Protector Support matrices please visit: hp.com/go/dataprotector
For more information on HP 3PAR StoreServ storage, refer to: hp.com/go/3PARStoreServ
For more information on the Onboard Administrator, refer to: hp.com/info/onboard
For more information on HP Virtual Connect, refer to: hp.com/go/virtualconnect
For more information on HP StoreEver installation and configuration guide, refer to: hp.com/go/storeever


For more information on the HP blade server’s, refer to: hp.com/go/bladesystem
For more information on SMI-S agent:
For SAP downloads and installation: service.sap.com
HP Oracle Applications and Technology Site: hporacle.com

To help us improve our documents, please provide feedback at hp.com/solutions/feedback.