

# Hitachi Data Protection Suite for SAP Business Suite on Unified Compute Platform for VMware vSphere

## Reference Architecture Guide

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## Feedback

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# Table of Contents

<b>Solution Overview.....</b>	<b>3</b>
<b>Key Solution Elements.....</b>	<b>5</b>
Hardware Elements.....	5
Software Elements.....	6
Hitachi Data Protection Suite.....	7
Hitachi ShadowImage.....	7
Hitachi Thin Image .....	8
<b>Solution Design.....</b>	<b>9</b>
Backup Components on SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere.....	10
Logical Components of HDPS.....	11
High-level Backup Infrastructure.....	14
Hitachi Data Protection Suite Installation.....	16
Storage Architecture for Backup on Hitachi Unified Storage VM.....	17
CommCell Configuration.....	22
Backup and Recovery Operations.....	35
<b>Engineering Validation.....</b>	<b>42</b>
Test Methodology.....	42
Test Results.....	43

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# Hitachi Data Protection Suite for SAP Business Suite on Unified Compute Platform for VMware vSphere

## Reference Architecture Guide

The reference architecture guide [SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere](#) describes a framework within which an Oracle-based SAP Business Suite landscape can be deployed on Hitachi Unified Compute Platform for VMware vSphere. In order to offer Unified Compute Platform for VMware vSphere as an enterprise platform for SAP Business Suite to customers, it is necessary to ensure that all major aspects of SAP infrastructure operations such as vSphere deployment, data protection, and automation can be handled within the solution.

This paper describes a data protection (operational protection) example architecture using Hitachi Data Protection Suite (HDPS) as backup software. HDPS is capable of backup/recovery of SAP Business Suite systems on various databases such as Oracle, MSSQL Server, DB2, Max DB, and Sybase ASE. Refer to <http://documentation.commvault.com/hds/v10/article?p=backup.html> for all the SAP backup solutions supported with HDPS. HDPS can create backups using traditional approaches (network based backups) as well as using Intellisnap and Hitachi storage array Shadow and Thin Image backups. In this reference architecture guide, an SAP ERP system based on the Oracle database is used for testing purposes.

This architecture provides the following business benefits for customers:

- SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere can be operated as a standalone solution without requiring the effort of integrating into legacy data protection infrastructures.
  - Provides a contained environment in which to evaluate new Hitachi backup solutions in daily real life operations before rolling them out into the complete customer landscape.
  - Operating costs can be significantly reduced by automated infrastructure solutions.
-

This technical paper assumes familiarity with the following:

- Storage area network-based storage systems
- General storage concepts
- General network knowledge
- SAP Business Suite platform
- Common IT best practices
- Oracle database backup, restore and recovery concepts

Use this document to assist sales and support, to understand the example reference architecture for SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere data protection configuration, and to help with deployment of the configuration.

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## Solution Overview

This reference architecture guide describes a data protection procedure for SAP Business Suite with the Oracle database on Hitachi Unified Compute Platform for VMware vSphere using the backup/recovery application Hitachi Data Protection Suite (HDPS) powered by Commvault. HDPS can be used in two different ways to backup the SAP Business Suite system and Oracle database:

- Network based backup: traditional online and offline backup of Oracle database and backup of archive logs.
- Storage based backup of Oracle database volumes. Database volume backup is done with HDPS Intellisnap. HDPS Intellisnap makes use of HDS ShadowImage and Thin Image backup methodologies. Online and Offline backups can be taken using this method also. For engineering validation, online backups have been used.

In this solution, there is a combined approach. For the database volumes, HDS Thin Image and ShadowImage backups are used, which are much faster than traditional network based backup approaches. For archive log backups, traditional streaming is used, as it provides file based backup and restore of archive logs, and therefore provides easier way of database recovery. Also, for SAP file system backup, a traditional network based backup approach is deployed, as the data agent used for SAP Oracle (explained later) does not cover SAP file systems. HDPS creates application aware backups using SAP's command line tools for Oracle administration (BRTOOLS), which make these backups usable by the SAP system for operational recovery as well as for general housekeeping purposes. HDPS provides the program *backint*, which is an interface to SAP administration tools. Backint integrates with both backup approaches explained above. HDPS Intellisnap can also be used for creating snapshots of operating system virtual machines based on SAP systems.

This solution demonstrates the following:

### 1. Thin Image Backups

- Perform online Thin Image backups (snapshots) of SAP system's Oracle database on Hitachi Unified Storage VM array.
  - Recover SAP system's Oracle database with point-in-time recovery using Thin Image backups.
-

## 2. ShadowImage Backups

- Perform online ShadowImage backups (clones) of SAP system's Oracle database on Hitachi Unified Storage VM array.
- Backup copy of ShadowImage backups from storage array to tape library.
- Recover SAP system's Oracle database with point in time recovery using ShadowImage backups from Hitachi Unified Storage VM array or tape library.

## 3. Archive Log Backups

- Perform traditional archive log backups of offline redo log files generated by SAP system's Oracle database to tape.
- Restore of offline redo log files from tape.

## 4. SAP File System Backups

- Perform backup of the SAP application's critical file system from the Linux operating system and any other customer-specific application directories to tape.
- Restore SAP application's file system from tape.

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**Note** — These procedures were developed in a lab environment. Many things affect production environments beyond prediction or duplication in a lab environment. Follow recommended practice by conducting proof-of-concept testing for acceptable results before implementing this solution in your production environment. Test the implementation in a non-production, isolated test environment that otherwise matches your production environment.

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This paper discusses the architecture and configuration needed to perform the backup and recovery in detail. For specific details on the SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere in this solution, refer to the reference architecture guide *SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere* at <http://www.hds.com/assets/pdf/sap-business-suite-on-hitachi-ucp-for-vmware-vsphere-reference-architecture-guide.pdf>.

## Key Solution Elements

### Hardware Elements

Table 1, Table 2, and Table 3 describe the hardware used to deploy the backup and recovery solution for an SAP ERP system and Oracle database on Hitachi Unified Compute Platform for VMware vSphere.

**Table 1. Unified Compute Platform Management Servers and Storage**

<i>Feature</i>	<i>Configuration</i>
Server Type	<ul style="list-style-type: none"> <li>■ Two CR 210HM 1U Rack mount</li> </ul>
CPU	<ul style="list-style-type: none"> <li>■ Two Intel® Xeon® E5-2670</li> <li>■ Total 16 physical cores (8 per CPU)</li> <li>■ 2.6 GHz</li> </ul>
Memory	<ul style="list-style-type: none"> <li>■ 192 GB (12 × 16 GB)</li> </ul>
Network	<ul style="list-style-type: none"> <li>■ 2 Port 1Gb onboard card</li> <li>■ 2 Port 10 Gb (Emulex) PCIe card</li> </ul>
Fibre Channel	<ul style="list-style-type: none"> <li>■ Hitachi FiVE 8 Gb 2 Port Fibre Channel PCIe</li> </ul>
Hitachi Unified Storage VM	<ul style="list-style-type: none"> <li>■ Block storage for SAP ERP Application and database</li> </ul>
Tape Library	<ul style="list-style-type: none"> <li>■ Tape Library for backup copy of ShadowImage and archive log backups.</li> </ul>

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Note : Check Commvault's website <https://ma.commvault.com/Support/CompatibilityMatrices> for all supported tape libraries.

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**Table 2. Unified Compute Platform Compute Chassis**

<i>Feature</i>	<i>Configuration</i>
Chassis Type	<ul style="list-style-type: none"> <li>■ Two Hitachi CB 500 Chassis</li> <li>■ Scalable to Eight CB520H B1/B2 Blades per chassis</li> </ul>
Power and Cooling	<ul style="list-style-type: none"> <li>■ Four 2142W Power Supplies</li> <li>■ Six Fan Modules</li> </ul>
Admin Access	<ul style="list-style-type: none"> <li>■ Two SVP Modules</li> </ul>
Network Switches	<ul style="list-style-type: none"> <li>■ Two Brocade 6746 - 24 Port 10 Gb Ethernet Switch Modules (16 internal, 8 external)</li> </ul>
Fibre Channel Switches	<ul style="list-style-type: none"> <li>■ Two Brocade 5460 - 12 Port Fibre Channel Switch Modules (8 internal, 4 external)</li> </ul>

**Table 3. Unified Compute Platform Compute Blades**

<i>Feature</i>	<i>Configuration</i>
Blade Type	<ul style="list-style-type: none"> <li>■ CB520H B2 with CNA</li> </ul>
CPU	<ul style="list-style-type: none"> <li>■ Two Intel® Xeon® E5-2690v2</li> <li>■ Total 20 physical cores (10 per CPU)</li> <li>■ 3 GHz</li> </ul>
Memory	<ul style="list-style-type: none"> <li>■ 192 GB (12 × 16 GB)</li> </ul>
Network	<ul style="list-style-type: none"> <li>■ Onboard 2 Port 10 Gb Ethernet</li> </ul>
Fibre Channel	<ul style="list-style-type: none"> <li>■ Hitachi FiVE 8 Gb 2 Port Fibre Channel Mezzanine Card</li> </ul>

## Software Elements

Table 4 describes the software deployed in this solution.

**Table 4. Software Elements**

<i>Software</i>	<i>Version</i>
SAP ERP	SAP Business Suite 7 i2010
Oracle RDBMS	11.2.0.3
HDPS Powered by CommVault	V10 SP7
RedHat Linux	6.4
Microsoft® Windows	2012 R2 Data Center Edition
VMware vSphere	5.5
Hitachi Command Control Interface (CCI)	01-32-03/01

## Hitachi Data Protection Suite

[Hitachi Data Protection Suite](#), powered by CommVault® is a tightly integrated blend of snapshot, replication and persistent copies that are application-aware, secure, de-duplicated, managed and accessible through a single, unified platform. This unified approach results in an easy, automated and low cost data management solution, at a fraction of the time, effort and money required by separate point products.

Today's dynamic storage environments are too complex to manage with native tools, loosely integrated software packages and disjointed processes. Hitachi Data Protection Suite delivers powerful data protection capabilities within a truly unified platform. The Data Protection Suite's automated, policy-driven IntelliSnap supports leading storage platforms and applications. It also helps users protect hundreds of virtual machines in minutes and easily scales to thousands of VMs and physical servers.

- Ensures 100% application consistent snapshots and shifts the data protection workload from the virtual platform to storage system.
- Manages and protects hundreds of VMs within a single management interface with minimal impact on production environments.
- Enables robust private and public cloud solutions.
- Provides universal de-duplication—starting from the source all the way to tape, globally across sites—across VMs.
- Tightly integrates with Hitachi Content Platform to provide intelligent, policy-based data movement that enables seamless tiering to the cloud.

## Hitachi ShadowImage

[Hitachi ShadowImage](#) Replication software is a non-disruptive, host-independent, data-replication solution for creating copies of any IT administrator-accessible data within a single Hitachi storage system. ShadowImage Replication also maintains the availability of host applications by enabling backup operations to run concurrently while business or production applications are online.

Features of Hitachi ShadowImage:

- Provides high-speed, non-disruptive, full volume, RAID-protected local mirroring and point-in-time capabilities for Hitachi storage platforms.
  - Ideal for either open systems or mainframe environments.
  - Enables nearly instant point-in-time recovery from data corruption or data loss compared to non-disk based solutions, such as tape- or vault-based recovery.
-

## Hitachi Thin Image

[Hitachi Thin Image](#) snapshot provides logical, change-based, point-in-time data replication within Hitachi storage systems for immediate business use. Business usage can include data backup and rapid recovery operations, as well as decision support, information processing, and software testing and development.

Features of Hitachi Thin Image:

- Maximum capacity of 5.0 PB enables larger data sets or more virtual machines to be protected.
  - Maximum 1024 snapshots for greater snapshot frequency and/or longer retention periods.
  - Asynchronous operation greatly improves response time to host.
  - Enhanced for super-fast data recovery performance.
-

## Solution Design

This solution was tested using one SAP ERP system (ABAP stack) and Oracle database configuration only; however, any system that is part of SAP Business Suite (ABAP stack) on Oracle database is supported with this reference architecture. SAP SCM, which uses the liveCache database in addition to Oracle, is supported but not covered in this reference architecture guide. For information about how to deploy this type of backup solution, refer to [http://documentation.commvault.com/hds/v10/article?p=prod\\_overview/sap\\_max.htm](http://documentation.commvault.com/hds/v10/article?p=prod_overview/sap_max.htm). For information concerning your implementation, contact your HDS Global Services and Support (GSS) representative. The solution design has the following sections:

- Backup Components on SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere
  - Logical Components of HDPS
  - High-level Backup Infrastructure
  - Hitachi Data Protection Suite Installation
  - Storage Architecture for Backup on Hitachi Unified Storage VM
  - CommCell Configuration
  - Backup and Recovery Operations
-

## Backup Components on SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere

Data protection of the complete solution SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere can be divided in two parts:

### 1. Unified Compute Platform (UCP) Management Stack

The management stack consists of the following virtual machines and the associated applications that are supported by each virtual machine, as shown in Table 5.

**Table 5. Virtual Machines and Associated Applications**

<i>Virtual Machines</i>	
<ul style="list-style-type: none"> <li>■ AD               <ul style="list-style-type: none"> <li>■ Active Directory</li> <li>■ DNS</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ vCenter               <ul style="list-style-type: none"> <li>■ vSphere 5.x</li> <li>■ AutoDeploy</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>■ UCP Management               <ul style="list-style-type: none"> <li>■ UCP Director</li> <li>■ ESXi Images</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ UCP Utility               <ul style="list-style-type: none"> <li>■ DHCP</li> <li>■ Syslog</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>■ HCS (Hitachi Command Suite)               <ul style="list-style-type: none"> <li>■ HCSM (Hitachi Compute Systems Manager)</li> <li>■ HDvM (Hitachi Device Manager)</li> <li>■ Storage Navigator</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ SRM (Site Recovery Manager)               <ul style="list-style-type: none"> <li>■ CCI</li> <li>■ SRA (Storage Replication Adapter)</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>■ HTnM               <ul style="list-style-type: none"> <li>■ Tuning Manager</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ DCD               <ul style="list-style-type: none"> <li>■ Datacenter Director</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>■ WSUS               <ul style="list-style-type: none"> <li>■ Windows OS Patches</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ WDS               <ul style="list-style-type: none"> <li>■ OS Images</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>■ SQL               <ul style="list-style-type: none"> <li>■ vCenter</li> <li>■ SSO</li> <li>■ UCP Director</li> </ul> </li> </ul>	

HDPS Intellisnap specific agents that support snapshots of virtual machines refer to [http://documentation.commvault.com/hds/v10/article?p=products/vs\\_vmware/snap/overview.htm](http://documentation.commvault.com/hds/v10/article?p=products/vs_vmware/snap/overview.htm). For backup and restore of databases, file-systems, or other applications such as active directory of the UCP management stack refer to <http://documentation.commvault.com/hds/v10/article?p=backup.html>

#### 1. UCP Compute Stack

The compute stack consists of:

- RedHat Linux 6.4 virtual machines
- SAP Business Suite and Oracle database.

The scope of this paper only covers the backup and restore procedure for SAP Business Suite and Oracle database. For backups of Linux virtual machines using HDPS Intellisnap refer to: [http://documentation.commvault.com/hds/v10/article?p=products/vs\\_vmware/snap/overview.htm](http://documentation.commvault.com/hds/v10/article?p=products/vs_vmware/snap/overview.htm)

## Logical Components of HDPS

**CommCell** - the term used to describe a single, unique data management domain. The CommCell domain consists of following logical software components:

**CommServe** - provides command and control. This is a central management instance with its own SQL server database that provides management functions for the whole backup infrastructure. It communicates with all clients and media agents and coordinates all operations such as backups, restores, copies, and media management within a CommCell.

**Media Agent** - provides media management and data indexing. Media agent is responsible for transmission of data between client and backup media.

**Data Agent** - provides support for different file systems and applications, plus any add-on capabilities like media management or advanced features. These agents are deployed on the client machine and trigger the backup and restore functions based on commands received from CommCell. In this solution, two data agents are used:

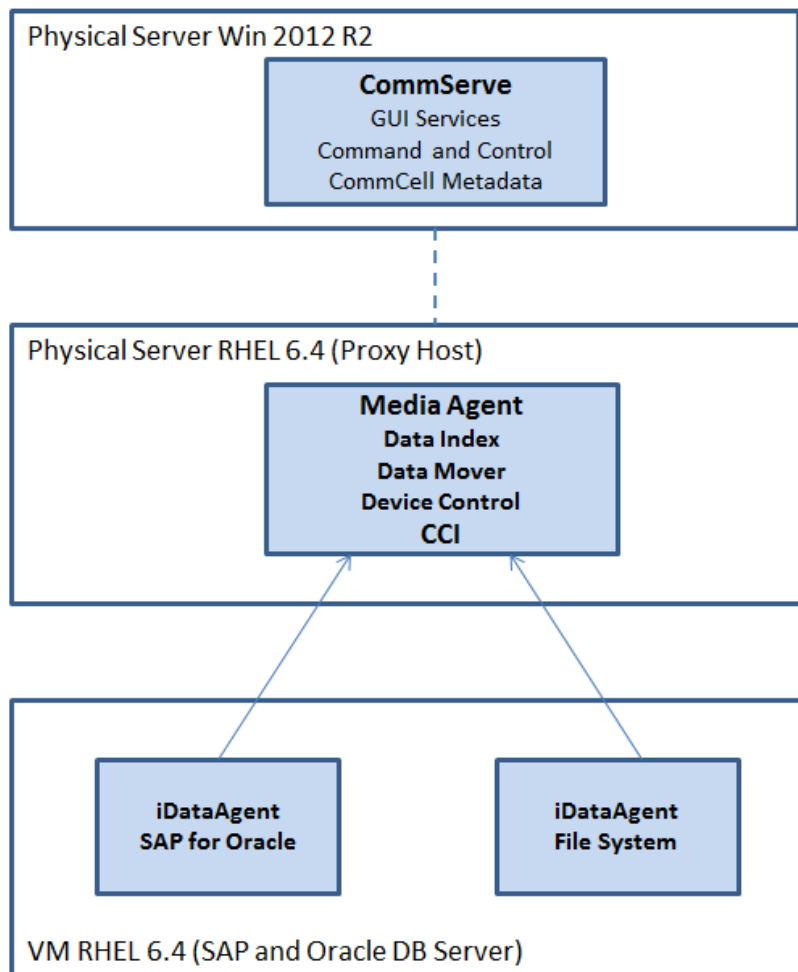
- SAP Oracle iDataAgent is installed on the virtual machine that has the SAP application and Oracle database installed. SAP Oracle iDataAgent recognizes the Oracle database file system structure of an SAP system and knows what to backup.
  - Linux File System Agent is used to backup SAP application's non-database file system which includes the SAP system profile, kernel, and transport directory. This agent is not specific to any application or database, but can be used for backup of any file system on Linux. These file systems must be browsed from the server and added to subclients (explained in the CommCell Configuration section).
-

**Proxy Host** - can be used to offload the task of backup copy to the media. This is usually an optional component, but in this solution using a physical proxy host is mandatory. HDPS can only mount the ShadowImage volumes on a physical server to perform a backup copy to media and restore to production volumes. The physical proxy host that is used must have the same operating system as the client host. Hence, the physical proxy host used in this solution has RedHat Linux 6.4 operating system.

**Command and Control Interface (CCI)** - enables you to perform storage system configuration and data management operations by issuing commands to the Hitachi RAID storage systems. CCI issues commands to Hitachi Unified Storage VM for creating Thin Image or ShadowImage backups of the SAP Oracle production volumes. An HORCM instance is automatically created by HDPS Intellisnap based on the array configuration in CommCell.

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Figure 1 shows the CommCell architecture used in this solution. CommServe must be installed on the Windows operating system as it also has an SQL Server database for its own operations. The Media Agent must be installed on a separate proxy host because the operating system must be the same type (RHEL 6.4) as the systems that are being backed up (SAP systems). For validation purposes, two blades from the solution are used as backup servers. One blade is used to install the Windows 2012 R2 operating system and CommServe. The second blade is used to install Media Agent, Proxy Host, and CCI. Both of these blades are used as bare metal and not virtual machines. SAP Oracle iDataAgents and Linux File System agent must always be installed on the same server as the SAP system.



**Figure 1**



## High-level Backup Infrastructure

iDataAgents are always installed on the client VMs (whose host software backup is to be taken). For example, SAP Oracle iDataAgent is installed on the server where SAP Business Suite and Oracle database are running. Other components can be installed on one or more backup servers. The CommServe and Media Agent components are always part of the backup solution using HDPS, no matter what functionality is desired. The use of a proxy host is usually optional but it is recommended to reduce load on production servers during backup and in this solution it is necessary. Only the iDataAgent types and their number need to be specified in order to deliver the desired solution. One or more CommCells may be deployed within the customer's environment in order to meet geographic, technical or business needs. The backup infrastructure for this solution requires a Windows 2012 R2 server for the installation of CommServe. Physical servers have been used for CommServe installation, although it can also be installed on a virtual machine. Also, a RedHat Linux 6.4 physical server is required for the installation of the proxy server and media agent. There are two possible options for installing backup servers in a customer environment:

### 1. Customer supplied hardware:

Plug the external backup servers HBAs directly into the Brocade 6510 FC switches and backup server NIC directly into the 10 Gig Ethernet switch. While this option consumes ports on the switch, it does not take away compute resources and also offloads all backup processes outside of UCP. Mark backup Ethernet switch ports as unmanaged ports.

### 2. CB 500 blades:

Blades from any CB 500 chassis on UCP on the VMware rack can be used as backup servers. This option allows the backup servers to already be fully integrated into the environment, utilizing the existing Fibre Channel connections to the array. This will use the compute resources from the solution, but it will not consume additional Brocade 6510 switch ports. In Unified Compute Platform Director, create a custom service template for the blade and apply it so that this blade can be excluded from Unified Compute Platform Director management. Mark backup Ethernet switch ports as unmanaged ports.

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This solution is tested in the lab using option 2, CB520H blades in the UCP on VMware rack. Figure 2 describes the backup infrastructure and SAN design.

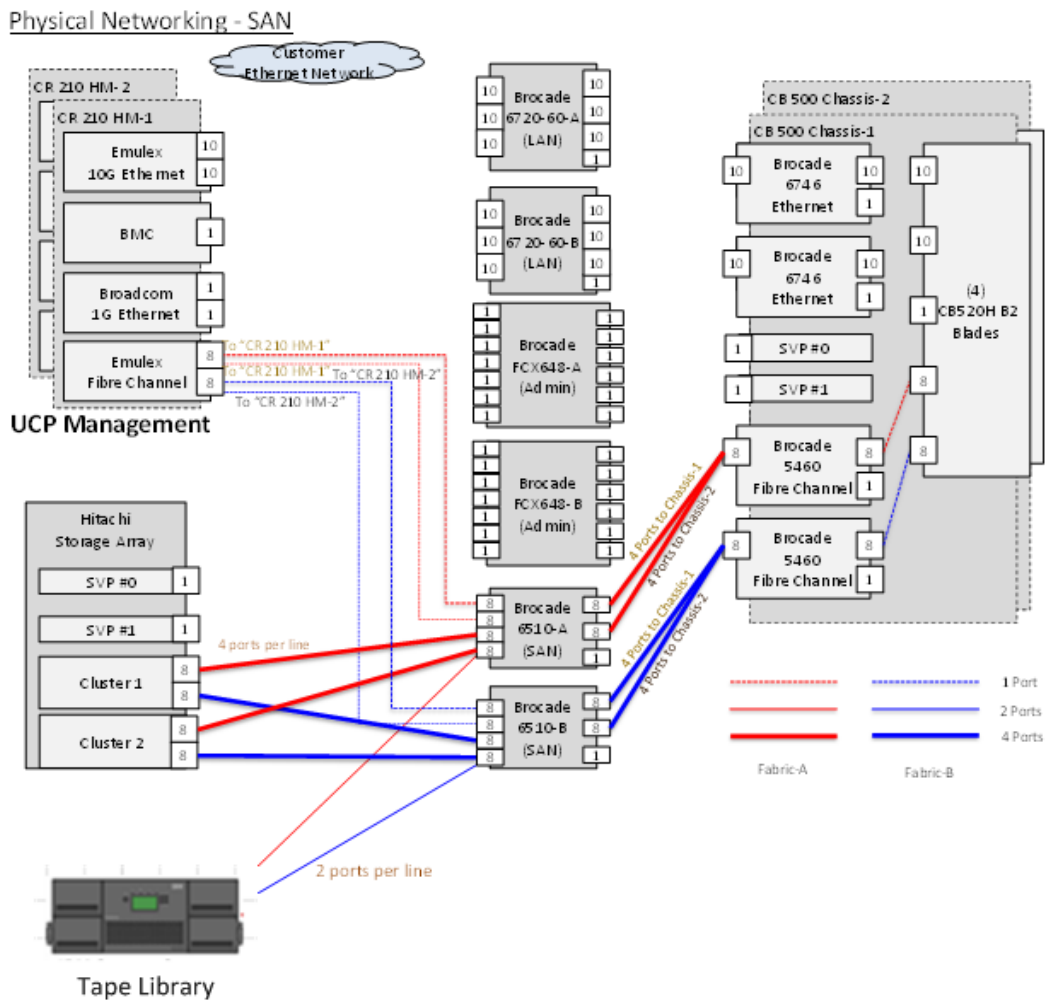


Figure 2

The Hitachi Unified Compute Platform used for this reference architecture uses two redundant SAN fabrics. Each fabric is comprised of one 8 Gb Brocade 6510 Fibre Channel switch and one 8 Gb Brocade 5460 Fibre Channel switch in every blade chassis. Each CB520H B2 compute blade has two redundant 8 Gb Fibre Channel connections, one in each SAN fabric. There is one 8 Gb connection to Hitachi Unified Storage VM from each of the Brocade 6510 SAN switches. Also, there are two connections from each Brocade 6510 switch to the tape library (there are two drive boxes on the tape library used for validation and one connection goes to each drive box from each of the Brocade 6510 switches). Media Agent Server (the Proxy Host) needs a connection to the tape library and Hitachi Unified Storage VM. To achieve this, SAN zoning is performed on each of the Brocade 6510 switches. Zoning is performed between one HBA port of the Compute Blade 500 servers, one Hitachi Unified Storage VM port, and two ports of the tape library on each of the Brocade 6510 switches.

## Hitachi Data Protection Suite Installation

This section highlights where in this solution the HDPS components are installed and links to necessary documentation for performing the installation.

### CommServe Installation

Install Windows 2012 R2 server on the CB520H B2 blade. CommServe must be installed on the Windows server as it also installs an SQL server database on this Windows machine. For requirements to install CommServe refer to [http://documentation.commvault.com/hds/v10/article?p=system\\_requirements/commserve.htm](http://documentation.commvault.com/hds/v10/article?p=system_requirements/commserve.htm)

For installation of CommServe refer to <http://documentation.commvault.com/hds/v10/article?p=deployment/install/commserve.htm>

### MediaAgent Installation

Install RedHat Linux 6.4 on the CB520H B2 blade on the proxy host. For basic scalability and hardware requirements refer to [http://documentation.commvault.com/hds/v10/article?p=system\\_requirements/ma.htm](http://documentation.commvault.com/hds/v10/article?p=system_requirements/ma.htm) . However, resource required by Media Agent depends on the amount of data that is moved.

During the installation, HDPS installer gathers the details of the CommServe instance and adds Media Agent to this instance.

For the installation of Media Agent in a Linux environment refer to [http://documentation.commvault.com/hds/v10/article?p=deployment/install/ma\\_unix.htm](http://documentation.commvault.com/hds/v10/article?p=deployment/install/ma_unix.htm)

### SAP Oracle iDataAgent Installation

SAP Oracle iDataAgent is installed on the Linux virtual machine on which SAP and Oracle are installed.

For requirements to install SAP Oracle iDataAgent refer to [http://documentation.commvault.com/hds/v10/article?p=system\\_requirements/sap.htm](http://documentation.commvault.com/hds/v10/article?p=system_requirements/sap.htm)

For installation of SAP Oracle iDataAgent refer to [http://documentation.commvault.com/hds/v10/article?p=products/sap\\_oracle/deployment\\_unix.htm](http://documentation.commvault.com/hds/v10/article?p=products/sap_oracle/deployment_unix.htm)

During the installation, HDPS installer prompts for the details of the CommServe instance and adds SAP Oracle iDataAgent to this instance.

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## Linux iDataAgent for File System Installation

Linux iDataAgent for File System is installed on the Linux virtual machine on which SAP and Oracle are installed.

For requirements to install Linux iDataAgent for File System refer to [http://documentation.commvault.com/hds/v10/article?p=system\\_requirements/linux.htm](http://documentation.commvault.com/hds/v10/article?p=system_requirements/linux.htm)

For installation of Linux iDataAgent for File System refer to <http://documentation.commvault.com/hds/v10/article?p=products/linux/deployment.htm>

During the installation, HDPS installer prompts for the details of the CommServe instance and adds Linux iDataAgent for File System.

## Storage Architecture for Backup on Hitachi Unified Storage VM

This section explains the storage architecture of backup infrastructure and the manual steps required on Hitachi Unified Storage VM before HDPS configuration.

The SAP for Oracle iDataAgent backup covers the following:

- Dynamic Provisioning Volumes that contains Oracle database files (\*.data\*)
- Dynamic Provisioning Volumes Oracle database control files (\*.dbf)
- Dynamic Provisioning Volumes Oracle parameter files (\*.ora)
- Archive log files (file based backup used in this reference architecture)

The iDataAgent for Linux file system backup covers the following:

- SAP system profiles
  - SAP kernel
  - SAP transport directory
-

SAP Oracle iDataAgent automatically identifies the Oracle database Dynamic Provisioning Volumes (DP-VOLs) for backup. iDataAgent for Linux file system, on the other hand, is not an SAP specific agent and therefore all SAP file systems whose backup is to be taken, should be manually configured in the subclient of this agent (explained later in the CommCell Configuration section). In this reference architecture, archive log backup and SAP file system backup are configured as network based backups to tape. Therefore, no manual storage configuration is required for these two types of backups.

This section explains the storage configuration for ShadowImage and Thin Image backups of Oracle database volumes (/oracle and /sapdata volumes). These volumes are created as DP-VOLs in the Hitachi Dynamic Provisioning Pool. For Oracle database storage architecture details, refer to the reference architecture guide [SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere](#). These DP-VOLs are the source for ShadowImage and Thin Image backup volumes and are called PVOLs. One Hitachi Dynamic Provisioning Pool is created for ShadowImage and Thin Image each. These pools are called ShadowImage Pool (SI Pool) and Thin Image Pool (TI Pool). There will be one target volume for each of the PVOLs in ShadowImage and Thin Image backups. For ShadowImage, this target volume is called SVOL, and for Thin Image, this target volume is called VVOL. All SVOLs reside in the SI Pool and all VVOLs reside in the TI Pool. Information regarding these pools and volumes is configured in the CommCell console and Intellisnap uses them to perform backups.

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Figure 3 shows the DP-VOLs of SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere solution that are identified by SAP Oracle iDataAgent automatically for ShadowImage and Thin Image backup. In the [SAP Business Suite on Hitachi Unified Compute Platform for VMware vSphere](#) reference architecture, the same DP-VOL is used for Oracle binaries (/oracle) and the SAP file system. This implies that when /oracle DP-VOL is restored, the SAP file system will also be restored along with it. It may not be the desired scenario in some environments. To avoid this, /oracle and the SAP file system must be installed on separate DP-VOLs. Because the SAP file system backup is not part of backups performed by SAP Oracle iDataAgent, to cover data protection in the second scenario (separate DP-VOLs for /oracle and SAP file systems), the SAP file system backup is configured as a network-based backup in this reference architecture guide. This provides more flexibility as /oracle DP-VOL backup and restore is done with other Oracle database DP-VOLs using ShadowImage or Thin Image backup, and SAP file system backup and restore can be performed separately with Linux File System iDataAgent as required. These two backup and restores may or may not be performed together based on customer requirements.

## Storage Layout

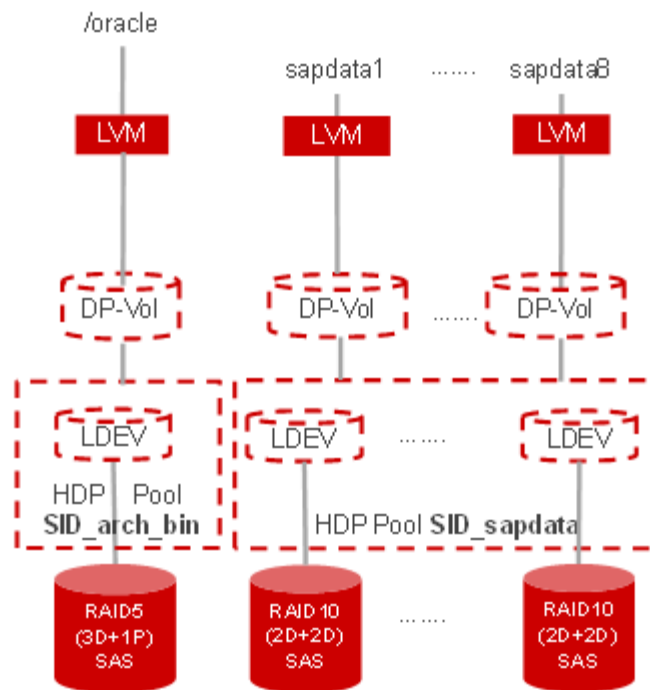


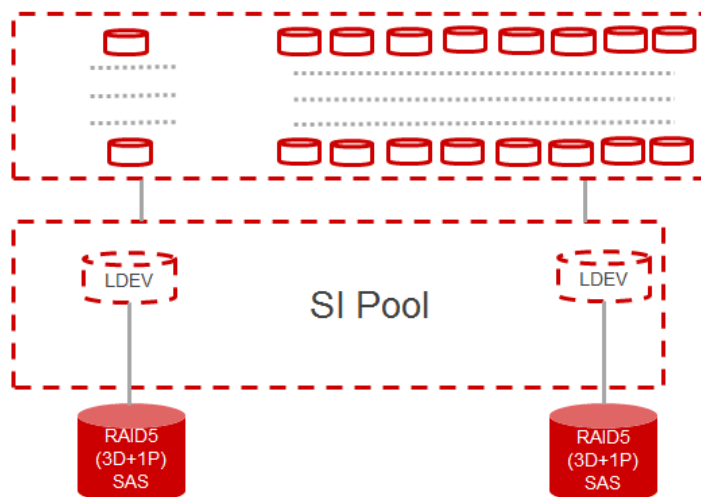
Figure 3

## ShadowImage Pool

A ShadowImage Pool (SI Pool) is a Hitachi Dynamic Provisioning pool created manually with a size large enough to carry the desired number of SVOLs for all the PVOLs (maximum of three SVOLs). In this reference architecture, there are two SVOLs for each PVOL. Use the following guidelines for creating SI Pool and SVOLs:

1. SI Pool and SVOLs are created manually before configuring HDPS. An SI Pool is created with the Pool Type set to *Dynamic Provisioning*. SVOLs are created as DP-VOLs in the SI Pool.
2. All SVOLs are created in a single Dynamic Provisioning Pool (SI Pool).
3. A maximum of three mirror units (MUs) or SVOLs of PVOLs are allowed.
4. All of the SVOLs of the ShadowImage pool need to be created with the same name, and with the same CU number or same CU number range. The CU number is the middle number of the LDEV ID (LDKC:CU:LDEV). This CU number (or CU number range) and name of the SVOL LDEV is configured in HDPS Intellisnap to recognize the target volumes.

### ShadowImage Architecture



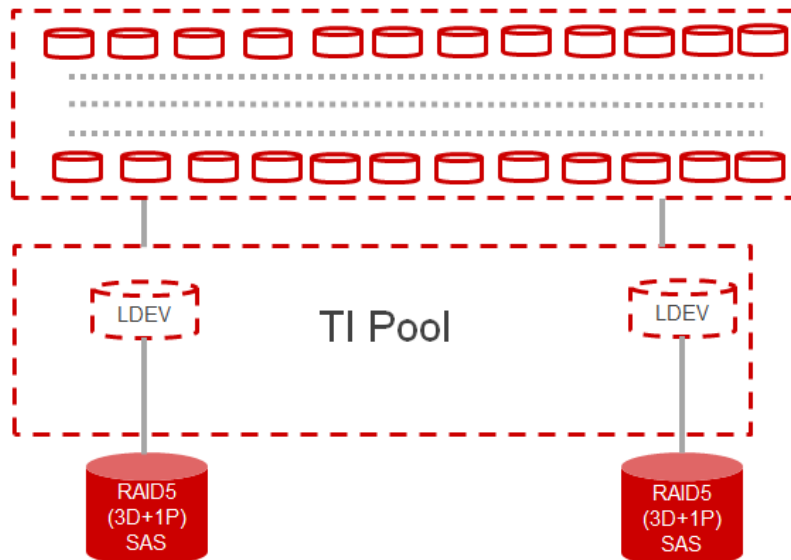
**Figure 4**

## Thin Image Pool

For Thin Image backups, a Thin Image (TI Pool) is manually created on the storage array with a size big enough to hold the maximum number of Thin Image copies required. The TI pool is created with the Pool type set to *Thin Provisioning*. Thin Image volumes of PVOLs are called VVOLs. One VVOL is created for each PVOL whose Thin Image copy is created. However, VVOLS for the Thin Image will be created automatically by Intellisnap (through CCI) when the Thin Image backup is requested. Also, VVOLS need not be of the same size and PVOLS, because the size of VVOL depends on the changed data in PVOL since the last backup. Figure 5 shows the storage architecture of Thin Image.

Multiple VVOLS are created automatically in the Thin Image Pool (TI Pool) by Intellisnap for Oracle and Sapdata Thin Image operation. Since this is not a complete replica, the size of VVOLS will generally be smaller than the original Oracle and Sapdata volumes. Intellisnap needs to be configured with the Pool ID to be used to create VVOLS.

*Thin Image Architecture*



**Figure 5**



## CommCell Configuration

This section covers the configuration of HDPS. These configuration steps are performed in CommCell console. Some of these configuration steps are generic, for example, adding a tape library to CommCell, and some are specific to data agents, for example, configuration of archive log backup of an SAP system. ShadowImage Pool and Thin Image pool must be created as described in the previous section of this guide before starting the configuration steps. During the configuration, information regarding Hitachi Unified Storage VM and tape library is added to Intellisnap through the CommCell console. Storage policies are created to configure the destination (storage array or tape) and retention period of backups. A database instance is created for each SAP system. In this reference architecture, a single database instance has been created which is an SAP ERP system (SID P08) used for validation of the backup/restore procedure. Finally, subclients are created for this database instance. A **subclient** is created within data agents in the CommCell console for every separate type of backup operation. For example, a subclient is created for ShadowImage backup or SAP file system backup. Subclient defines the properties of backup operation such as content and type of backup, storage policy, schedule (if any), and the proxy server (if used). In this reference architecture, a subclient has been created for each ShadowImage backup operation, Thin Image backup, archive log backup, and SAP file system backup. These configuration steps are described below in detail.

Configuring the CommCell server includes the following:

- ConfigureTape and Hitachi Unified Storage VM Array
  - Configure Storage Policies
  - Create SAP Database Instance in CommCell
  - Create Subclient for ShadowImage
  - Create a Subclient for Thin Image
  - Create a Subclient for Archive Log Backups
  - Create a Subclient for SAP File System Backups
  - Installation of CCI
-

## ConfigureTape and Hitachi Unified Storage VM Array

The **tape library** is connected to the Media Agent on the proxy host through the Fibre Channel connection. It is configured through CommCell console -> Storage -> Library and Drive -> Select Media Agent -> Detect/Configure Devices. All media devices connected to the Media Agent are detected. Right click on the tape library and click configure. The tape library is now ready to use. Figure 6 shows steps to configure the tape library.

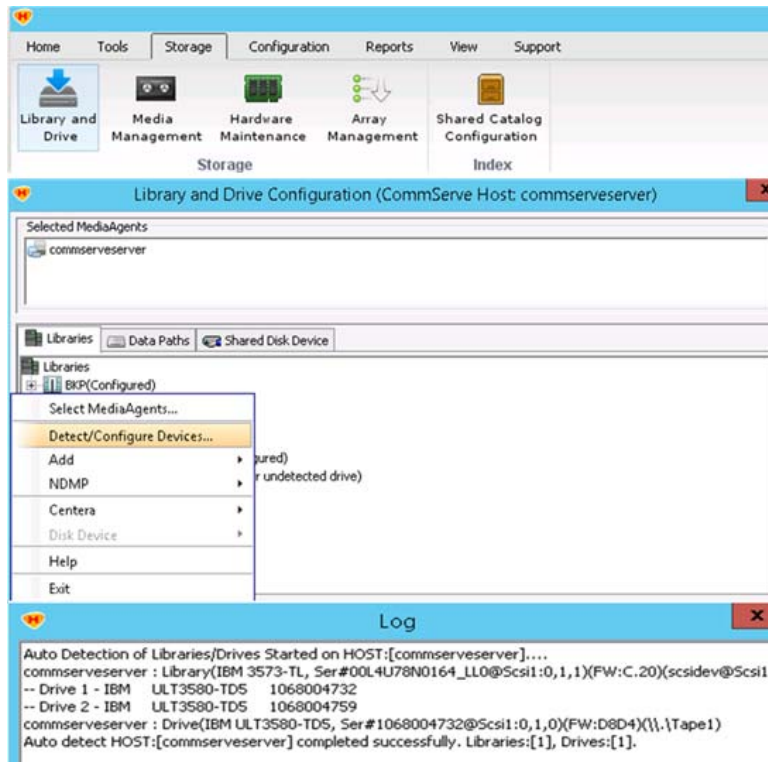


Figure 6

## Hitachi Unified Storage VM

Hitachi Unified Storage VM is configured through CommCell console -> Storage -> Array Management.

In the **General** section enter the array vendor, Name, which is the serial number for the array, control host (not required when managing array using CCI), and username/password of Storage Navigator. HDPS can manage Hitachi storage array in two ways:

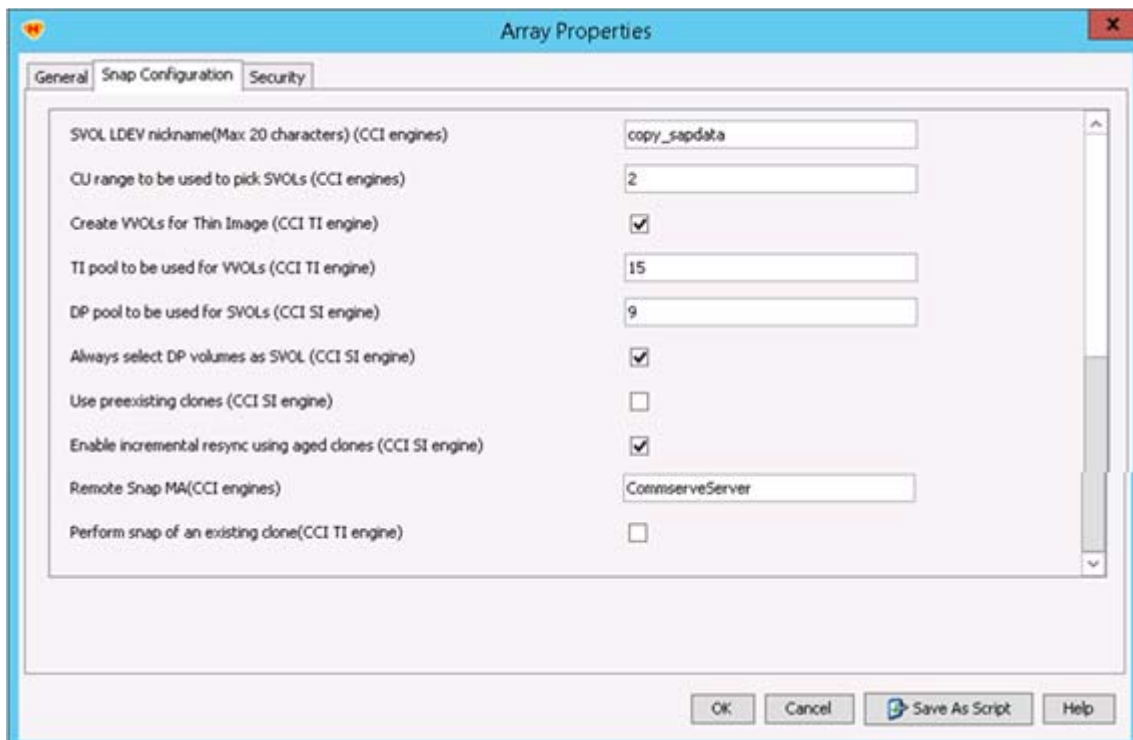
- Using Hitachi Device Manager
- Using Hitachi Command Control Interface (CCI)

For this reference architecture, Hitachi Unified Storage VM is used, and this storage array can only be managed using CCI. Refer to [http://documentation.commvault.com/hds/v10/article?p=features/snap\\_backup/support\\_snapbackup.htm](http://documentation.commvault.com/hds/v10/article?p=features/snap_backup/support_snapbackup.htm) for support matrix of different storage vendors.

In the **Snap Configuration** section enter the details regarding ShadowImage and Thin Image.

- **SVOL LDEV nickname** is the name of volumes picked by Intellisnap for ShadowImage. All SVOLs for ShadowImage must be created with this name.
- **CU range to be used to pick SVOLs** is the CU number or range in the LDEV ID of volumes picked by Intellisnap for ShadowImage.
- **Create VVOLs for Thin Image** and **TI pool to be used for VVOLs** are used by Intellisnap to automatically create Thin Image VVOLs in the mentioned Pool. Page 7 describes how to create a TI Pool.
- **DP Pool to be used for SVOLs** is the Pool ID used by Intellisnap to find ShadowImage SVOLs. Page 8 describes how to create an SI Pool.
- **Enable incremental resync using aged clones** allows Intellisnap to resync the ShadowImage volumes that have passed the data retention time criteria.
- **Remote Snap MA** has the name of the remote snap media agent.

Figure 7 shows the array configuration for this solution.



**Figure 7**

Other options are available for array configuration and can be used based on specific requirements. Refer to [http://documentation.commvault.com/hds/v10/article?p=features/snap\\_backup/help/snap\\_hds.htm](http://documentation.commvault.com/hds/v10/article?p=features/snap_backup/help/snap_hds.htm).

## Configure Storage Policies

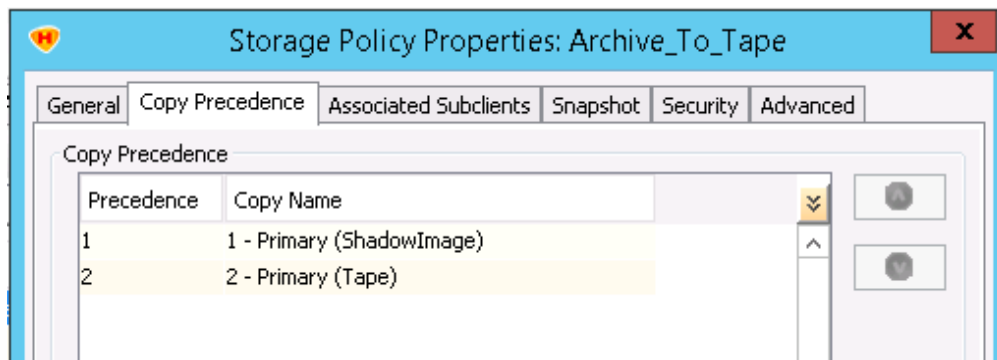
All of the subclients associated with SAP Oracle iDataAgent will use a storage policy to perform backup and restore operations. Storage policies act as a channel for backup and restore operations. Its chief function is to map data from its original location to a physical media. Storage policies are configured with information data paths (the index location of the backup), subclient, copy precedence, and retention period. Create storage policies and storage policy copies for different operations using the CommCell console.

In this solution, the storage policy **Archive\_To\_Tape** is used for ShadowImage backup and copies for ShadowImage backup and backup to tape have been created, as shown in Figure 8. The following Copy Precedence policies are created:

- 1-Primary (ShadowImage) for ShadowImage backup on the storage array
- 2-Primary (Tape) for backup on tape library.

CommServe performs browse and restore operations from the storage policy copy with the lowest copy precedence. For example, in this scenario, when a backup is selected for restore, CommServe will first check to see if a backup is available on the storage array since ShadowImage copy has lower precedence. If not (backup is aged and deleted due to retention policy), CommServe will check the tape library and will restore the backup from there.

Separate storage policies are created for Thin Image backup, archive log backup and SAP file system backups. Only one storage policy copy is required for these types of backups as Thin Image backups are only created on the storage array. Archive log backups and SAP file system backups are only created on the tape library.



**Figure 8**

The data retention period is configured in the storage policy copies.

For engineering validation of ShadowImage backup, retention of 1 job cycle was used. This means that two SVOLs of PVOL were kept on the storage array. As soon as a new job was completed and the data aging job was run, the first copy was reclaimed and available for resync by a new backup operation. It is also possible to have 'no retention' (refer to the option shown in Figure 9). If 'no retention' is selected, only one SVOL is kept on the storage array for every PVOL. This SVOL is resynced every time a new backup is executed.

For backups on tape library, a retention period of 28 days is configured. This means that backups will be kept for 28 days on tape before the data aging job deletes it.

---

The data aging job must be scheduled to run periodically to delete backups that have expired per data retention criteria and reclaim space on the storage array and tape library. Refer to Figure 9 for configuration details.

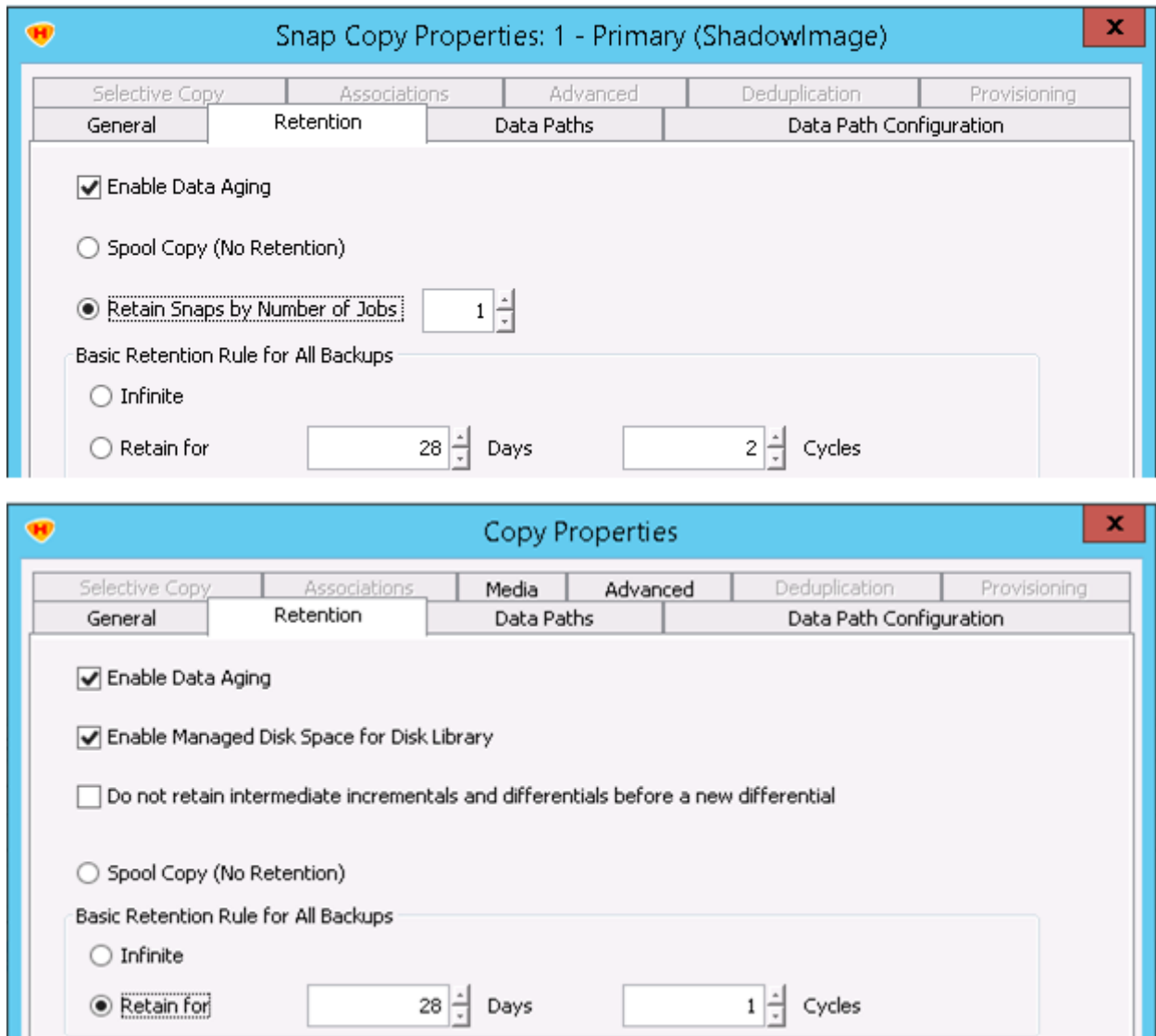


Figure 9

### Create SAP Database Instance in CommCell

During installation, SAP Oracle iDataAgent is added to the CommServe instance. Add SAP Oracle database under the agent whose backup will be taken using HDPS Intellisnap. Perform the following steps to maintain the properties of the new SID:

- Create a new SID (System ID) for the SAP Oracle database
  - Go to Client Computers -> SAP Linux VM -> SAP for Oracle
  - Provide the Oracle SID
  - Provide the SAP kernel location
  - Provide the SAP and Oracle administration user and connect string
  - Enable Intellisnap Operations
  - Provide proxy server information
-

Figure 10 shows the SID created for this solution.

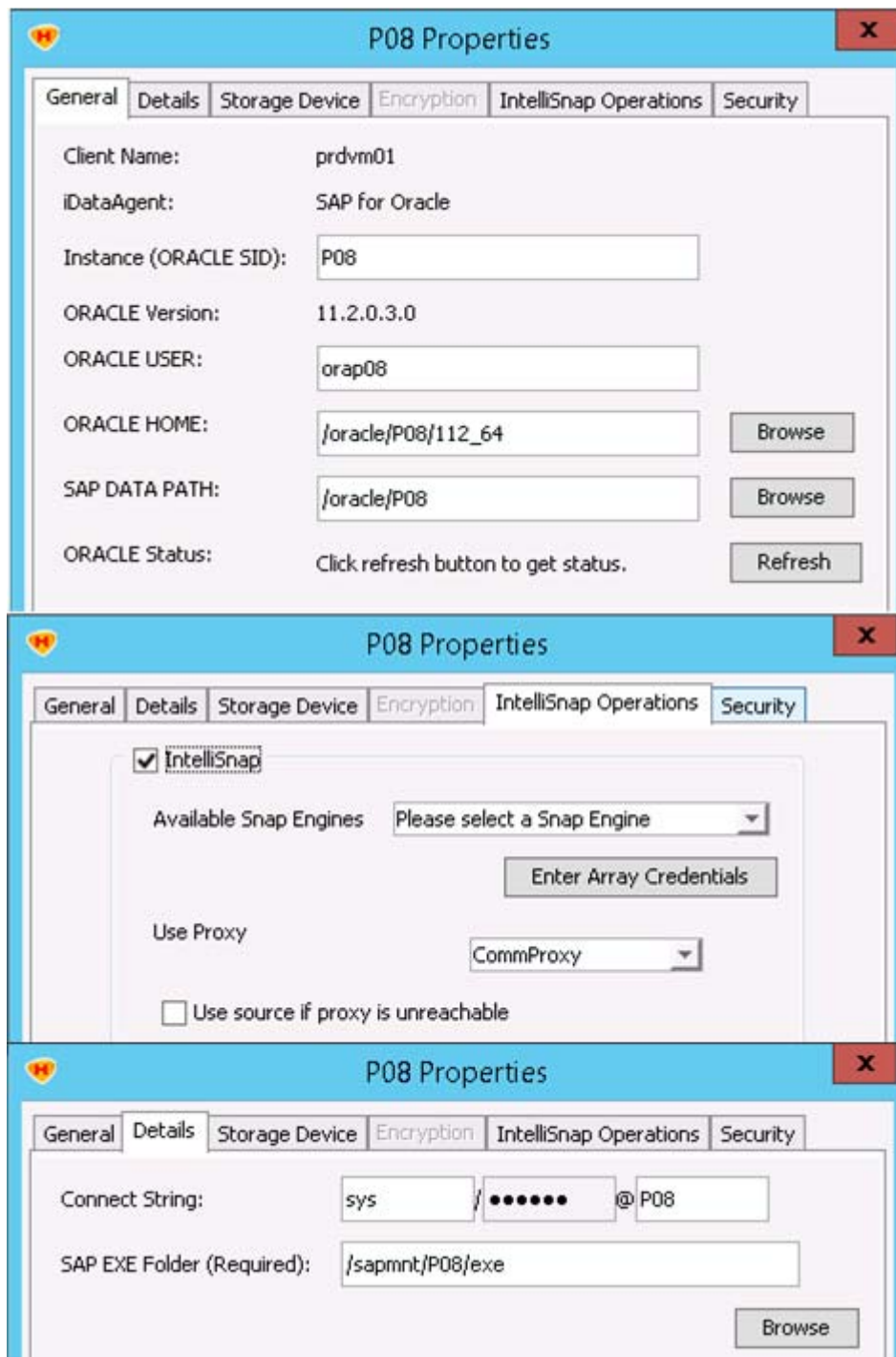


Figure 10



## Create Subclient for ShadowImage

Create a subclient under SAP Oracle SID for ShadowImage backup. As shown in Figure 11, this subclient is configured to take a backup of data only (data files, control files and parameter files). The HDS array's ShadowImage backup using CCI is selected. Traditional log backup is selected and therefore, Intellisnap does not take a ShadowImage of the archive log volume but will take a traditional backup of the archive log files over Ethernet. Proxy server is configured. Storage Policy Archive\_To\_Tape is used for this subclient.

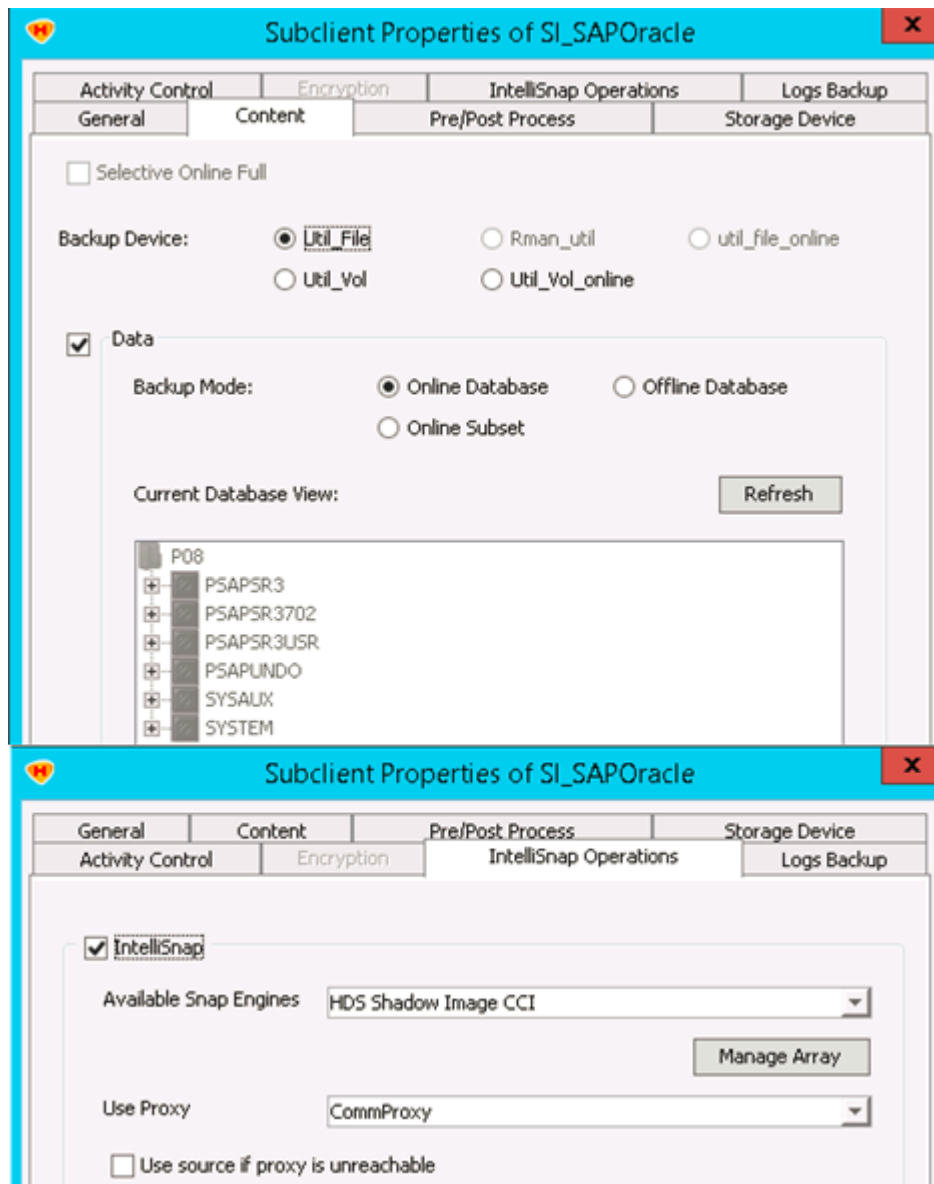


Figure 11

## Create a Subclient for Thin Image

Create a subclient under SAP Oracle SID for Thin Image backup. As shown in Figure 12, this subclient is configured to take a backup of data only (data files, control files and parameter files). The HDS array's Thin Image backup using CCI is selected. Traditional log backup is selected and therefore Intellisnap does not create a Thin Image backup of the archive logs volume, but will take a traditional backup of archive log files over Ethernet. Proxy server is configured. Storage Policy for Thin Image does not have a copy for backup to tape.

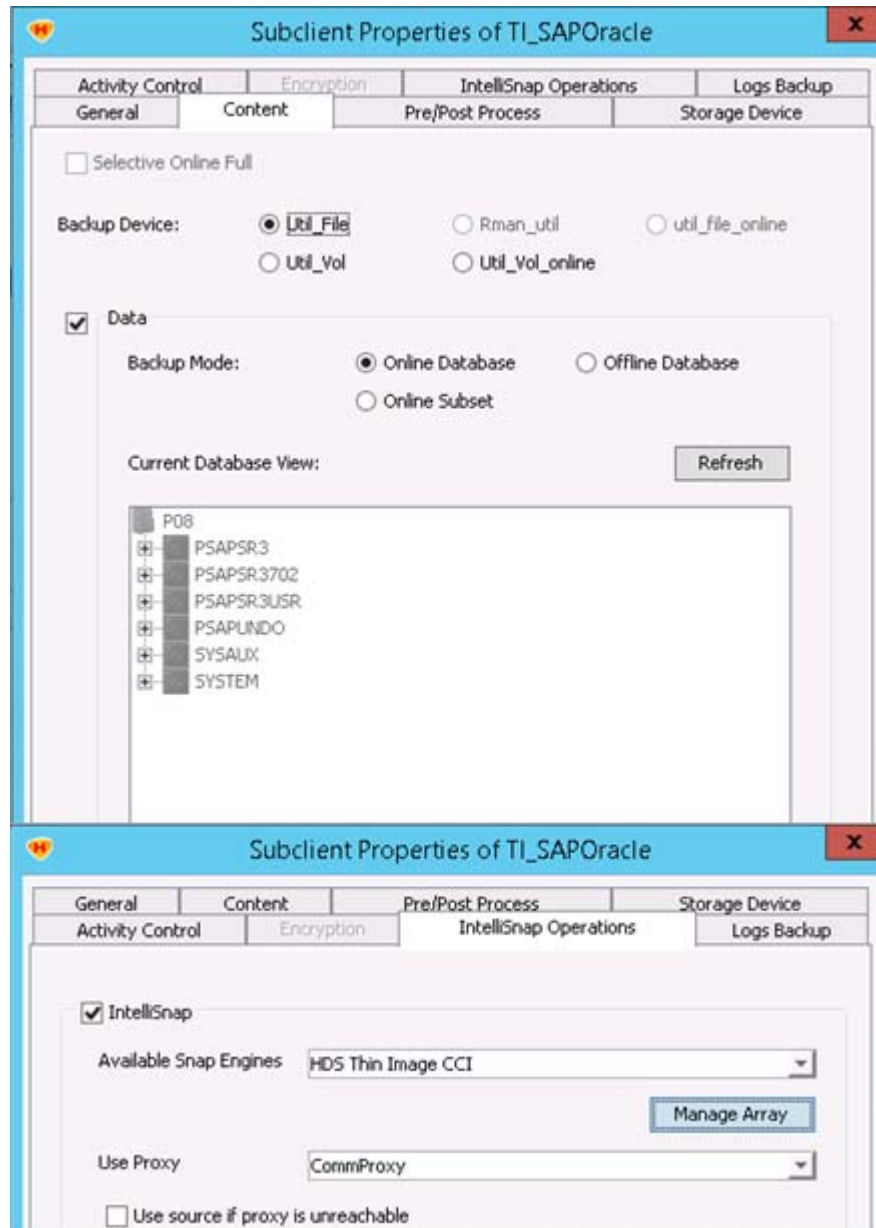


Figure 12

## Create a Subclient for Archive Log Backups

Create a subclient under SAP Oracle SID for archive log backups. As shown in Figure 13, this subclient is configured to take backups of archive logs only. Log backups are done using traditional streaming over the production Ethernet network through Media Agent on the proxy host to the tape drive. Data backup is unchecked as this subclient is only for archive log backup. Intellisnap operations are unchecked.

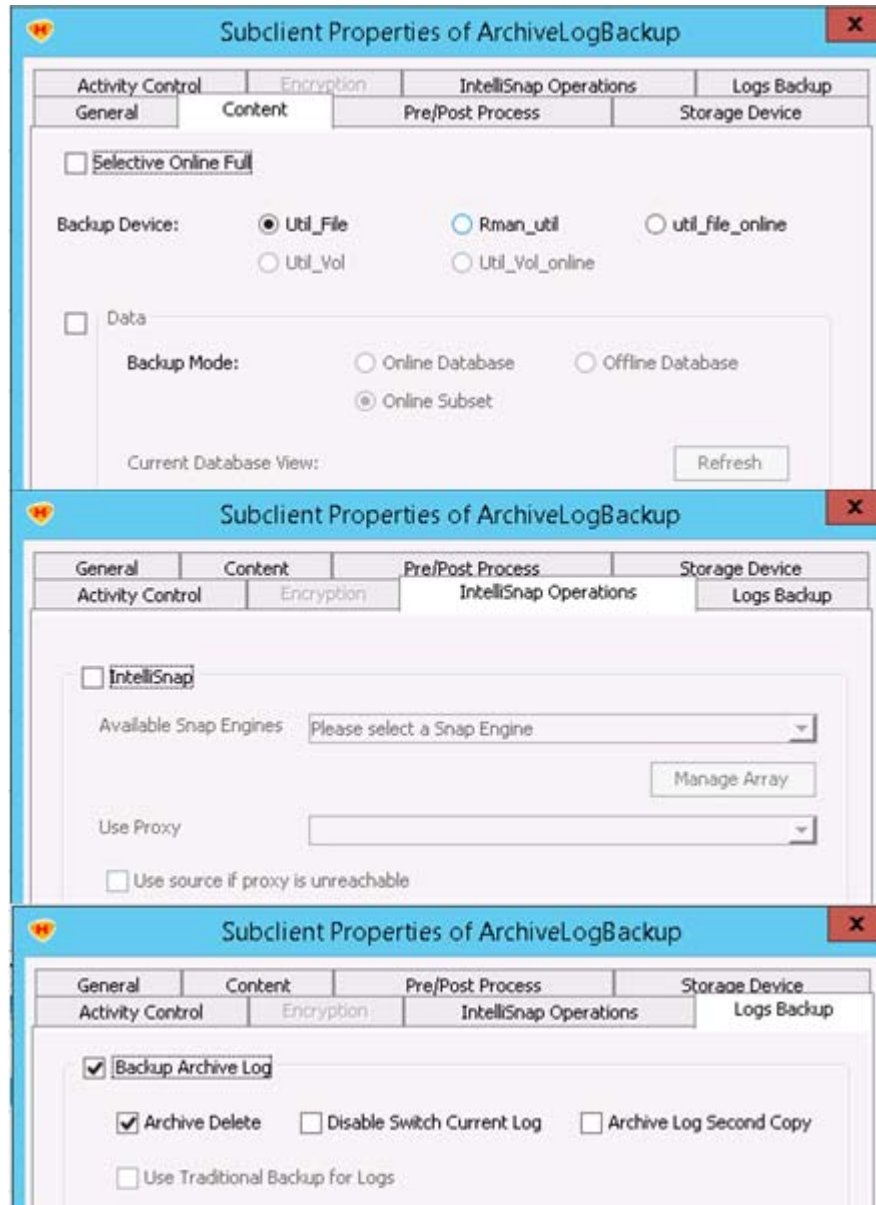


Figure 13

## Create a Subclient for SAP File System Backups

Create a subclient under SAP Linux server -> File System -> default. As shown in Figure 14, this subclient is configured to take backups of SAP File systems /usr/sap and /sapmnt. Use the Browse button to select these file systems manually. Linux file system agent is not specific to SAP and does not recognize any SAP-specific file systems automatically. Any other customer-specific file system can be selected as well. File system backup is done using traditional streaming over the production Ethernet network through Media Agent on the proxy host to the tape drive. Intellisnap operations are unchecked. Any customer-specific file systems can be added.

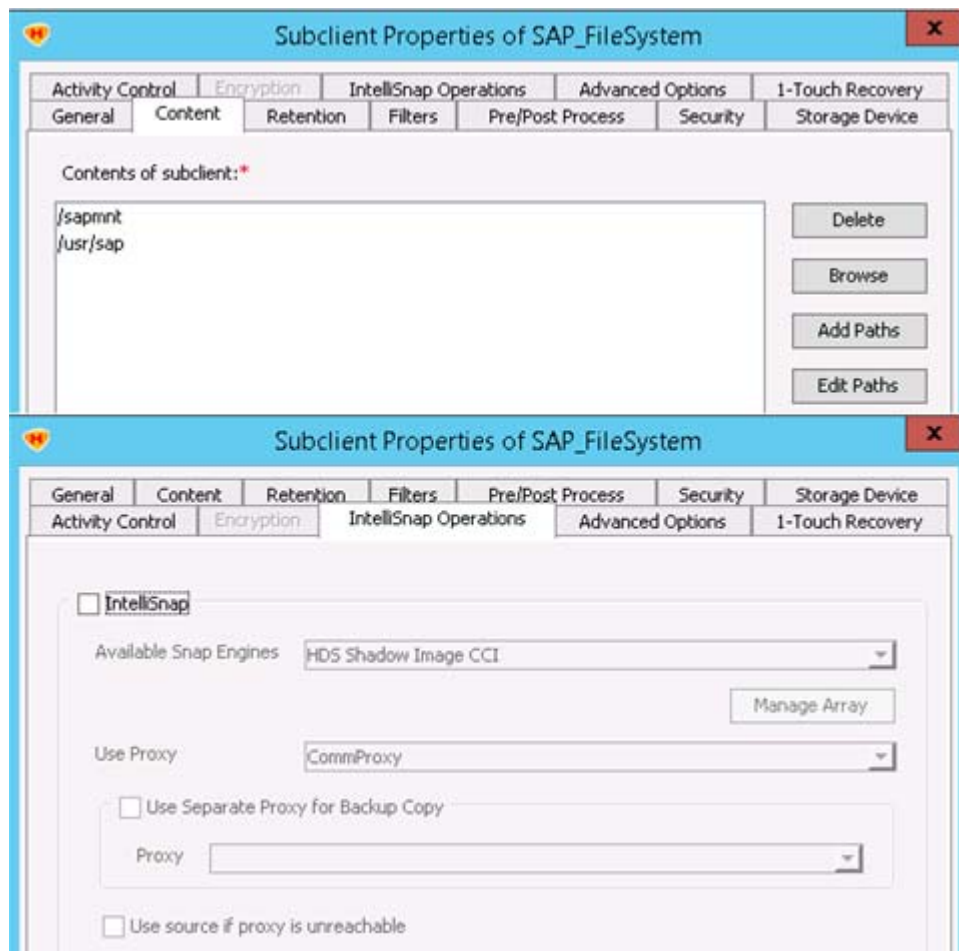


Figure 14

## Installation of CCI

Install the CCI engine on the proxy server host and create a LUN for the command device. The command device performs all of the functions on the storage array as instructed by Intellisnap. From Storage Navigator, select the LUN and enable command device security and user authentication. Figure 15 shows the command device configuration. Specify the path of the CCI installation in the snap configuration area. An HORCM (Hitachi Open Remote Copy Manager) instance is created by Intellisnap to issue commands to the storage array. The HORCM instance operates as a daemon process on the host server. When HORCM is activated, it refers to the configuration definition files. The HORCM instance communicates with the storage system. No manual configuration is required for the HORCM instance. Intellisnap automatically creates the HORCM instance and its configuration file. Also, it assigns an instance number to the HORCM instance and starts the HORCM instance to perform necessary array functions. For more details about CCI and its functions refer to <http://www.hds.com/assets/pdf/ccli-user-and-reference-guide.pdf>.

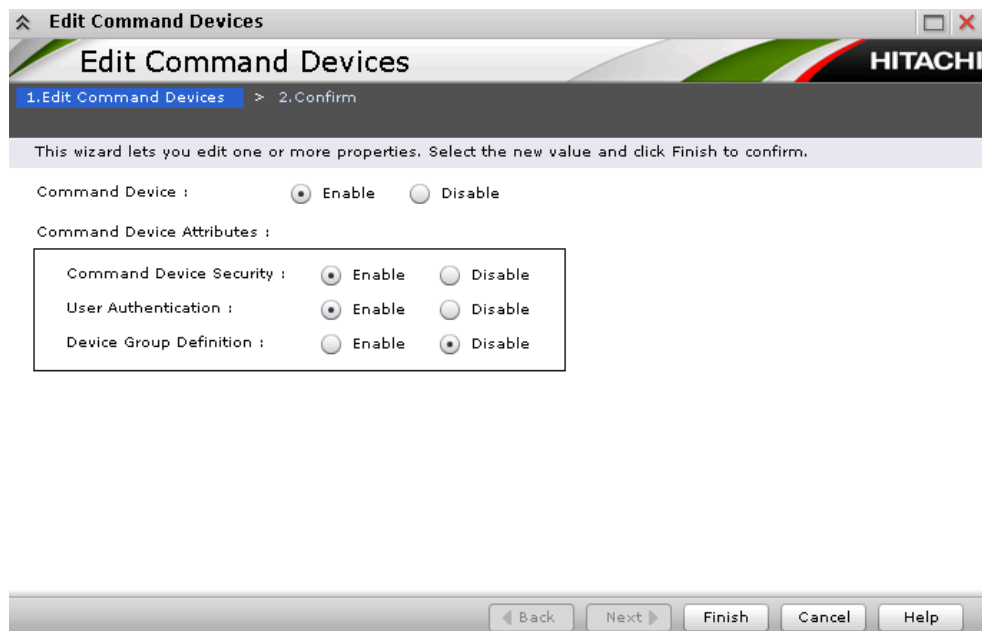


Figure 15

## Backup and Recovery Operations

The following section describes the Thin Image and ShadowImage backup steps.

### Thin Image and ShadowImage Backup

1. The backup job initiates from the CommCell Console via schedule or an on-demand job.
2. CommServe communicates with SAP Oracle iDataAgent, which starts the BRTOOLS backup job. This job puts the Oracle database in backup mode ('begin backup').
3. CCI is called to validate the underlying disk structure for the database datafiles, logs files, control files, and parameter files.
4. CCI issues commands to Hitachi Unified Storage VM to perform the backup operation.
  - Thin Image: CCI creates a VVOL for each PVOL and creates a Thin Image copy. VVOLs are created based on the 'Snap Configuration' details of Hitachi Unified Storage VM configured in the CommCell console.
  - ShadowImage: CCI identifies the SVOLs for PVOLs backup and resyncs the data. It waits for synchronization to finish and puts SVOLs in split state.
5. BRTOOLS executes 'end backup' and finishes after successful completion of Thin Image and ShadowImage backup.
6. SVOLs are mounted on the proxy host to archive ShadowImage backup to tape.
7. Backup of SVOLs to tape library is performed based on the Primary copy of the storage policy which is the tape library.
8. SVOLs are unmounted from the proxy host.

---

Note: After every successful Thin Image or ShadowImage backup, an archive log backup is automatically triggered by Intellisnap. A new BRTOOLS job is started for this purpose. The archive log backup and restore procedure is explained later.

---

Figure 16 shows the backup process.

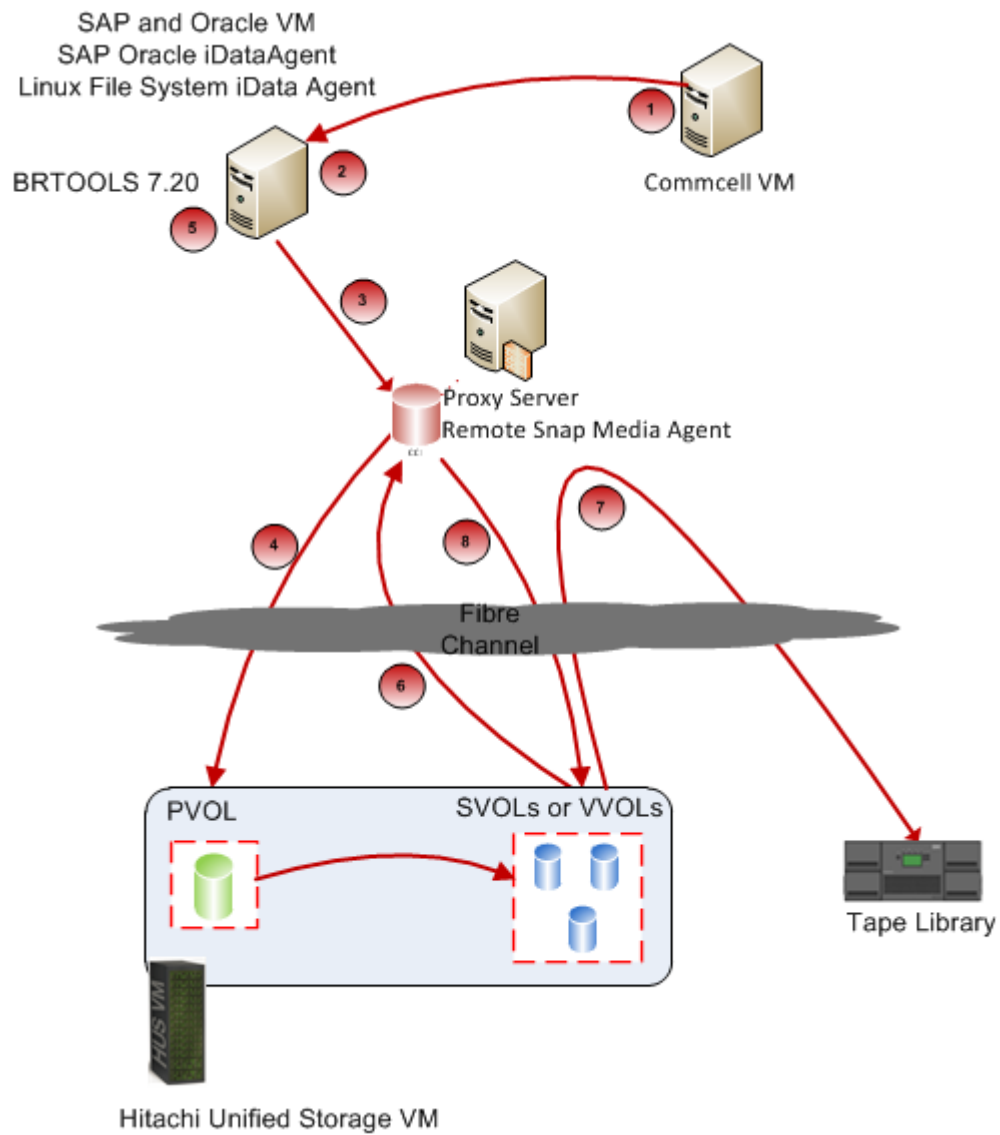


Figure 16

## Thin Image and ShadowImage Restore and Recovery from Storage Array

Before starting the restore and recovery operation, the system administrator must shutdown the SAP system and Oracle database.

1. The user selects the Thin Image backup or ShadowImage backup for restore and recovery. If point in time recovery is required, the user also selects the recovery end time. If no time is selected, CommServe takes the end time of the selected backup as the recovery end time by default.
  2. CommServe checks its metadata to find if the selected backup is present on storage array or tape library. If a backup is present on the storage array it will be restored from there, otherwise it will be restored from the tape library (this section explains restore from storage array).
  3. CommServe communicates with SAP Oracle iDataAgent which starts the BRTOOLS restore job.
  4. PVOLs are unmounted from the SAP and Oracle database server.
  5. CCI is called to perform the restore operation on the Hitachi Unified Storage VM.
  6. The restore job subsequently performs following two tasks:
    - (1) Reverse sync the Oracle datafiles, control files and parameter files SVOLs or VVOLs to the PVOLs.
    - (2) Restores the archive log files from the tape library to the *oraarch* directory of Oracle database server through Media Agent.
  7. PVOLs are mounted to Oracle database server.
  8. CommServe starts the Oracle instance and performs recovery using archive log files restored in step 6(2).
-



Figure 17 shows the restore and recovery process from the storage array.

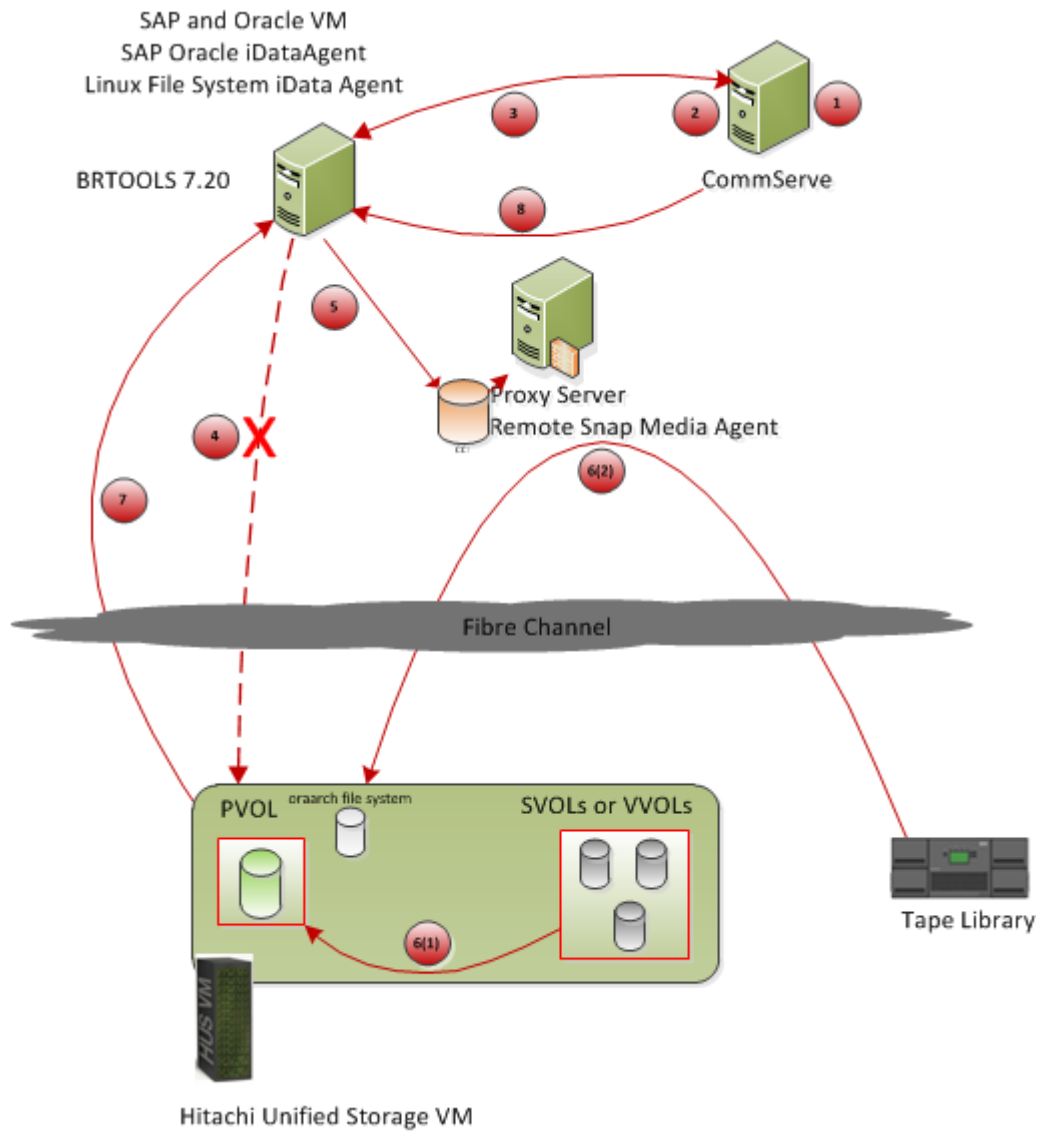


Figure 17

## ShadowImage Restore and Recovery from Tape Library

Before starting the restore and recovery operation, the system administrator must shutdown the SAP system and Oracle database. In this reference architecture, only ShadowImage backups are copied to the tape library.

1. The user selects the ShadowImage backup for restore and recovery. If point in time recovery is required, the user also selects the recovery end time. If no time is selected, CommServe takes the end time of the selected backup as the recovery end time by default.
  2. CommServe checks its metadata to find if the selected backup is present on the storage array or tape library. If the backup is present on the storage array it will be restored from there, otherwise it will be restored from the tape library (this section explains restore from tape library).
  3. CommServe communicates with SAP Oracle iDataAgent which starts the BRTOOLS restore job.
  4. PVOLs are:
    - (1) Unmounted from SAP and Oracle DB server.
    - (2) Mounted on the proxy host.
  5. The restore job subsequently performs following two tasks:
    - (1) Copies data from tape library to the Oracle database PVOLs through Media Agent.
    - (2) Restores the archive log files from the tape library to the *oraarch* directory of the Oracle database server through Media Agent
  6. After the copy on PVOLs is complete, they are:
    - (1) Unmounted from the proxy host.
    - (2) Mounted on the SAP and Oracle DB servers.
  7. CommServe starts the Oracle instance and performs recovery using archive log files restored in step 5(2).
-

Figure 18 shows the restore and recovery process from the storage array.

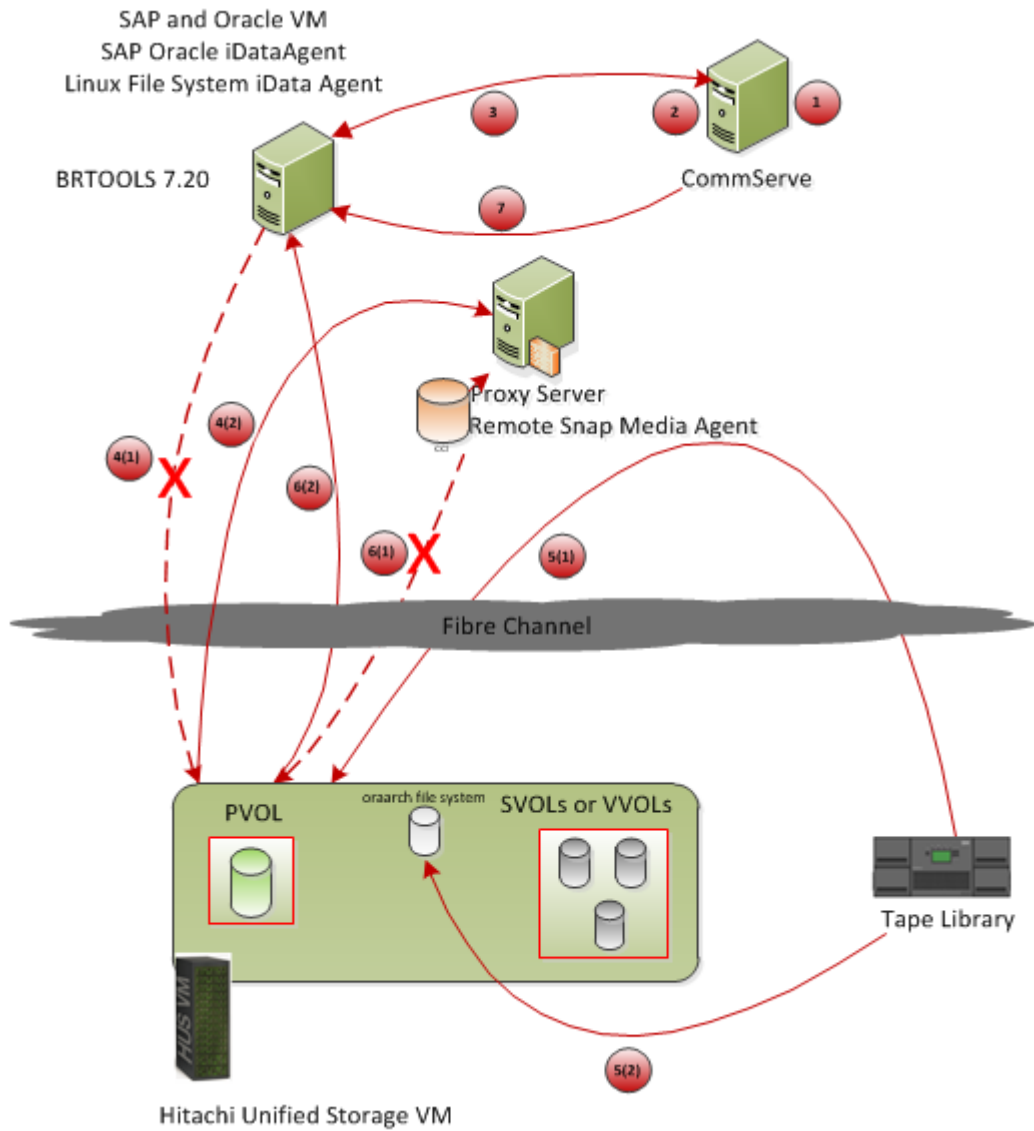


Figure 18

## Archive Log Backup

A traditional archive log backup approach has been taken in this solution. This means that archive log backups will be streamed over the production LAN.

1. Archive log backup is triggered by a scheduled job or on demand.
2. CommServe will communicate with SAP Oracle iDataAgent which will trigger the BRTOOLS job.
3. <SID>arch\*.dbf files are saved to the tape library over the production LAN and then deleted from the database file system.
4. The backup is indexed based on the data path in the storage policy.

## Archive Log Restore

5. Archive log restore is triggered by the user and the time window when the logs were generated.
6. CommServe will communicate with SAP Oracle iDataAgent which will trigger the BRTOOLS job.
7. The job refers to the arch<SID>.log file and the indices of archive log backup jobs to locate the required files on tape.
8. <SID>arch\*.dbf files are restored from the tape library over the production LAN to the *oraarch* file system of the Oracle database.

## SAP File System Backup and Restore

SAP File System backup is not part of SAP Oracle iDataAgent functions which only backup database related files. Linux File System iDataAgent is installed separately for file system backup. Unlike SAP Oracle iDataAgent, this agent does not automatically recognize the SAP related files that need to be part of the backup. Manual configuration of /usr/sap, /sapmnt, transport directory, and any other customer-specific file system that needs backup is required. When backup is initiated on demand or by a schedule through the CommCell console, the file system agent performs a backup of configured file systems over the production LAN to the tape library. These backups are not part of typical SAP system database restore. Restore is initiated separately in scenarios such as file system corruption, accidental deletion of files, and the need for older log files. When restore is triggered for a specific backup job, CommServe checks the index of the job, finds the backup on the tape library, and restores it on the SAP Linux virtual machine. In this reference architecture guide the restore to source folder option is used, but it is possible to specify an alternate destination path. When restoring to the source folder, it is the responsibility of the system administrator to keep a backup (copy) of the source folder before performing the restore.

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## Engineering Validation

Validation of the SAP Business Suite on Hitachi Unified Compute Platform for VMware: Data Protection using Hitachi Data Protection Suite solution was conducted in the Hitachi Data Systems Lab.

### Test Methodology

The validation testing includes the backup and recovery operations discussed in this reference architecture paper. Successful Thin Image, ShadowImage, archive log, and file system backups were performed to the storage array as well as tape libraries. Also, successful restores from all of these backups were performed from storage array and tape library. Database recovery was also performed with archive recovery until end of backup and point in time.

---

## Test Results

During testing, the following were executed successfully:

1. On demand and scheduled Thin Image backup of SAP ERP Oracle database.
2. On demand and scheduled ShadowImage backup of SAP ERP Oracle database.
  - ShadowImage backup to local storage array
  - Backup of ShadowImage to tape library
3. Restore and Recovery from Thin Image backup
  - Restore and recovery from Thin Image backup
  - Restore from Thin Image backup and point in time recovery
4. Restore and recovery from ShadowImage backup
  - (1) Restore from storage array
    - Restore and recovery from ShadowImage backup
    - Restore from ShadowImage backup and point in time recovery
  - (2) Restore from tape library
    - Restore and recovery from ShadowImage backup
    - Restore from ShadowImage backup and point in time recovery
5. Backup and restore of archive logs (Backup and restore testing of archive logs is also a part of ShadowImage or Thin Image backup and restore procedure. In this step, backup and restore of archive logs was tested individually).
6. Backup and restore of SAP file system.

The SAP system was found up and running fine after each restore and recovery operation. No errors were discovered in Oracle trace log files.

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