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Protect Hitachi Unified Compute Platform and Oracle Database 12c using Hitachi Data Instance Director, Veritas NetBackup, and Hitachi Content Platform

Reference Architecture Guide

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Feedback

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Revision History

Revision	Changes	Date
AS-565-00	Initial release	December 2016
AS-565-01	Added automation shell script to take HDID Snapshot, mount snapshot to mount server, and RMAN backup to Hitachi Content Platform using Veritas NetBackup.	January 2017
AS-565-02	Added official product naming and details for Brocade switches.	May 2017
MK-SL-072-00	Updated branding to Hitachi Vantara	June 8, 2018

Table of Contents

Protect Hitachi Unified Compute Platform and Oracle Database 12c using Hitachi Data Instance Director, Veritas NetBackup, and Hitachi Content Platform

Reference Architecture Guide

Use this reference architecture guide to design a solution with Hitachi Data Instance Director (HDID) to protect Hitachi Unified Compute Platform for non-multitenant Oracle Database 12c with Oracle Real Application Clusters (RAC) in a single-site environment. This explains how to use Veritas NetBackup to backup a snapshot of Hitachi Thin Image mount of Oracle Database 12c to Hitachi Content Platform (HCP) for intensive data protection, recovery, and retention.

This environment uses integrated servers, storage systems, and network with storage software in a converged solution for Oracle. It provides reliability, high availability, scalability, and performance while processing small-scale to large-scale OLTP workloads. The dedicated servers run Oracle Database 12c Release 1 with the Oracle Real Application Cluster option. The operating system is Red Hat Enterprise Linux 6.6.

This solution for your oracle environment uses Microsoft® Windows Server® 2012 R2 virtual machines (VM) to run the following in this solution:

- One Data Instance Director master node
- One Data Instance Director repository node
- One NetBackup master node

Validation of the best practices in this solution was with Oracle Database 12c, Hitachi Virtual Storage Platform G600 (VSP G600), Veritas NetBackup 7.7.3, and Hitachi Content Platform. However, this solution works for all storage systems and Oracle versions supported by the following:

- Hitachi Data Instance Director
- Hitachi Content Platform
- Veritas NetBackup (specific versions)

This document is for the following audience:

- Database administrators
- Storage administrators
- Backup administrators
- IT professionals with the responsibility of backing up, restoring and recovering, or disaster database recovery of an Oracle Database solution

To use this best practice guide, you need familiarity with the following:

- Storage area networks
- Hitachi Content Platform
- Hitachi Data Instance Director
- Hitachi Thin Image
- Veritas NetBackup
- Oracle Database administration
- Oracle Database 12c Release 1 with the Oracle RAC option
- Red Hat Enterprise Linux

Note — These practices 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.

Solution Overview

This solution describes Hitachi Unified Compute Platform for Oracle Database protection solution to do the following:

- Perform an Oracle Database 12c backup with Hitachi Thin Image snapshot, and perform a backup mount on the proxy server using Hitachi Data Instance Director.
- Perform an Oracle Database 12c restore, and recovery operations using Hitachi Data Instance Director.
- Perform an Oracle Database 12c backup from a proxy server to Hitachi Content Platform using Veritas NetBackup.
- Perform a restore and recovery operations on the application or production host from Hitachi Content Platform storage using Veritas NetBackup.

High-level Concepts

These are the high-level concepts covered by this reference architecture:

- **Backup Oracle database** with scheduled snapshot and mount Hitachi thin image snapshot on the proxy server using Hitachi Data Instance Director.
- **Backup Hitachi Thin image mounted snapshot** from proxy server to Hitachi Content Platform using Veritas NetBackup.
- **Perform restore and recovery of an Oracle database** using Hitachi Data Instance Director REVERT operation and recover Oracle database with manual steps.
- **Perform restore and recovery of an Oracle database** from Hitachi Content Platform through Veritas NetBackup directly to application or production host.

Solution Benefits

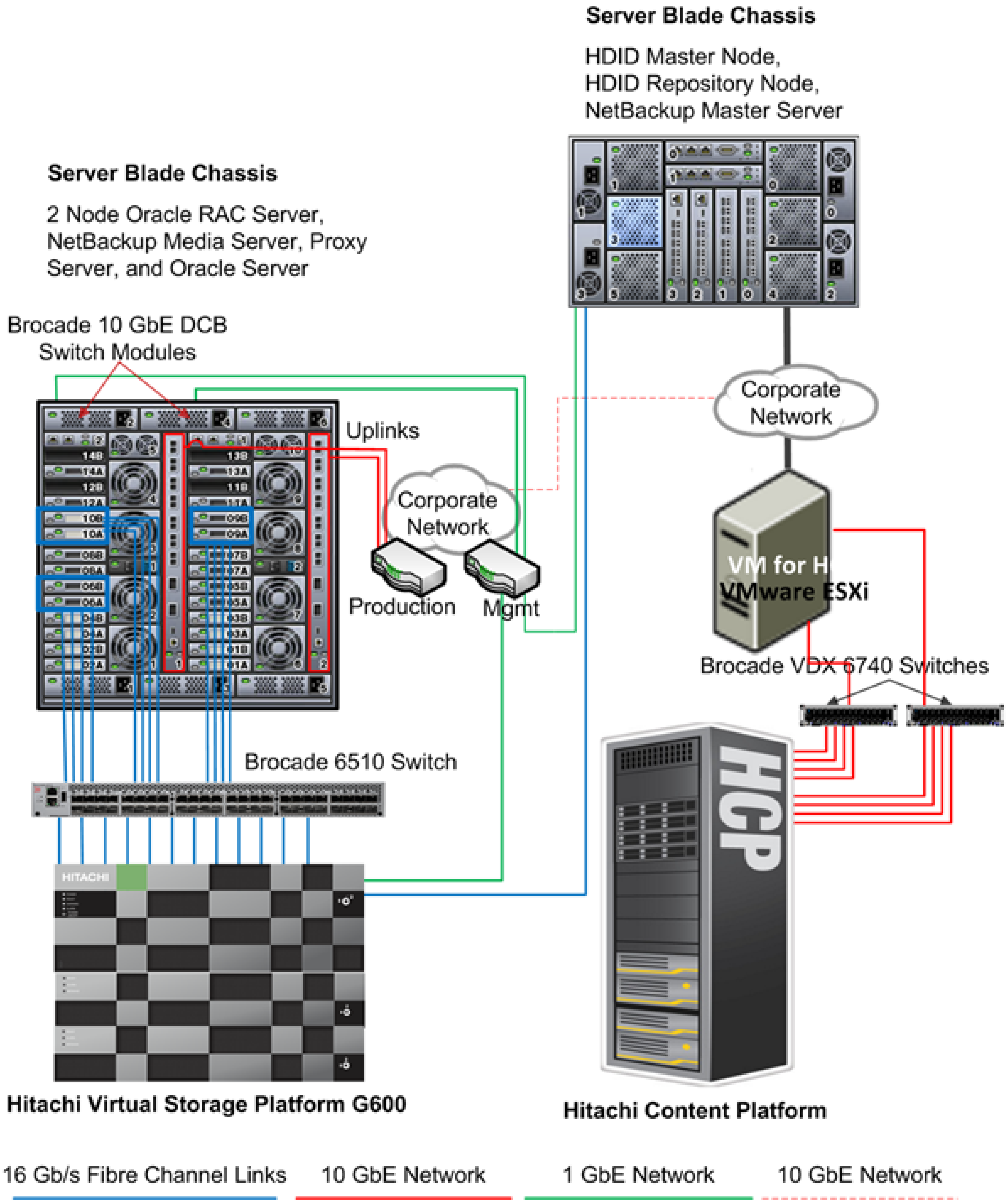
These are the benefits of using this solution:

- Protect Oracle database against disasters.
- Perform disaster recovery and operational recovery on the primary site with zero RPO for a server failure.
- Create frequent or temporary backups of the data without affecting the primary server.
- Back up data that is too large to complete in the allocated time.
- Prevent data loss or data integrity issues.
- To reduce load on the production server, use a proxy server for Oracle database movement.
- Enable IT organizations and cloud service providers to store, share, synchronize, protect, preserve, analyze and retrieve file data from a single system. Address future data change and growth.

High Level Infrastructure

Figure 1 on page 4 shows the high-level infrastructure for this solution.

Figure 1


Server Blade Chassis
HDID Master Node,
HDID Repository Node,
NetBackup Master Server
Server Blade Chassis
2 Node Oracle RAC Server,
NetBackup Media Server, Proxy
Server, and Oracle Server
Brocade 10 GbE DCB
Switch Modules
Uplinks
Corporate
Network
Production
Mgmt
Corporate
Network
VM for H
VMware ESXi
Brocade VDX 6740 Switches
Brocade 6510 Switch
HITACHI
HCP
Hitachi Virtual Storage Platform G600
Hitachi Content Platform
16 Gb/s Fibre Channel Links
10 GbE Network
1 GbE Network
10 GbE Network

Key Solution Components

The key solution components for this solution are in Table 1, “Hardware Components,” on page 5 and Table 2, “Software Components,” on page 6.

TABLE 1. HARDWARE COMPONENTS

Hardware	Detailed Description	Version	Quantity
Hitachi Virtual Storage Platform G600	■ 2 controllers ■ 8 × 16 Gb/s Fibre Channel ports per controller ■ 16 backend SAS ports ■ 256 GB cache memory ■ 64 × 1.2 TB 10k RPM SAS hard disk drives (HDD) ■ 16 × 1.6 TB flash memory drives (FMD)	83-01-03-40/00	1
Virtual machines running on virtualization platform	■ 3 virtual machine running Microsoft® Windows Server® 2012 (x86_64) for Hitachi Data Instance Director ■ 2 vCPU ■ 8 GB RAM ■ 1 virtual machine running Microsoft Windows Server 2012 for Veritas NetBackup master server		1
Server for Hitachi Content Platform access node	■ Server runs VMware ESXi 6.0 to host a virtual machine ■ 1 virtual machine for Hitachi Content Platform storage access node ■ 16 vCPU ■ 64 GB RAM	7.2.2.6	1
Hitachi Content Platform storage node	■ 2 half system nodes ■ 6 TB HDD, with a total of 168 TB per node ■ 10 GbE Ethernet SFP+ SR Optical ■ 4 × 1GbE Management port	2.1.0.11	1
Brocade 6510 switch	■ 48 port Fibre Channel 16 Gb/s switch	7.4.1b	1
Brocade VDX 6740	■ 48 port 10 GbE switch	5.0.1d	2

TABLE 2. SOFTWARE COMPONENTS

Software	Version	Function
Hitachi Storage Navigator	N/A	Storage management suite
Hitachi Command Suite	8	Storage management suite
Hitachi Data Instance Director	5.3	Data protection software
Microsoft® Windows Server® 2012 R2	Enterprise	Microsoft host
Microsoft Windows Server 2012 R2	Standard	Virtual machines
Red Hat Enterprise Linux	6.6	Operating system for Oracle RAC
Oracle ASM	12c Release 1 (12.1.0.2.0)	Oracle ASM
Oracle Database	12c Release 1 (12.1.0.2.0)	Oracle Database system
Hitachi Dynamic Provisioning	VSP G600	Storage license
Hitachi Thin Image	VSP G600	Storage license
Veritas NetBackup Master Server	7.7.3	Master Server
Veritas NetBackup Media Server	7.7.3	Media Server
Veritas NetBackup Client	7.7.3	Client
Hitachi Content Platform — Virtual Machine System	7.2.2.6	Virtual machine with Content Platform installed and configured
Hitachi Content Platform	S10 - 7.2.2	Long term storage

Hitachi Virtual Storage Platform G Series Family

The Hitachi Virtual Storage Platform G series family enables the seamless automation of the data center. It has a broad range of efficiency technologies that deliver maximum value while making ongoing costs more predictable. You can focus on strategic projects and to consolidate more workloads while using a wide range of media choices.

The benefits start with Hitachi Storage Virtualization Operating System RF. This includes an all new enhanced software stack that offers up to three times greater performance than our previous midrange models, even as data scales to petabytes.

Virtual Storage Platform G series offers support for containers to accelerate cloud-native application development. Provision storage in seconds, and provide persistent data availability, all the while being orchestrated by industry leading container platforms. Moved these workloads into an enterprise production environment seamlessly, saving money while reducing support and management costs.

This solution uses Virtual Storage Platform G600, which supports Oracle Real Application Clusters.

Hitachi Storage Virtualization Operating System

Hitachi Storage Virtualization Operating System (SVOS) spans and integrates multiple platforms. It integrates storage system software to provide system element management and advanced storage system functions. Used across multiple platforms, Storage Virtualization Operating System includes storage virtualization, thin provisioning, storage service level controls, dynamic provisioning, and performance instrumentation.

Storage Virtualization Operating System includes standards-based management software on a Hitachi Command Suite (HCS) base. This provides storage configuration and control capabilities for you.

Storage Virtualization Operating System uses Hitachi Dynamic Provisioning (HDP) to provide wide striping and thin provisioning. Dynamic Provisioning provides one or more wide-striping pools across many RAID groups. Each pool has one or more dynamic provisioning virtual volumes (DP-VOLs) without initially allocating any physical space. Deploying Dynamic Provisioning avoids the routine issue of hot spots that occur on logical devices (LDEVs).

To enable essential management and optimization functions, this solution uses Hitachi Storage Navigator, a part of Storage Virtualization Operating System. Storage Navigator runs on most browsers. A command line interface is available.

Hitachi Vantara recommends the use of multiple dedicated dynamic provisioning pools for different types of Oracle data. This avoids intermixing different types of data I/O, which benefits performance during peak database operations.

Brocade Switches

Brocade Switches Brocade and Hitachi Vantara partner to deliver storage networking and data center solutions. These solutions reduce complexity and cost, as well as enable virtualization and cloud computing to increase business agility.

The solution uses the following Brocade products:

- Brocade 6510, a 48 port Fibre Channel 16 Gb/s switch
- Brocade VDX 6740, a 48 port 10 GbE switch

Hitachi Data Instance Director

Hitachi Data Instance Director provides a modern, holistic approach to data protection, recovery, and retention.

Data Instance Director has a unique work flow-based policy engine, presented in a white board-style user interface. It helps you to map copy data management processes to business priorities. Data Instance Director includes a wide range of fully integrated storage-based and host-based incremental-forever data capture capabilities. These can be combined into complex workflows to automate and simplify copy data management.

Veritas NetBackup

Veritas NetBackup supports a variety of platforms, which include Microsoft® Windows®, UNIX, and Linux systems. NetBackup includes the following server and the client software:

- The master server manages backups, archives, and restores. The master server is responsible for media and device selection for NetBackup. Typically, the master server contains the NetBackup catalog. The catalog contains the internal databases that contain the information about NetBackup backups and configuration.
- Media servers provide additional storage by allowing NetBackup to use attached storage devices. Media servers can also increase performance by disturbing the network load. Media servers can be referred to as device hosts.
- Client software resides on the computers that contain data to back up. Servers also contain client software, and can be backed up.

NetBackup accommodates multiple servers that work together under the administrative control of one NetBackup master server. This combination of managed and unmanaged services let you build, deploy, and manage applications any way you like.

Hitachi Content Platform

Hitachi Content Platform (HCP) provides distributed object storage for advanced unstructured data storage management. This helps you address challenges of ever-growing volumes of unstructured file storage. Divide a single Content Platform into multiple virtual object stores, secure access to each store, and uniquely configure each store for a particular workload.

Eliminate storage silos using Content Platform with a single object storage infrastructure. This supports a wide range of data types, applications, and users with different service level needs in enterprise and cloud environments.

Hitachi Content Platform archives fixed content to provide the following:

- Ensure content integrity, authenticity, security, completeness, and accessibility over the long term, in accordance with relevant laws and regulations.
- Offer fast, online access to content.
- Allow integrated searching and indexing of the archive, including search of file contents.
- Support business continuity, data recovery, compliance search, and retention needs.
- Scale horizontally to support multiple applications and content types.
- Scales vertically to support continued data growth.

Red Hat Enterprise Linux

Red Hat Enterprise Linux delivers military-grade security, 99.999% uptime, support for business-critical workloads, and so much more. Ultimately, the platform helps you reallocate resources from maintaining the status quo to tackling new challenges.

Oracle Database With the Real Application Clusters Option

Oracle Database has a multi-tenant architecture so you can consolidate many databases quickly and manage them as a cloud service. Oracle Database also includes in-memory data processing capabilities for analytical performance. Additional database innovations deliver efficiency, performance, security, and availability. Oracle Database comes in two editions: Enterprise Edition and Standard Edition 2.

Oracle Real Application Clusters (Oracle RAC) is a clustered version of Oracle Database. It is based on a comprehensive high-availability stack that can be used as the foundation of a database cloud system, as well as a shared infrastructure. This ensures high availability, scalability, and agility for any application.

Solution Design

This describes the infrastructure to protect Hitachi Unified Compute Platform for Oracle Database 12c with the Real Application Cluster option using Hitachi Data Instance Director, Veritas NetBackup, and Hitachi Content Platform.

Specific infrastructure configuration includes the following:

- **Oracle RAC Servers**

  Configure two server nodes as an Oracle Real Application Cluster.

- **Proxy (mount) Server, NetBackup Media server, Oracle Server**

  Configure one Oracle RAC node as a proxy server (mount machine), which is also a NetBackup media server and Oracle server.

- **Storage System**

  Map LDEVs to each port that is presented to the server as LUNs.

- **SAN Connection**

  Connect each 16 Gb/s Fibre Channel HBA port to the storage front-end ports through a switched SAN fabric.

- **Hitachi Data Instance Director nodes and Veritas NetBackup Master Server Virtual Machines**
  - **Hitachi Data Instance Director Master Node**

    Install one Data Instance Director master node on the virtual machine.
  - **Hitachi Data Instance Director Repository Node**

    Install and configure one Data Instance Director repository node on the virtual machine.
  - **Veritas NetBackup Master Server**

    Install and configure one Veritas NetBackup master server on the virtual machine.
- **Hitachi Content Platform Virtual Machine Access Node and Hitachi Content Platform Storage Node**
  - **Hitachi Content Platform Virtual Machine Storage Access Node**

    Configure one Hitachi Content Platform virtual machine to add, access Hitachi Content Platform storage nodes and to create a tenant configuration.

Note — Hitachi Vantara recommends configuring a VMware vSphere High Availability cluster for the Hitachi Content Platform virtual machine. A vSphere High Availability cluster lets a collection of VMware ESXi hosts work together to optimize their levels of availability.

  - **Hitachi Content Platform Storage Node**

    Install and configure two Hitachi Content Platform storage nodes, and add these to the Hitachi Content Platform virtual machine.

Storage Architecture

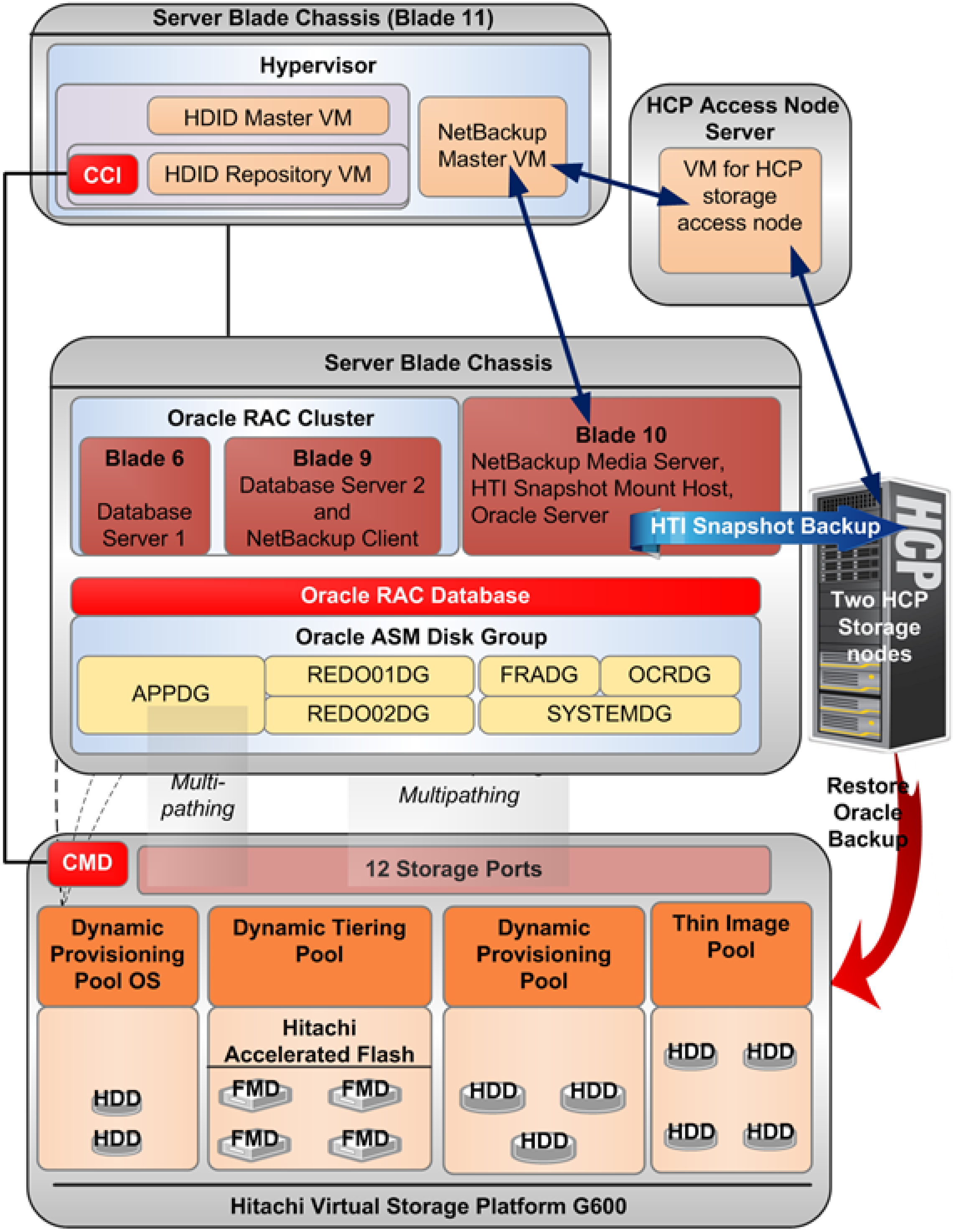
This describes the storage architecture for this solution. It takes into consideration Hitachi Vantara and Oracle recommended practices for the deployment of database storage design.

Storage Configuration

Create the following storage pools using Hitachi Dynamic Provisioning on Hitachi Virtual Storage Platform G600, as shown in Figure 2 on page 10:

- Operating system pool using two HDD groups configured as RAID-5 (3D+1P)
- Dynamic tiering pool with 30 virtual volumes (VVols) using four FMD groups using Hitachi Accelerated Flash configured as RAID-10 (2D+2D)
- Dynamic provisioning pool with 24 VVols using three HDD groups configured as RAID-6 (6D+2P)
- Hitachi Thin Image (HTI) pool using four HDD groups configured as RAID-6 (6D+2P)

Figure 2


Server Blade Chassis (Blade 11)
Hypervisor
HDID Master VM
CCI
HDID Repository VM
NetBackup Master VM
HCP Access Node Server
VM for HCP storage access node
Server Blade Chassis
Oracle RAC Cluster
Blade 6
Database Server 1
Blade 9
Database Server 2 and NetBackup Client
Blade 10
NetBackup Media Server, HTI Snapshot Mount Host, Oracle Server
HTI Snapshot Backup
HCP
Two HCP Storage nodes
Oracle RAC Database
Oracle ASM Disk Group
APPDG
REDO01DG
REDO02DG
FRADG
OCRDG
SYSTEMDG
Multi-pathing
Multipathing
Restore Oracle Backup
CMD
12 Storage Ports
Dynamic Provisioning Pool OS
HDD
HDD
Dynamic Tiering Pool
Hitachi Accelerated Flash
FMD
FMD
FMD
FMD
Dynamic Provisioning Pool
HDD
HDD
HDD
Thin Image Pool
HDD
HDD
HDD
HDD
Hitachi Virtual Storage Platform G600

Environment Diagram

Figure 3 shows environment diagram of Hitachi Unified Compute Platform for Oracle Database 12c protection solution using Hitachi Data Instance Director, Veritas NetBackup, and Hitachi Content Platform (HCP) using Hitachi Thin Image (HTI) snapshots.

Figure 3

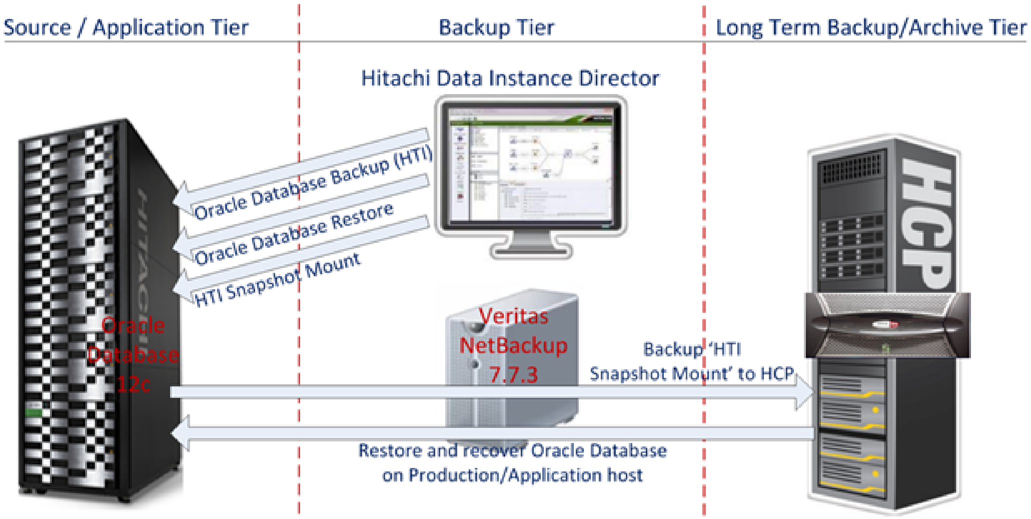

Source / Application Tier
Backup Tier
Long Term Backup/Archive Tier
Hitachi Data Instance Director
Oracle Database Backup (HTI)
Oracle Database Restore
HTI Snapshot Mount
HITACHI
Oracle Database 12c
Veritas NetBackup 7.7.3
Backup 'HTI Snapshot Mount' to HCP
HCP
Restore and recover Oracle Database on Production/Application host

Table 3 shows the storage pool configuration used for this solution.

TABLE 3. STORAGE POOL CONFIGURATION

Pool ID	hdid-os-sas-pool-01	hdid-ora-fmd-pool-01	hdid-ora-sas-pool-01	hdid-ti-sas-pool-01
Pool Type	Dynamic Provisioning	Dynamic Provisioning	Dynamic Provisioning	Thin Image Provisioning
RAID Group	3-1 – 3-2	4-1 – 4-4	5-1 – 5-3	6-1 – 6-4
RAID Level	RAID-5 (3D+1P)	RAID-10 (2D+2D)	RAID-6 (6D+2P)	RAID-6 (6D+2P)
Drive Type	1.2 TB 10k RPM SAS Drive	1.6 TB Flash Module Drive (FMD)	1.2 TB 10k RPM SAS Drive	1.2 TB 10k RPM SAS Drive
Number of Drives	8	16	24	32
Pool Capacity	9.6 TB	12.8 TB	21.6TB	28.8 TB

Table 4, “Storage Pool Configuration,” shows the logical storage configuration used in this solution. Table 5, “520H B4 Server Blade Specifications on Hitachi Compute 2500,” shows the server blade specifications used on Hitachi Compute Blade 2500. Table 6, “520H B4 Server Blade Specifications on Hitachi Compute Blade 500,” shows the server blade specifications used on Hitachi Compute Blade 500.

TABLE 4. STORAGE POOL CONFIGURATION

Pool ID	hdid-os-sas-pool-01	hdid-ora-fmd-pool-01	hdid-ora-sas-pool-01	hdid-ti-sas-pool-01
Number of VVols	3	30	24	N/A
VVol Size	200GB	400GB	200GB	N/A
Purpose	Operating System	Oracle ■ OLTP Application Tablespaces	Oracle ■ System ■ Sysaux ■ Undo ■ Temp ■ Redo Logs ■ Parameter file ■ Password file ■ Oracle Cluster Registry ■ Voting Disk	Hitachi Thin Image snapshot images
Storage Port	1A, 2A, 1B, 2B, 1C, 2C, 1D, 2D, 3C, 4C, 3D, 4D			1A, 2A

TABLE 5. 520H B4 SERVER BLADE SPECIFICATIONS ON HITACHI COMPUTE 2500

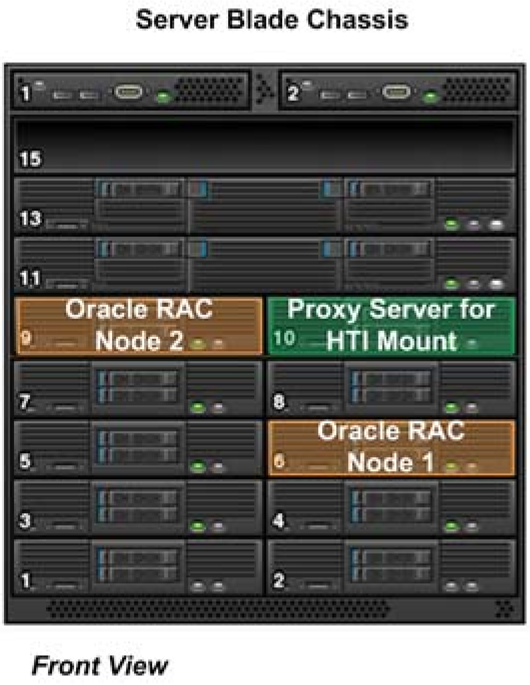
Server	Form Size	Server Name	Role	CPU Core	RAM	Blade
Node1	Half-Width size	hdid-hcp-oracle-01	Oracle RAC node	16	256 GB	6
Node2	Half-Width size	hdid-hcp-oracle-02	Oracle RAC node	16	256 GB	9
Node3	Half-Width size	hdid-mount-host	Mount host, Veritas NetBackup media server, and Oracle host	16	256 GB	10

TABLE 6. 520H B4 SERVER BLADE SPECIFICATIONS ON HITACHI COMPUTE BLADE 500

Form Size	Server Name	Role	CPU Core	RAM
Half-Width size	HV01	Hosts for Hitachi Data Instance Director virtual machines and NetBackup Master virtual machine	24	384 GB

Figure 4 shows the infrastructure for the 2-socket server used in this solution.

Figure 4



Database Layout

The database layout design uses recommended practices for Hitachi Data Instance Director for use with Oracle Database 12c. Configuration details in this document are for the tested environment. However, your production environment may vary.

Table 7, “Oracle RAC ASM Disk Group and Oracle Database File Structure,” on page 14 provides the recommended files system and database file structure for a Hitachi Data Instance Director environment to protect Hitachi Unified Compute Platform for Oracle Database 12c. The descriptions of the Oracle RAC ASM disk groups, the Oracle Database, and the Oracle node ASM disk groups (proxy server) file structure follow the table.

Note — For recommendations concerning Oracle file location prior to Hitachi Data Instance Director backup and Data Instance Director block storage requirements, and restrictions or limitations with your environment, refer to *Hitachi Data Instance Director User Guide* or Protecting Oracle12c with Hitachi Data Instance Director in a Single Site Best Practice Guide (AS-431-00 or later, PDF).

TABLE 7. ORACLE RAC ASM DISK GROUP AND ORACLE DATABASE FILE STRUCTURE

Database Files	OCRDG Disk Group	REDO01 Disk Group	REDO02 Disk Group	FRADG Disk Group	DATADG Disk Group	APPDG Disk Group
Oracle Cluster Registry and Voting Disks	X					
Parameter file					X	
Password file					X	
Control files				X		
Redo log file		X	X			
Archive log files				X		
System data files					X	
Application small and big data files						X

This is the Oracle RAC ASM disk groups and Oracle Database file structure description:

- **OCRDG** — Disk group contains Oracle Clusterware and Oracle RAC database configuration information.
- **REDO01** — Disk group contains redo log group 1.
- **REDO02** — Disk group contains redo log group 2.
- **FRADG** — Disk group contains archived redo logs and flashback logs. It also contains a control file.
- **DATADG** — Disk group contains system data files that are created during database creation with Oracle Database Configuration Assistant utility. Disk group also contains an Oracle parameter file (spfile), which is a shared file between two oracle RAC nodes. Disk group also contains the Oracle password file.
- **APPDG** — Disk group contains application data files including small and big tablespaces.

This is the Oracle node ASM disk groups (proxy server) description:

- **OCRDG** — Disk group contains Oracle Clusterware and Oracle RAC database configuration information.

Table 8 shows LUNs, operating system disks, and Oracle ASM disk mappings for Oracle Database.

TABLE 8. LUNS, OPERATING SYSTEM DISKS, AND ORACLE ASM DISK MAPPINGS

LDEVs	LUN	Pool	Operating System Device	ASM Disk	ASMDG	Purpose
0:02:10	0	ora-boot-db-1	/dev/sda1	N/A	N/A	Operating system and Oracle software binaries for the first Oracle database server in a two-node Oracle RAC Database
0:02:11	0	ora-boot-db-2	/dev/sda1	N/A	N/A	Operating system and Oracle software binaries for the second Oracle database server in a two-node Oracle RAC Database
0:02:12 - 0:02:16	1 - 5	ora-data-1 - ora-data-5	/dev/sdb - /dev/sdf	OCR_0000 - OCR_004	OCR	Oracle Cluster Registry and Voting Disk
0:02:17	6	ora-data-6	/dev/sdg1	REDODG01_0000	REDODG01	Online REDO log group
0:02:18	7	ora-data-7	/dev/sdh1	REDODG02_0000	REDODG02	Online REDO log group
00:02:1F - 00:02:2C	14 - 24	ora-data-14 - ora-data-27	/dev/sdo1 - /dev/sdz1	FRADG_0000 - FRADG_0011	FRADG	Flash Recovery Area
0:02:19 - 00:02:2C	8 - 13	ora-data-8 - ora-data-13	/dev/sdi1 - /dev/sdn1	DATADG_0000 - DATADG_0005	DATADG	Sys Sysaux Undo Temp
0:01:12 - 00:01:2D	30-57	ora-fm-data-03 - ora-fmd-data-32	/dev/sdae1 - /dev/sdaz1, /dev/sdba1 - /dev/sdbf1	DATAFMD_0000 - DATAFMD_00029	APPDG	Application Data

TABLE 8. LUNS, OPERATING SYSTEM DISKS, AND ORACLE ASM DISK MAPPINGS (CONTINUED)

LDEVs	LUN	Pool	Operating System Device	ASM Disk	ASMDG	Purpose
0:00:21	0	ora-boot-db-2	/dev/sda1	N/A	N/A	Operating system and Oracle software binaries for the One node Oracle RAC which is also a Proxy node for a Hitachi Thin Image mount operation
0:00:22	1	ora-ocr-proxy-1 - ora-ocr-proxy-5	/dev/sdb	OCR_0000 - OCR_004	OCR	Oracle Cluster Registry and Voting Disk

Table 9, “Oracle Configuration,” on page 16 shows the Oracle ASM configuration. Table 10, “Oracle ASM LUN Count,” on page 16 shows LUN count for the Oracle RAC database.

TABLE 9. ORACLE CONFIGURATION

Environment	Set to This
RAC configuration	Yes
ASM	Yes - Oracle 2 Node RAC Database

TABLE 10. ORACLE ASM LUN COUNT

ASM File Group	LUN Count for a Two Node Oracle RAC	LUN Count for a One Node Oracle RAC for Hitachi Thin Image, Proxy Server, and NetBackup Media Server
OCRDG	5	5
DATADG	10	N/A
APPDG	30	
REDO1DG	1	
REDO2DG	1	
FRADG	12	

Table 11 shows Oracle Database parameters used in Oracle RAC 2-node database configuration.

TABLE 11. ORACLE DATABASE PARAMETERS

Set This	To This
SGA_TARGET	75 GB
PGA_AGGREGATE_TARGET	25 GB
DB_CACHE_SIZE	16 GB
DB_KEEP_CACHE_SIZE	16 GB
DB_RECYCLE_CACHE_SIZE	16 GB
LOG_BUFFER	255066112
USE_LARGE_PAGES	TRUE
FILESYSTEMIO_OPTIONS	SETALL

SAN Architecture

Map the provisioned LDEVs to multiple ports on Hitachi Virtual Storage Platform G600 (VSP G600). These LDEV port assignments provide multiple paths to the storage system from the host for high availability.

On Virtual Storage Platform G600, use four SAN switch connections for the Oracle host HBA to the storage port.

This provides a four-path connection for all LUNs mapped to each of the database servers in the Oracle RAC database.

Table 12, “SAN HBA Connection Configuration to Hitachi Virtual Storage Platform G600,” on page 18 and Table 13, “Hitachi Content Platform Connection to Network Switch,” on page 18 show details of the Fibre Channel switch connect configuration on the Hitachi Virtual Storage Platform G600 ports.

Note — Although all ports for the Hitachi Content Platform nodes are connected to a single network switch, Hitachi Vantara recommends having two ports connected on one switch and two ports connected on the another switch on the Hitachi Content Platform node for high availability.

TABLE 12. SAN HBA CONNECTION CONFIGURATION TO HITACHI VIRTUAL STORAGE PLATFORM G600

Host	HBA	Storage Host Group	Switch Zone	Storage Port
hdid-hcp-oracle-01	HBA1-1	CB2500_229_B6_HBA1_1	CB2500_229_B6_HBA1_1_ASE_42_33_3C	CL3-C
	HBA1-2	CB2500_229_B6_HBA1_2	CB2500_229_B6_HBA1_2_ASE_42_33_4C	CL4-C
	HBA2-1	CB2500_229_B6_HBA2_1	CB2500_229_B6_HBA2_1_ASE_42_33_3D	CL3-D
	HBA2-2	CB2500_229_B6_HBA2_2	CB2500_229_B6_HBA2_2_ASE_42_33_4D	CL4-D
hdid-hcp-oracle-02	HBA1-1	CB2500_229_B9_HBA1_1	CB2500_229_B9_HBA1_1_ASE_42_33_1C	CL1-C
	HBA1-2	CB2500_229_B9_HBA1_2	CB2500_229_B9_HBA1_2_ASE_42_33_2C	CL2-C
	HBA1-1	CB2500_229_B9_HBA2_1	CB2500_229_B9_HBA2_1_ASE_42_33_1D	CL1-D
	HBA1-2	CB2500_229_B9_HBA2_2	CB2500_229_B8_HBA2_2_ASE_42_33_2D	CL2-D
hdid-mount-host	HBA1-1	CB2500_229_B10_HBA1_1	CB2500_229_B10_HBA1_1_ASE_42_33_1A	CL1-A
	HBA1-2	CB2500_229_B10_HBA1_2	CB2500_229_B10_HBA1_2_ASE_42_33_2A	CL2-A
	HBA2-1	CB2500_229_B10_HBA2_1	CB2500_229_B10_HBA2_1_ASE_42_33_1B	CL1-B
	HBA2-2	CB2500_229_B10_HBA2_2	CB2500_229_B10_HBA2_2_ASE_42_33_2B	CL2-B
Hypervisor	HBA1_1	CB500_11_HBA1_1	CB500_11_HBA1_1_ASE_42_33_1A	Command Device

TABLE 13. HITACHI CONTENT PLATFORM CONNECTION TO NETWORK SWITCH

Storage	Hitachi Content Platform port	Switch	Switch Port
Hitachi Content Platform Node1	Port 1	Brocade VDX 6740	7
	Port 2		11
	Port 3		12
	Port 4		21
Hitachi Content Platform Node2	Port 5	Brocade VDX 6740	7
	Port 6		11
	Port 7		12
	Port 8		21

Network Architecture

This architecture requires the following separate networks:

- **Private Network (also called cluster interconnect)** — This network must be scalable. In addition, it must meet the low latency needs of the network traffic generated by the cache synchronization of Oracle Real Application Clusters and inter-node communication among the nodes in the cluster.
- **Public Network** — This network provides client connections to the applications and Oracle Real Application Clusters.

Hitachi Vantara recommends using pairs of 10 Gb/s NICs for the cluster interconnect network and public network.

Each server blade in this reference architecture has a quad port 10 Gb/s onboard NIC. The NIC ports have interconnected links to the two internal 10 Gb/s Ethernet switches in the chassis.

Observe these points when configuring private and public networks in your Oracle Real Application Cluster environment:

- For each server in the clusterware configuration, use at least two identical, high-bandwidth, low-latency NICs for the interconnection.
- Use NIC bonding to provide failover and load balancing of interconnections within a server.
- Set all NICs to full duplex mode.
- Use at least two public NICs for client connections to the application and database.
- Use at least two private NICs for the cluster interconnection.

Physical Network Configuration

Figure 5 shows the network configuration for the Hitachi Data Instance Director (HDID) environment. It uses Oracle Real Application Cluster (RAC) nodes, Veritas NetBackup, and Hitachi Thin Image (HTI).

Figure 5

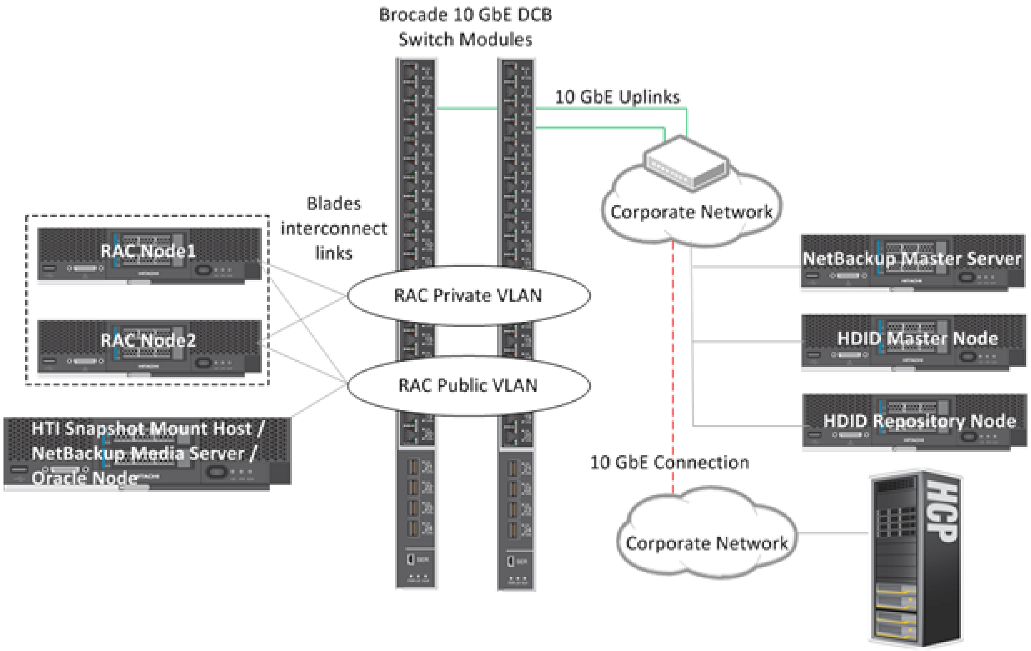


Table 14, “Network Configuration,” on page 20 shows the network configuration and Table 15, “Virtual IP and Scan Name Configuration,” on page 20 shows virtual IP address and SCAN name configuration used when testing the environment. Table 16, “Hitachi Content Platform Storage and Access Node Configuration,” on page 20 has the Hitachi Content Platform configuration used when testing. Your values may be different.

TABLE 14. NETWORK CONFIGURATION

Server	NIC Ports	NIC Bond	VLAN/Subnet	IP Address	Network
Database Server 1 (Blade 6)	B6NIC-0	Bond1	208	192.168.208.22	Private
	B6-NIC-1				Private
	B6-NIC-2	Bond100	167	172.17.167.242	Public
	B6-NIC-3				Public
Database Server 2 (Blade 9)	B9NIC-0	Bond1	208	192.168.208.23	Private
	B9-NIC-1				Private
	B9-NIC-2	Bond100	167	172.17.167.243	Public
	B9-NIC-3				Public
Oracle host, Veritas NetBackup media server, proxy server for Hitachi Thin Image mount host (Blade 10)	B10-NIC-1	-	208	192.168.208.24	Private
	B10-NIC-3	-	167	172.17.167.246	Public

TABLE 15. VIRTUAL IP AND SCAN NAME CONFIGURATION

Server	Virtual IP	Scan Name - hdid-oracle-scan
Database Server 1 (Blade 6)	172.17.167.244	172.17.167.145 172.17.167.146 172.17.167.147
Database Server 2 (Blade 9)	172.17.167.245	

TABLE 16. HITACHI CONTENT PLATFORM STORAGE AND ACCESS NODE CONFIGURATION

Hitachi Content Platform	Module	Management IP	Data Access IP	VIP
Node1 — HCPS10-1	Server Module 1	172.17.252.116	172.17.167.118	172.17.167.120
	Server Module 2	172.17.252.154	172.17.167.119	172.17.167.122

TABLE 16. HITACHI CONTENT PLATFORM STORAGE AND ACCESS NODE CONFIGURATION

Hitachi Content Platform	Module	Management IP	Data Access IP	VIP
Node1 — HCPS10-2	Server Module 1	172.17.252.120	172.17.167.194	172.17.167.123
	Server Module 2	172.17.252.122	172.17.167.195	172.17.167.211
Hitachi Content Platform virtual machine storage access node		172.17.252.112		

Deploy the Solution

Deploying this solution requires doing the following procedures:

1. See “Deploy Hitachi Data Instance Director” on page 22.
    (1) “Install the Hitachi Data Instance Director Master Node and Repository Note” on page 22
    (2) “Create the Hitachi Data Instance Director Master Node” on page 22
    (3) “Define the Hitachi Data Instance Director Policy” on page 24
    (4) “Define Hitachi Data Instance Director Data Flow ” on page 26
    (5) “Distribute and Activate Hitachi Data Instance Director” on page 27
2. Prepare Hitachi Content Platform or Hitachi Command Suite
    - If Deploying with Hitachi Content Platform
        i. “Install Hitachi Content Platform ” on page 28
        ii. “Add Hitachi Content Platform Storage Nodes to the Hitachi Content Platform Access Node” on page 28
        iii. “Set Up a Hitachi Content Platform Tenant” on page 30
        iv. “Set Up a Hitachi Content Platform Tenant Data Access User Account” on page 31
    - If Deploying with Hitachi Cloud Services
        - “Deploy Hitachi Cloud Services” on page 32
3. Deploy Veritas NetBackup: System
    (1) “Set Up Veritas NetBackup Master Server ” on page 32
    (2) “Set Up Veritas NetBackup Media Server ” on page 32
    (3) “Set Up Veritas NetBackup Client” on page 33
4. Deploy Veritas NetBackup Cloud Connector
    (1) “Configure Veritas NetBackup Cloud Storage Server ” on page 33
    (2) “Configure a Disk Pool” on page 36
    (3) “Configure a Storage Unit ” on page 38
    (4) “Add Media Servers to the Cloud Storage Server” on page 39
    (5) “Configure Policies” on page 40

5. Tune NetBackup with Hitachi Cloud Storage
    - "Tunable Parameters " on page 44
    - "Disk Pool Properties" on page 45
    - "Storage Unit Properties" on page 45
    - "Global Attributes" on page 46
    - "Media Server Scalable Storage Properties" on page 46
    - "Storage Unit Properties" on page 45

Your checklist might vary based on your environment. More information about each of these procedures follows.

Deploy Hitachi Data Instance Director

To deploy Hitachi Data Instance Director in this solution, do these procedures.

Install the Hitachi Data Instance Director Master Node and Repository Note

The Hitachi Data Instance Director Installation Guide, User Guide, and other documentation are located in the documentation folder of the DVD and ISO image. Refer to the Installation Contents of the Hitachi Data Instance Director User's Guide for software and hardware details.

Deploy the **master node o**n a virtual machine running Microsoft® Windows Server® in a network. You can deploy a second passive master node on a virtual machine running Windows Server in a failover cluster.

A site might have more than one **repository node**. The repositories work together to allow searches or restores that pull data from several repositories.

Create the Hitachi Data Instance Director Master Node

Connect to the Hitachi Data Instance Director master node, which is installed on a virtual machine running Microsoft® Windows Server® 2012 R2 on Hitachi Compute Blade 500.

To create the Data Instance Director master node, do the following.

1. To open the Node Management screen, click **Node Manager** in the Navigation pane.

   The nodes that have Data Instance Director installed are detected automatically. These nodes display under **Unauthorized Nodes**.

2. To authorize the node, select (highlight) the node that is to become the master node under **Unauthorized Nodes**, and then click **Authorize**.
3. Add the node to the nodes connected to Oracle databases.

   (1) Under **Agentless/Hardware Node**, click **Oracle** in the drop-down list.

   (2) Click **Create**.

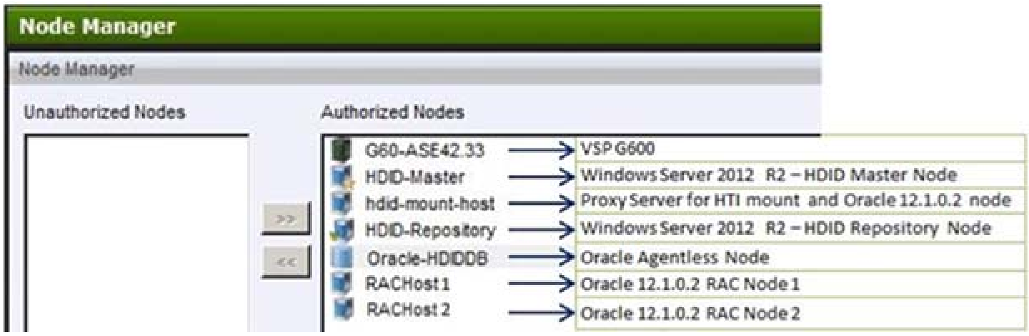
   (3) To add the single instance to the **Nodes connected to Oracle databases** list, select the Oracle node under **Available nodes** and then click **Add** [>>].

4. To add nodes that are part of Oracle RAC, select nodes in the RAC under **Available Nodes**, and then add them to the list on the right. Click **Next** to display the second page of the **Agentless/Hardware Node** dialog box.
5. Type the name to identify the node in the **Node Name** text box. This example uses the name **Oracle-HDIDDB**.

   The new node with the name **Oracle-HDIDDB** is under **Unauthorized Nodes**.

6. To authorize the node, select the new node under **Unauthorized Nodes**, and then click **Authorize**.

Figure 6



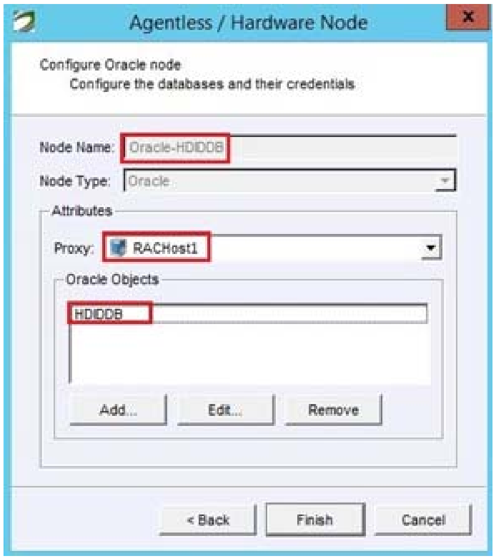
G60-ASE42.33	VSP G600
HDID-Master	Windows Server 2012 R2 – HDID Master Node
hdid-mount-host	Proxy Server for HTI mount and Oracle 12.1.0.2 node
HDID-Repository	Windows Server 2012 R2 – HDID Repository Node
Oracle-HDIDDB	Oracle Agentless Node
RACHost1	Oracle 12.1.0.2 RAC Node 1
RACHost 2	Oracle 12.1.0.2 RAC Node 2

The newly added Oracle agentless node is responsible for interfacing with the Oracle server. This must be either the Oracle server node (when dealing with a single-instance setup), or one of the Oracle RAC nodes (when dealing with a RAC setup). In this example, **RACHost1** is the proxy node.

The Oracle objects provide the Oracle SID after adding it. In this case, Hitachi Data Instance Director uses the credentials of the owner of the Oracle binary to connect to the database.

7. Click **Finish**.

Figure 7



Agentless / Hardware Node

Configure Oracle node
Configure the databases and their credentials

Node Name: Oracle-HDIDDB
Node Type: Oracle

Attributes
Proxy: RACHost1

Oracle Objects
HDIDDB

Define the Hitachi Data Instance Director Policy

A policy defines data classifications and data operations.

To create a new storage policy type for Oracle RAC databases, do the following.

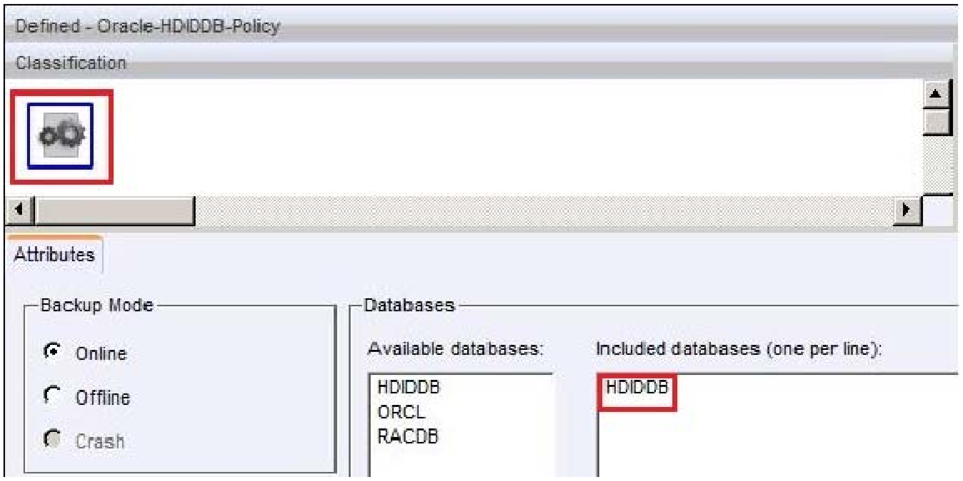
1. To open the **Policy Definition** screen and define a policy, click **Policy Definition** in the navigation pane.
2. Choose the **Attributes** for the Hitachi Data Instance Director database to be included.

   Included databases the databases that are replicated and mounted.

   (1) Under **Backup Mode**, click **Online.**

   (2) Under **Databases,** select **HDIDDB** from **Available databases**, and then click **Include**.

Figure 8



Defined - Oracle-HDIDDB-Policy

Classification

Attributes

Backup Mode
● Online
○ Offline
○ Crash

Databases

Available databases:
HDIDDB
ORCL
RACDB

Included databases (one per line):
HDIDDB

3. Define the data operation.

   Use the **Operation** palette (right of the screen) to define the data operation.

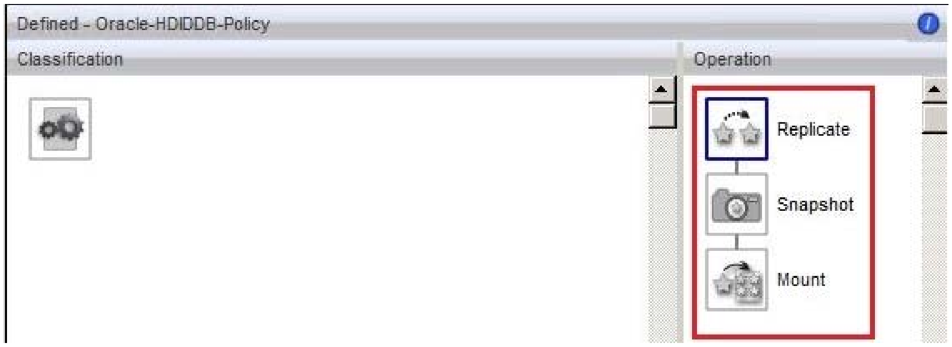
   (1) Drag the **Replicate** symbol to the **Operation** palette.

   (2) Attach the **Snapshot** symbol to the **Replicate** symbol.

   (3) Attach the **Mount** symbol to the **Snapshot** symbol.

   (4) Under **Schedules**, choose the name **HDIDDB-Schedule** for the Replicate, Snapshot and Mount operation.

Figure 9



Defined - Oracle-HDIDDB-Policy

Classification

Operation

Replicate

Snapshot

Mount

   (5) Name the script as an attribute.

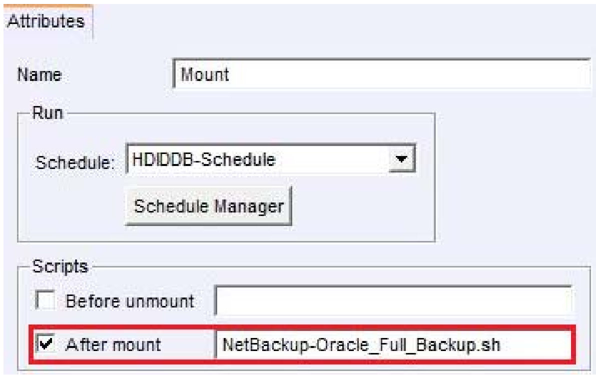
      i. Click the **Attributes** tab for the **Mount** symbol.

      ii. In the **Scripts** area, select the **After mount** check box.

      iii. In the **Scripts** area, type the script name in the text box. Use this name for the script, which is found in /opt/Hitachi/HDID/scripts on the hdid-mount-host machine:

         NetBackup-Oracle-Full_Backup.sh

Figure 10



Attributes

Name: Mount

Run

Schedule: HDIDDB-Schedule

Schedule Manager

Scripts

☐ Before unmount

☑ After mount NetBackup-Oracle_Full_Backup.sh

Define Hitachi Data Instance Director Data Flow

Assign the snapshot policy to the Oracle-HDIDDB agentless node connected to the Oracle database server or Oracle RAC.

To define the Hitachi Data Instance Director data flow, do the following.

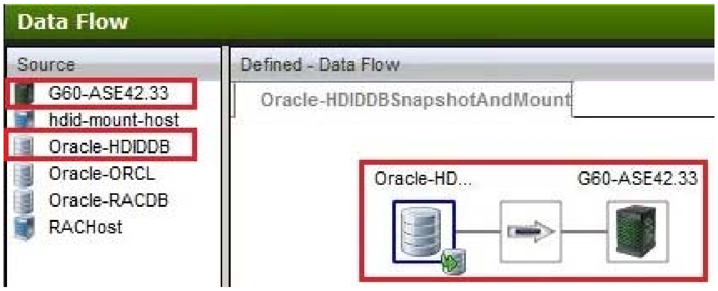
1. To open the **Data Flow** screen, click **Data Flow** in the Navigation pane.

   The **Source** palette, on the left, contains the source nodes, movers, and destination nodes. Replicating and mounting of an Oracle database requires you only to specify the Oracle server agentless node.

2. Drag the Oracle-HDIDDB source node to the **Defined-Data Flow** palette.
3. From the **Mover** pallet, select the **Batch** symbol (➡).
4. From the **Destination** palette, under **Hitachi Block Storage**, select the Hitachi Virtual Storage Platform G600 (VSP G600) storage as a target storage for the replicate and mount operation. In this example, the VSP G600 is labeled **G600-ASE42.33**.

   The VSP G600 storage is where the Oracle RAC nodes are present.

Figure 11



5. In the Defined-Data Flow palette, select the **Oracle-HDIDDB-SnapshotAndMount Dataflow** symbol to display a list of defined policies on the **Policies to assign locally tab** below the workspace.
6. Click the **Oracle-HDIDDB-Policy** check box and the **Snapshot** check box to assign them to the **Oracle-HDIDDB-SnapshotAndMount Dataflow**.
7. For the Virtual Storage Platform G600 storage (G600-ASE-42.33 in this example), do the following on the **Oracle-HDIDDB-Policy Replicate** tab:

   (1) For **Target Storage**, select the Hitachi Thin Image storage pool **ti-hdid-hcp-pool**.

   (2) For **Replication Type**, click the **Refreshed Snapshot** option.

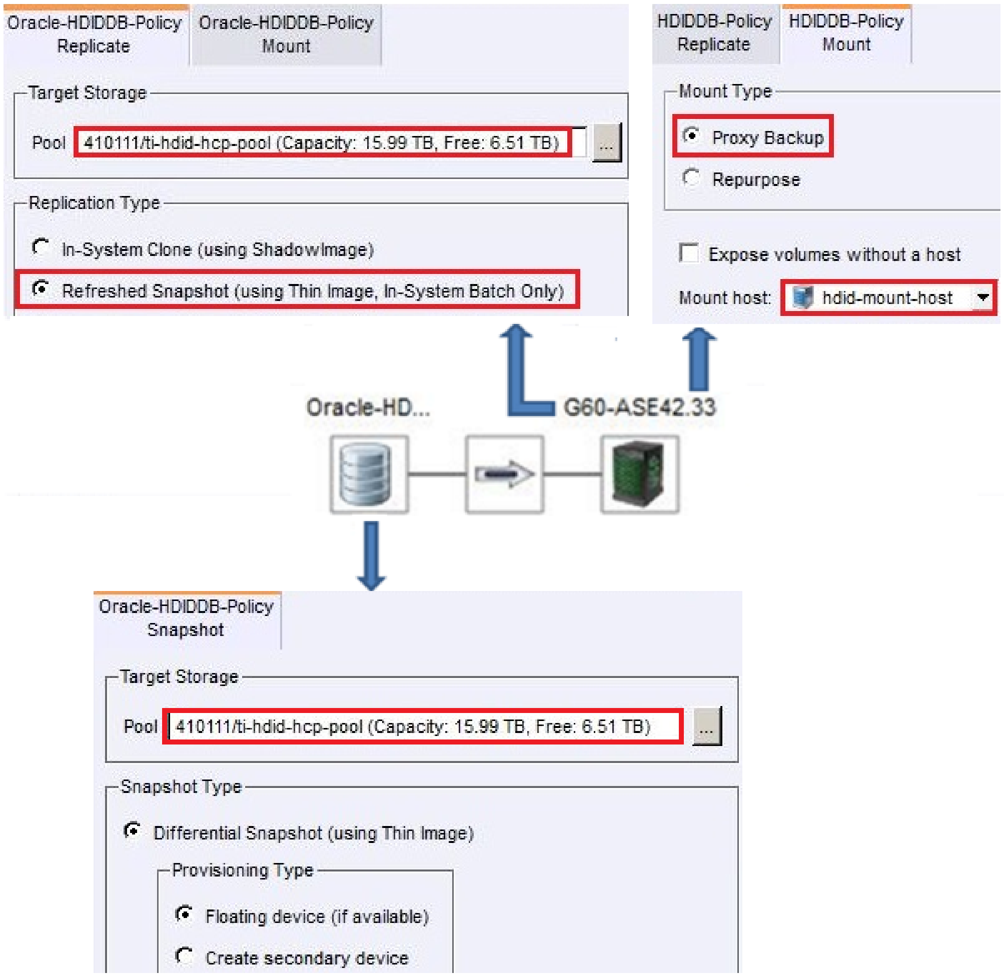
8. On the **Oracle-HDIDDB-Policy HTI Snapshot Mount** tab, do the following:

   (1) For **Mount Type**, click the **Proxy Backup** option.

   (2) For **Mount Host**, click **hdid-mount-host**.

Figure 12 on page 27 shows the complete data flow process.

Figure 12



Oracle-HDIDDB-Policy Replicate | Oracle-HDIDDB-Policy Mount

Target Storage

Pool 410111/ti-hdid-hcp-pool (Capacity: 15.99 TB, Free: 6.51 TB)

Replication Type

○ In-System Clone (using ShadowImage)

● Refreshed Snapshot (using Thin Image, In-System Batch Only)

HDIDDB-Policy Replicate | HDIDDB-Policy Mount

Mount Type

● Proxy Backup

○ Repurpose

□ Expose volumes without a host

Mount host: hdid-mount-host

Oracle-HDIDDB-Policy Snapshot

Target Storage

Pool 410111/ti-hdid-hcp-pool (Capacity: 15.99 TB, Free: 6.51 TB)

Snapshot Type

● Differential Snapshot (using Thin Image)

Provisioning Type

● Floating device (if available)

○ Create secondary device

Distribute and Activate Hitachi Data Instance Director

To distribute and activate Hitachi Data Instance Director, do the following.

1. From the tool bar, click the **Save and Compile** button. The **Rules Compilation** dialog box displays.
2. After the compiling the policy, click **Distribute Rules**.

This distributes the rules, and activates the policy.

Deploy Hitachi Content Platform

To deploy Hitachi Content Platform, perform the following procedures.

You can skip the procedures to deploy Hitachi Content Platform if you will integrate Veritas NetBackup with off-premises Hitachi Cloud Services.

Install Hitachi Content Platform

To install Hitachi Content Platform, do the following.

1. Apply Hitachi Content Platform pre-installation requirements and tasks.
2. Install the appliance operating system.
3. Install Hitachi Content Platform.

For complete details on installing Hitachi Content Platform, refer to *Hitachi Content Platform: Installing an HCP System.*

Add Hitachi Content Platform Storage Nodes to the Hitachi Content Platform Access Node

Repeat this process to add both Hitachi Content Platform storage nodes to the Hitachi Content Platform access node.

To add a Hitachi Content Platform storage node to the Hitachi Content Platform access node, do the following.

1. Add a storage node to the access node.

   Repeat this for both storage nodes.

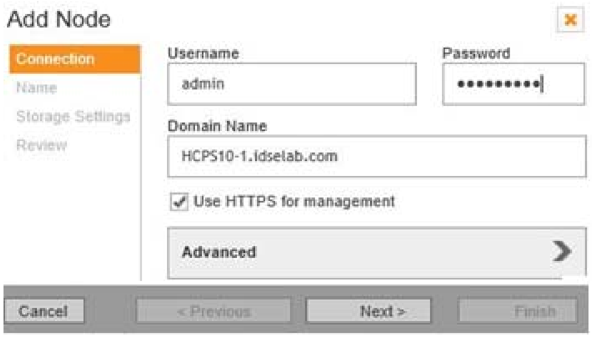
   (1) Using the System Management Console (SMC) for Hitachi Content Platform, from the **Hardware** menu, click **Add Node**.

   (2) From the **Connection** tab on **Add Node**, supply the following and then click **Next**:

   - **Username**
   - **Password**
   - **Domain Name**

   The Hitachi Content Platform node name and serial number display on the **Name** tab.

Figure 13



Add Node

Username: admin

Password: ••••••••••

Domain Name: HCPS10-1.idselab.com

☑ Use HTTPS for management

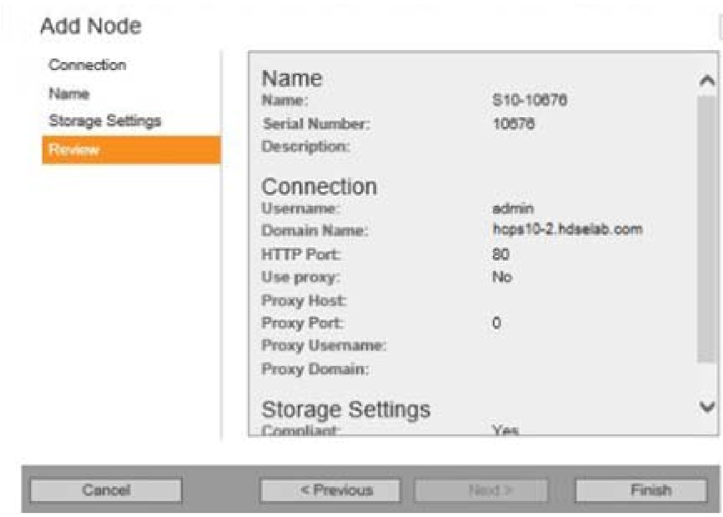
   (3) On the **Name** tab, click **Next**.

   (4) On the **Storage Settings** tab, to add node under the Content Platform pool, click **Add to existing storage pool**, and click **Next**.

   On the Review tab, a summary displays.

(5) To add the node to the Hitachi Content Platform pool, click **Finish**.

Figure 14



Name

Name:	S10-10676
Serial Number:	10676
Description:	

Connection

Username:	admin
Domain Name:	hcps10-2.hdselab.com
HTTP Port:	80
Use proxy:	No
Proxy Host:	
Proxy Port:	0
Proxy Username:	
Proxy Domain:	

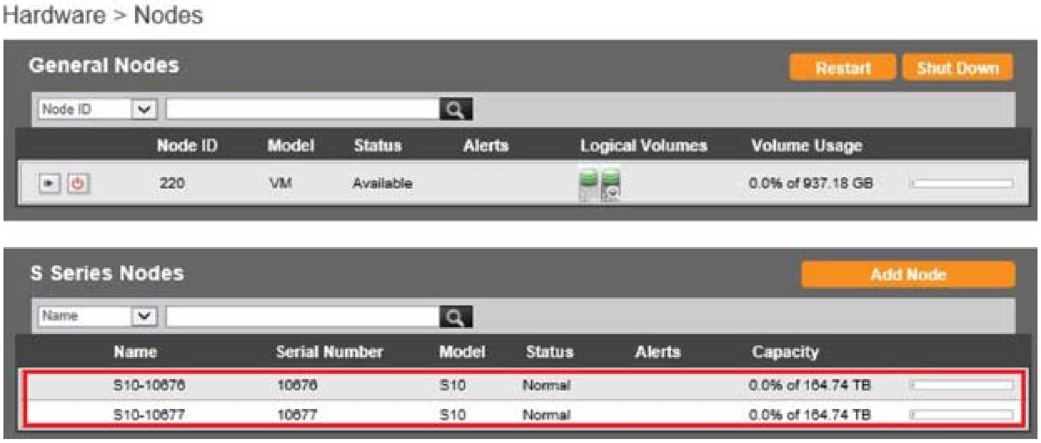
Storage Settings

Compliant:	Yes

Repeat this procedure to add the second Hitachi Content Platform node.

2. Verify both Hitachi Content Platform nodes are added. On the System Management Console (SMC). Click the **Hardware** menu and then click **Nodes**. Both nodes should display, as in Figure 15.

Figure 15



General Nodes

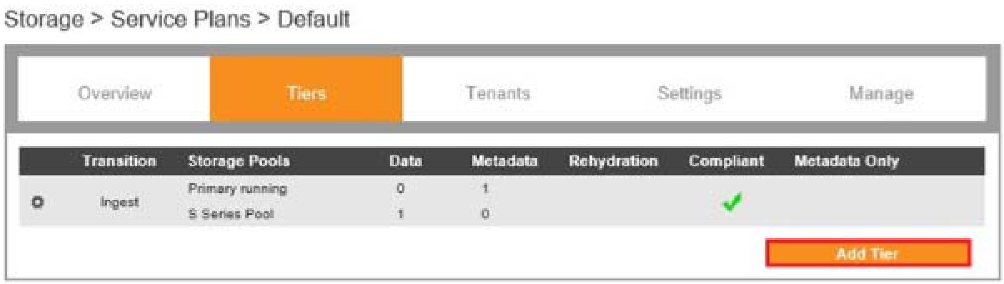
Node ID	Model	Status	Alerts	Logical Volumes	Volume Usage
220	VM	Available			0.0% of 937.18 GB

S Series Nodes

Name	Serial Number	Model	Status	Alerts	Capacity
S10-10676	10676	S10	Normal		0.0% of 164.74 TB
S10-10677	10677	S10	Normal		0.0% of 164.74 TB

3. Enable tiering on the Hitachi Content Platform node. From the System Management Console, click **Storage**, then **Service Plans**, and then click **Add Tier**.

Figure 16



	Transition	Storage Pools	Data	Metadata	Rehydration	Compliant	Metadata Only
○	Ingest	Primary running S Series Pool	0 1	1 0		✓	

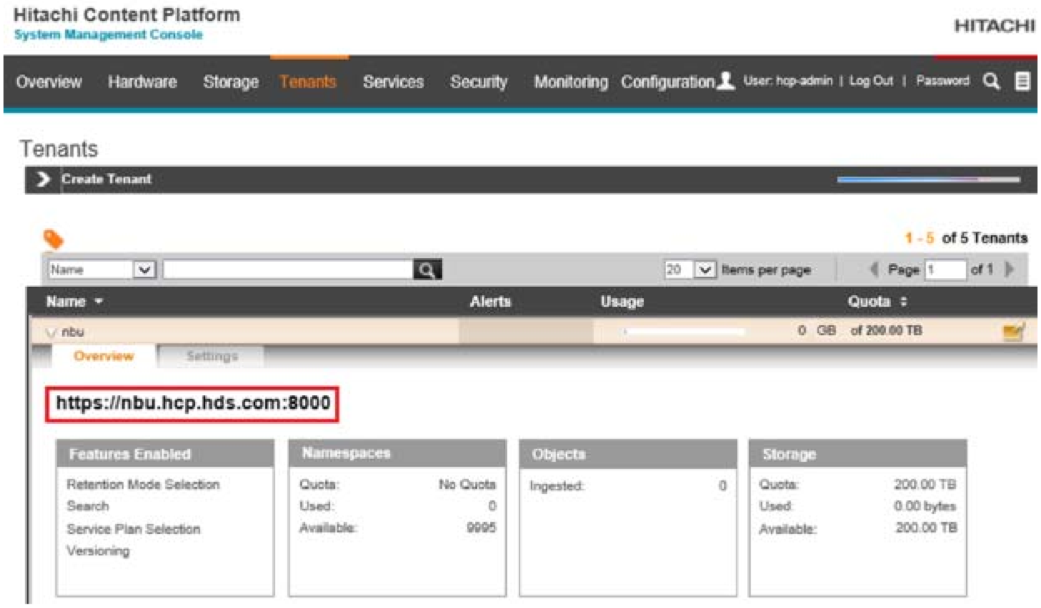
Set Up a Hitachi Content Platform Tenant

To set up a Hitachi Content Platform tenant, do the following.

1. Using the System Management Console (SMC), click **Tenants**, and then **Create Tenant**.
2. Do the following for the new tenant:
   (1) Configure the following for the tenant:
   - Tenant name
   - Hard quota
   - Soft quota
   - Namespace quota

   (2) Enable the features you want.
   (3) Provide credentials for the tenant's initial security account.
   (4) Click **Create Tenant**.

Figure 17



Name	Alerts	Usage	Quota
nbu			0 GB of 200.00 TB

https://nbu.hcp.hds.com:8000

Features Enabled

Retention Mode Selection
Search
Service Plan Selection
Versioning

Namespaces

Quota:	No Quota
Used:	0
Available:	9995

Objects

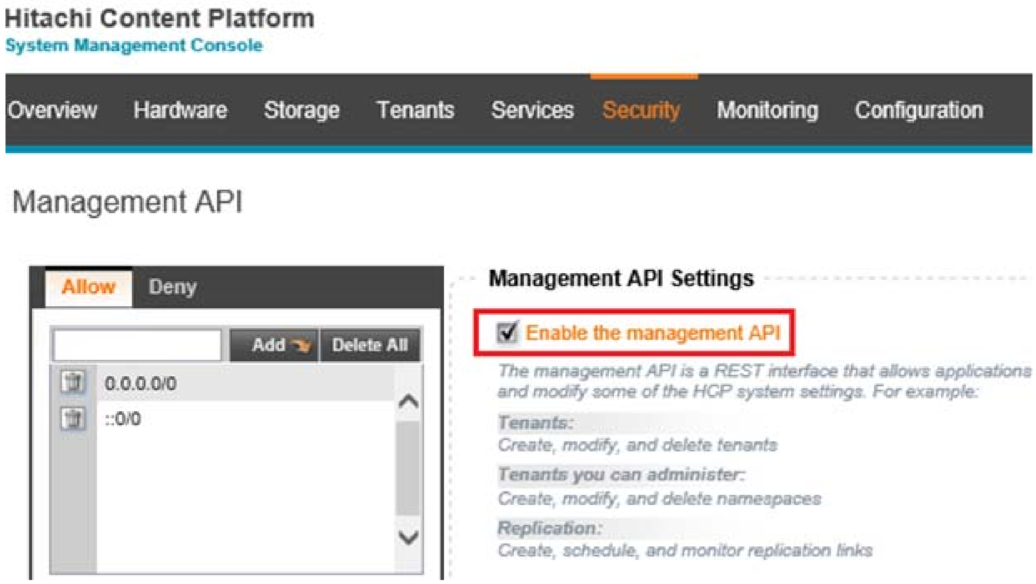
Ingested:	0

Storage

Quota:	200.00 TB
Used:	0.00 bytes
Available:	200.00 TB

3. Enable management through APIs for the tenant.
   1. (1) In the SMC, select the tenant that you created.
   2. (2) On the **Overview** tab, click the tenant URL. In Figure 17, the tenant URL shown is the one used during testing the environment (https://nbu.hcp.hds.com:8000). Your tenant URL will be different.
   3. (3) From the **Security** tab, click **Management API**, and then select the **Enabled Management through APIs** check box.

Figure 18



Management API

0.0.0.0/0

::0/0

Management API Settings

☑ Enable the management API

The management API is a REST interface that allows applications and modify some of the HCP system settings. For example:

Tenants:
Create, modify, and delete tenants

Tenants you can administer:
Create, modify, and delete namespaces

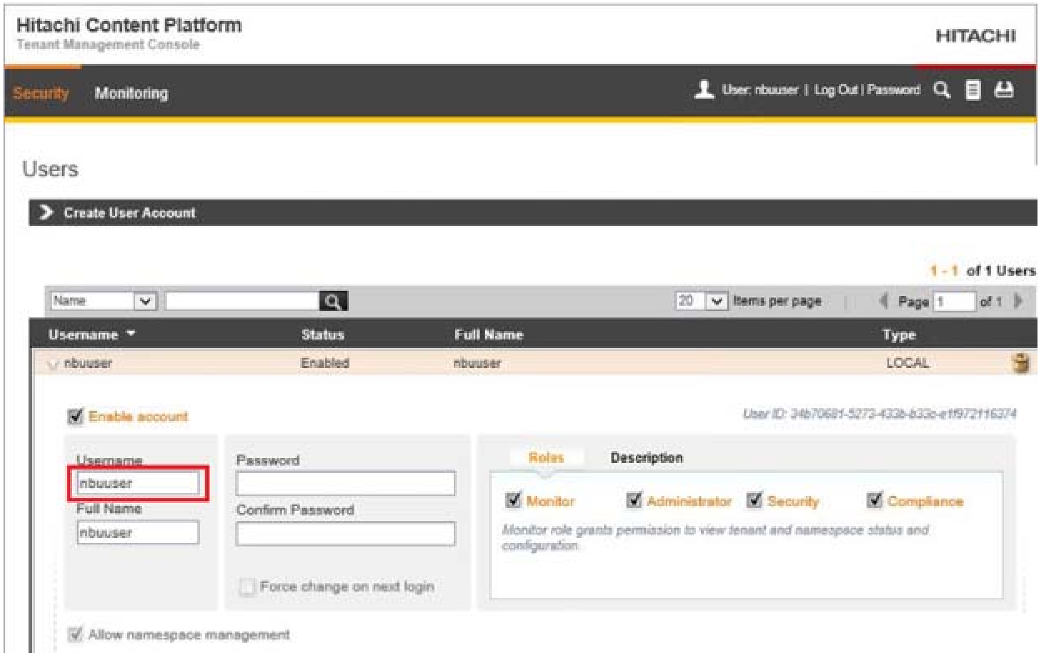
Replication:
Create, schedule, and monitor replication links

Set Up a Hitachi Content Platform Tenant Data Access User Account

To set up a user account for tenant data access for Veritas NetBackup on Hitachi Content Platform, do the following.

1. Using the Tenant Management Console, from the **Create a data access user for NetBackup** menu, click **Create User Account**.
2. Complete the following:
   - Username
   - Full name
   - Password
3. Select the **Allow namespace management** check box.
4. Assign the roles as needed.

Figure 19



Username	Status	Full Name	Type
nbuuser	Enabled	nbuuser	LOCAL

☑ Enable account

User ID: 34b70681-5273-433b-b33e-e1f972116374

Username: nbuuser

Full Name: nbuuser

Password:

Confirm Password:

☐ Force change on next login

☑ Monitor ☑ Administrator ☑ Security ☑ Compliance

Monitor role grants permission to view tenant and namespace status and configuration

☑ Allow namespace management

Deploy Hitachi Cloud Services

You can skip this procedure if you will integrate Veritas NetBackup with an on premise Hitachi Content Platform.

Visit Cloud Services to learn more about Hitachi Cloud Services.

To register with Hitachi Cloud Services, send an email message to hitachicloudservices@HitachiVantara.com

Deploy Veritas NetBackup System

To deploy Veritas NetBackup, perform the following procedures.

Set Up Veritas NetBackup Master Server

This deployment uses a platform running Microsoft® Windows Server®.

To install Veritas NetBackup Master Server, run the setup and follow the wizard.

Set Up Veritas NetBackup Media Server

After installing Veritas NetBackup Master Server, install NetBackup Media Server. Depending on your requirements, you can install one or more media servers.

This installation is on a Linux platform, which is also a Hitachi Data Instance Director proxy server and Oracle server.

Note — The NetBackup Master Server and Media Server should have same time zone and system time.

Set Up Veritas NetBackup Client

A Veritas NetBackup client is a NetBackup component where source data resides for backup.

Deploy Veritas NetBackup Cloud Connector

To deploy Veritas NetBackup Cloud Connector, perform the following procedures.

Configure Veritas NetBackup Cloud Storage Server

To configure Veritas NetBackup Cloud Storage Server, do the following.

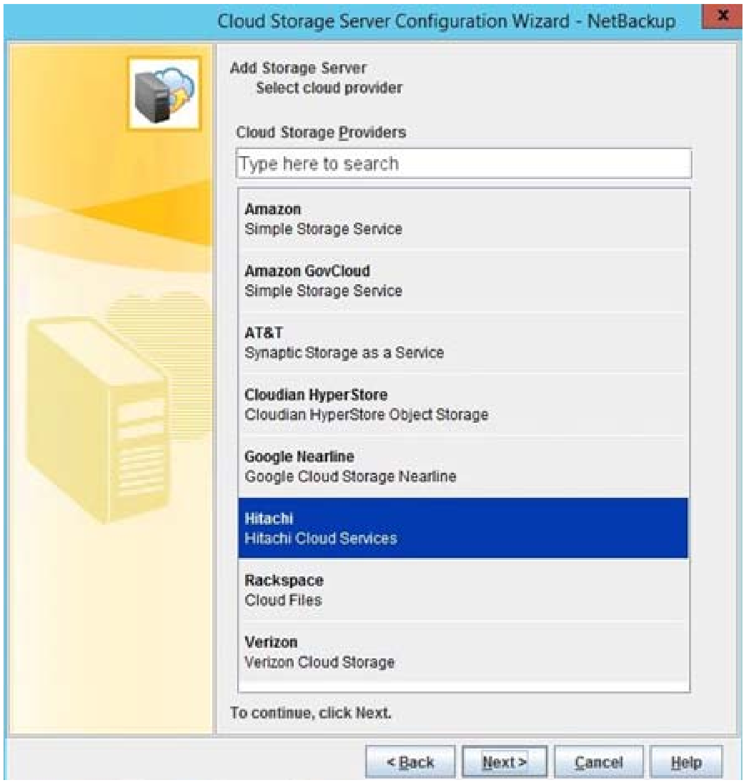
1. Start the Cloud Storage Server Configuration Wizard.

   (1) Using NetBackup Administration Console, do the following:

   - Click **Master Server** on the left pane.
   - Click **Configure Cloud Storage Server** on the right pane.

   (2) Click **Hitachi** in the list of cloud storage providers and click **Next** (Figure 20 on page 33).

Figure 20



Cloud Storage Server Configuration Wizard - NetBackup

Add Storage Server
Select cloud provider

Cloud Storage Providers

Type here to search

Amazon
Simple Storage Service

Amazon GovCloud
Simple Storage Service

AT&T
Synaptic Storage as a Service

Cloudian HyperStore
Cloudian HyperStore Object Storage

Google Nearline
Google Cloud Storage Nearline

Hitachi
Hitachi Cloud Services

Rackspace
Cloud Files

Verizon
Verizon Cloud Storage

To continue, click Next.

2. Add the cloud storage.

   (1) In **Cloud Storage Provider**, click **Add Cloud Storage**.

   (2) Add this configuration information.

      i. **Service host**: Enter the fully qualified domain name of Hitachi Content Platform or Hitachi Command Suite tenant.

      ii. **Service Endpoint:** Leave blank.

      iii. **HTTP Port:** 80 (default)

      iv. **HTTPS Port**: 443 (default)

      v. **Storage Server Name**: Enter the logical name you wish to use in NetBackup for this Hitachi Content Platform or Hitachi Command Suite tenant.

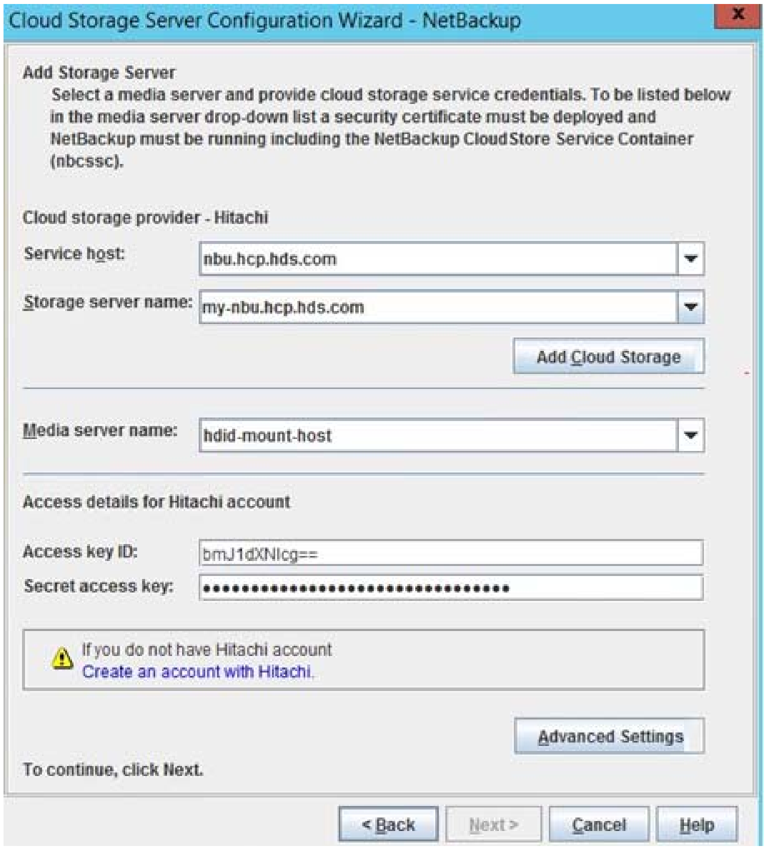
Note — When configuring an Amazon S3-compatible cloud provider like Hitachi Content Platform, Veritas recommends that storage server names should be logical names and should not match a physical host name.

      vi. **Endpoint Access Style**: Path Style (leave as is)

      vii. **Region Settings Tab**: Do not enter any region settings.

      viii. When finished, click **OK**.

Figure 21



Cloud Storage Server Configuration Wizard - NetBackup

Add Storage Server

Select a media server and provide cloud storage service credentials. To be listed below in the media server drop-down list a security certificate must be deployed and NetBackup must be running including the NetBackup CloudStore Service Container (nbcssc).

Cloud storage provider - Hitachi

Service host: nbu.hcp.hds.com

Storage server name: my-nbu.hcp.hds.com

Media server name: hdid-mount-host

Access details for Hitachi account

Access key ID: bmJ1dXNlcg==

Secret access key: ••••••••••••••••••••••••••••••••

If you do not have Hitachi account
Create an account with Hitachi.

To continue, click Next.

(3) Choose a media server name hosting Veritas NetBackup. You will add this storage server to the additional media server later.

(4) Type the Hitachi Content Platform or Hitachi Command Suite tenant user name in Base64-encoded format into the **Access key ID** text box. This is the tenant data access user created in the previous step.

(5) Type the Hitachi Content Platform or Hitachi Command Suite tenant user's password in MD5-hashed format into the **Secret access key** text box.

3. Make the advanced settings.

(1) Click **Advanced Settings**. The **Advanced Server Configuration** dialog box opens.

(2) Determine what to do with the **Use SSL** check box.

The **Use SSL** check box is selected by default.

- Leave the check box selected if the following is true:

  You are connecting to Hitachi Cloud Services.

  You are connecting to Hitachi Content Platform and you have installed a certificate signed by a trusted certificate authority on Hitachi Content Platform.

- Uncheck (clear) the check box if the following is true:

  You are connecting to Hitachi Content Platform and Hitachi Content Platform is using the self-signed certificate generated by the Hitachi Content Platform system.

Note — It may be possible to install a Hitachi Content Platform self-signed certificate on your Veritas NetBackup media server or servers in order to establish a trusted SSL connection between NetBackup and Hitachi Content Platform using self-signed certificates. However, that procedure is outside of the scope of this document.

(3) Determine what to do with the **Use Proxy Server** check box.

The **Use Proxy Server** check box is not selected by default.

- Select this check box only if you require a proxy to connect with Hitachi Content Platform or Hitachi Command Suite.

(4) Click **OK** to continue.

(5) In the wizard, click **Next**.

4. Make the compression and encryption settings.

(1) Determine the encryption setting.

By default, the **Encryption** check box is not selected.

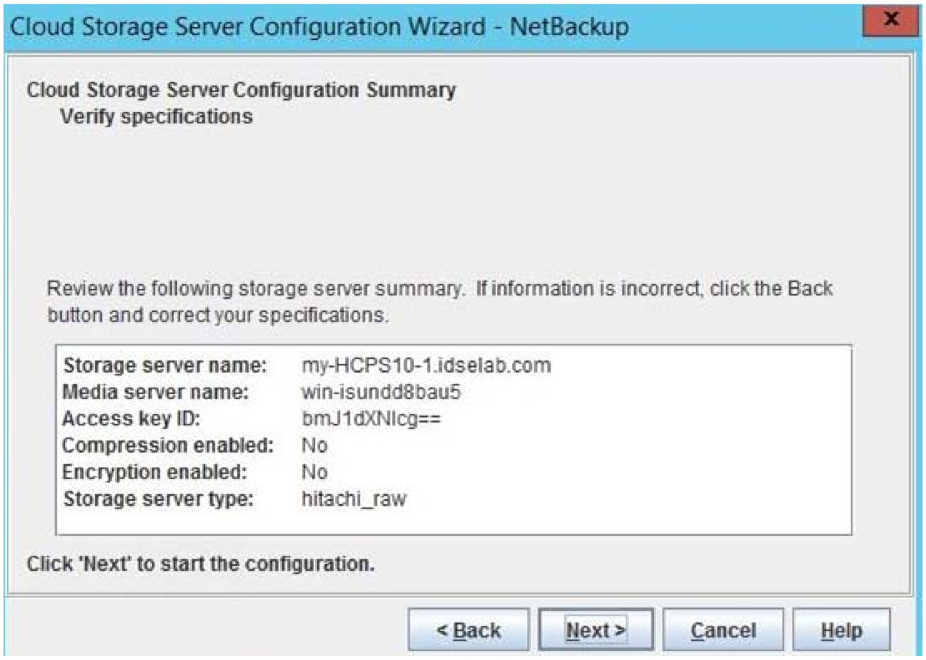
- Select this check box only if you want to encrypt data before sending it to Hitachi Content Platform or Hitachi Command Suite.

(2) Click **Next**.

The Cloud Storage Server Configuration Summary displays.

5. Verify that cloud storage server configuration settings are correct and click **Next**.

Figure 22



Cloud Storage Server Configuration Summary
Verify specifications

Review the following storage server summary. If information is incorrect, click the Back button and correct your specifications.

Storage server name:	my-HCPS10-1.idselab.com
Media server name:	win-isundd8bau5
Access key ID:	bmJ1dXNlcg==
Compression enabled:	No
Encryption enabled:	No
Storage server type:	hitachi_raw

Click 'Next' to start the configuration.

6. To continue to the Disk Pool Configuration wizard, when prompted, click **Next**.

Configure a Disk Pool

Use the Disk Pool Configuration wizard to define a disk pool.

To define a disk pool, do the following.

1. Create a bucket.

   On the first page of the Disk Pool wizard, you are prompted to select a storage server volume to add to the disk pool. The list of available volumes should be empty.

   (1) Click **Add New Volume**. The **Create Buckets** dialog box opens.

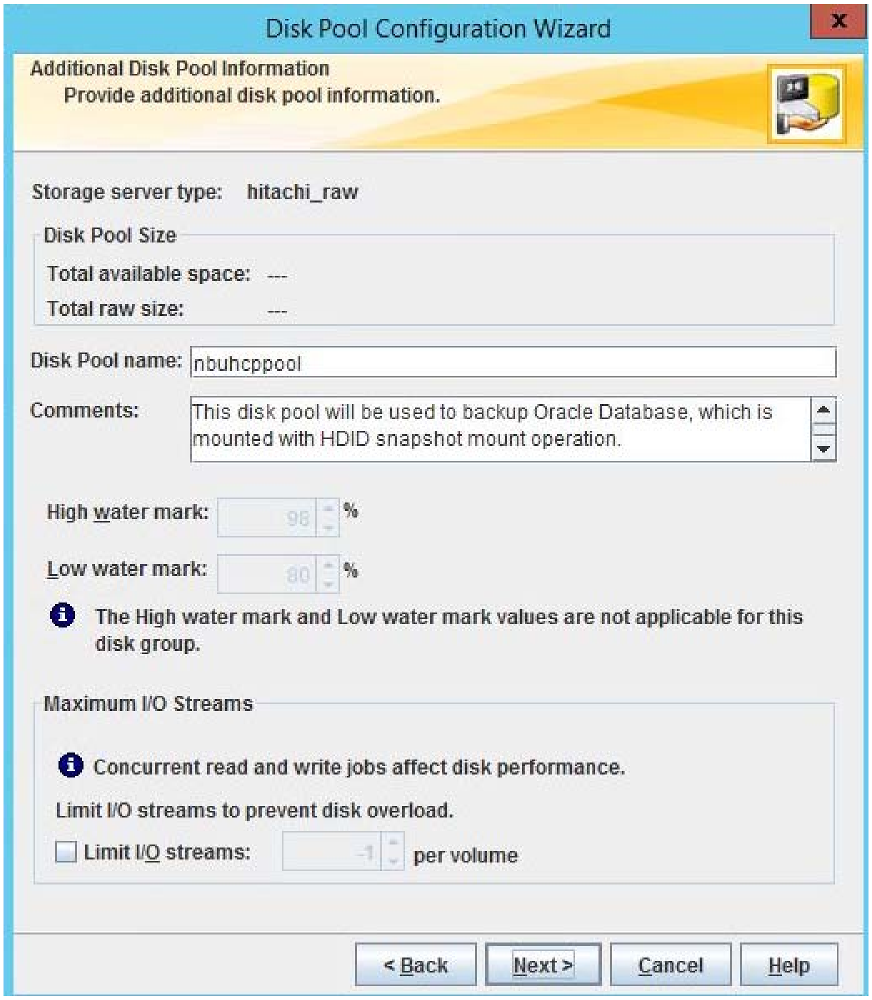
   (2) In the **Create Buckets** dialog box, type the name of the bucket (nbubucket) to be created.

   (3) Click **Add**.

   This is the name of the bucket or namespace to create in your Hitachi Content Platform or Hitachi Command Suite tenant where Veritas NetBackup files will be stored.

Note —The bucket or namespace is created with the tenant's default quota amount allocated. Ensure that the namespace has adequate quota for your needs.

Figure 23



Disk Pool Configuration Wizard

Additional Disk Pool Information

Provide additional disk pool information.

Storage server type: hitachi_raw

Disk Pool Size

Total available space: ---

Total raw size: ---

Disk Pool name: nbuhcppool

Comments: This disk pool will be used to backup Oracle Database, which is mounted with HDID snapshot mount operation.

High water mark: 98 %

Low water mark: 80 %

The High water mark and Low water mark values are not applicable for this disk group.

Maximum I/O Streams

Concurrent read and write jobs affect disk performance.

Limit I/O streams to prevent disk overload.

□ Limit I/O streams: -1 per volume

The recommendation is that you optimize the Hitachi Content Platform namespace for access by cloud protocols. This optimization is done by default for Hitachi Command Suite namespaces.

2. If this is a Hitachi Content Platform namespace, optimize it for access by cloud protocols from the Tenant Management Console.

    (1) From the Tenant Management Console, click **Namespaces**, click <namespace> , click **Settings**, and then click **Optimization**.

    (2) Click the **Optimized for cloud protocols only** option.

    (3) Click **Update Settings**.

3. In the Disk Pool wizard, provide additional information about the new pool.

    (1) Give your disk pool a name.

    (2) Leave high water mark and low water mark at the default values.

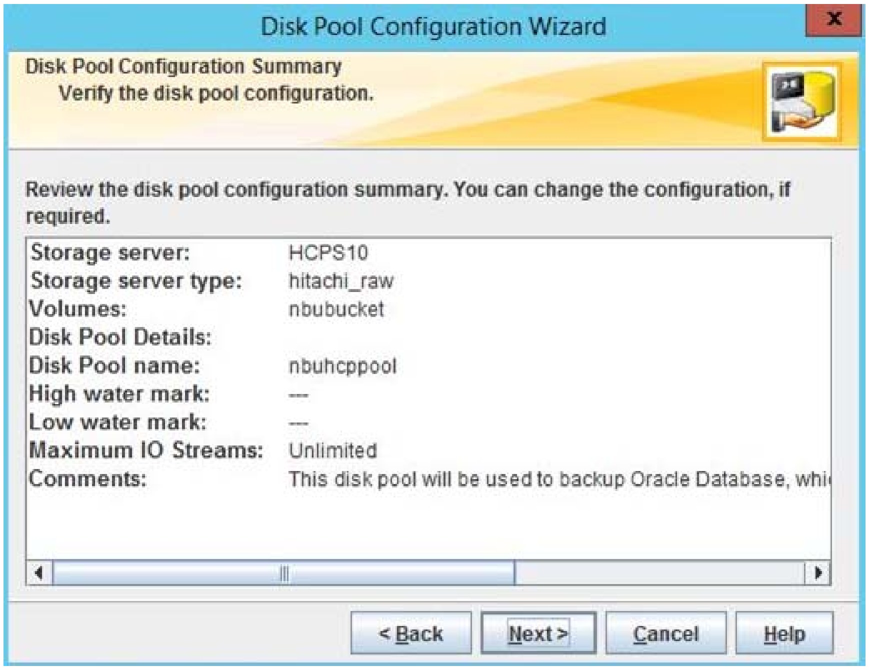
    (3) Leave the **Limit I/O streams** check box unselected.

    (4) Click **Next**.

(5) Confirm your choices and click **Next**.

(6) To continue with configuring a storage unit, select the **Create a storage unit** check box and click **Next**.

Figure 24



Disk Pool Configuration Wizard
Disk Pool Configuration Summary
Verify the disk pool configuration.

Review the disk pool configuration summary. You can change the configuration, if required.

Storage server: HCPS10
Storage server type: hitachi_raw
Volumes: nbubucket
Disk Pool Details:
Disk Pool name: nbuhcppool
High water mark: ---
Low water mark: ---
Maximum IO Streams: Unlimited
Comments: This disk pool will be used to backup Oracle Database, whi

< Back
Next >
Cancel
Help

Configure a Storage Unit

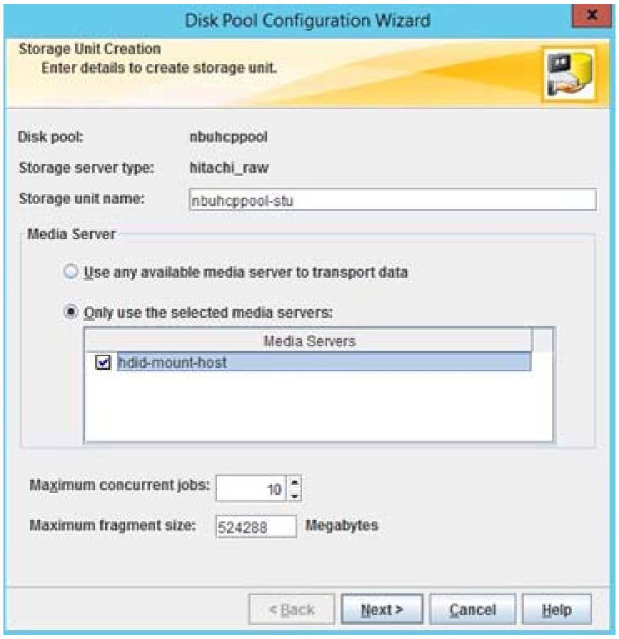
Do this procedure on the Storage Unit Creation page of the Disk Pool wizard.

To configure a storage unit, do the following.

1. Type the **Storage Unit Name.**
2. Under **Media Server**, click the **Use any available media server to transport data** option.
3. Set the **Maximum concurrent jobs** for your cloud storage unit.
4. Set the **Maximum fragment size** in megabytes.
5. Click **Next**.

See “Tune Veritas NetBackup with Hitachi Cloud Storage” on page 44 for more details on these properties.

Figure 25



Storage Unit Creation
Enter details to create storage unit.

Disk pool: nbuhcppool
Storage server type: hitachi_raw
Storage unit name: nbuhcppool-stu

Media Server

○ Use any available media server to transport data
● Only use the selected media servers:

Media Servers
☑ hdid-mount-host

Maximum concurrent jobs: 10
Maximum fragment size: 524288 Megabytes

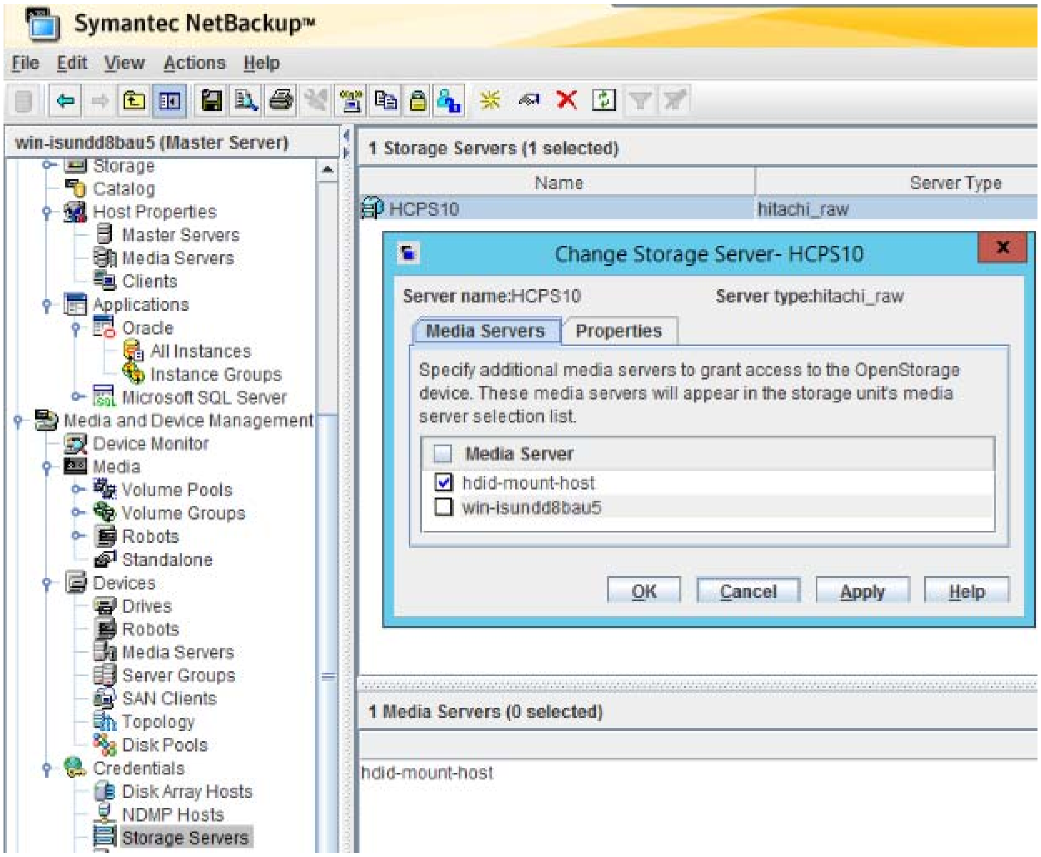
Add Media Servers to the Cloud Storage Server

To add media servers to the cloud storage server, do the following.

1. In the Veritas NetBackup Administration Console, click to expand **Media and Device Management**, then click to expand **Credentials**, and then click **Storage Servers**.
2. In the **Storage Servers** area, double-click the cloud storage server you created in the previous steps.
3. On the **Media Servers** tab of the **Change Storage Server** dialog box, select the media servers you want to have access to with this cloud storage server.

   Because you clicked **Use any available media server to transport data** in the storage unit settings, all the media servers that you select here are used by policies that use the storage unit you created.

Figure 26



Server name:HCPS10 Server type:hitachi_raw

Specify additional media servers to grant access to the OpenStorage device. These media servers will appear in the storage unit's media server selection list.

☐ Media Server
☑ hdid-mount-host
☐ win-isundd8bau5

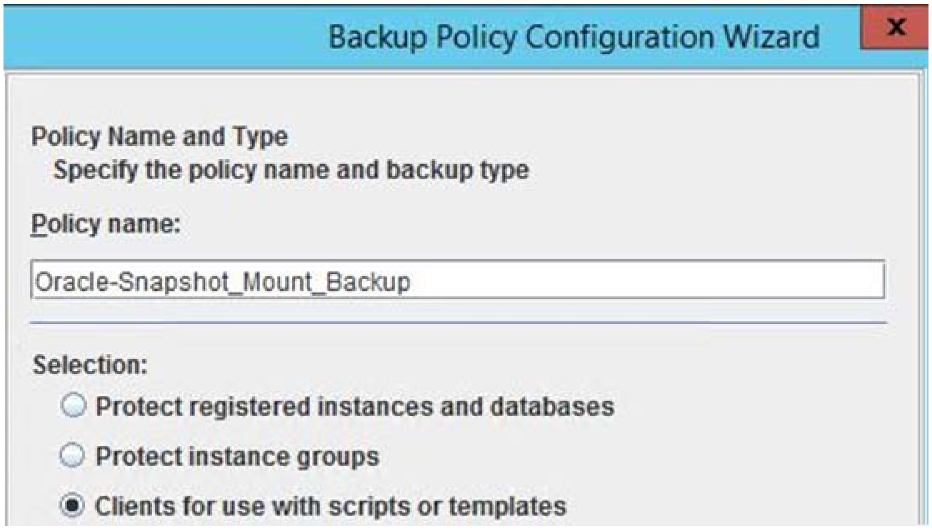
Configure Policies

In order to back up objects from Veritas NetBackup to Hitachi Content Platform, create a policy.

To create a backup policy, do the following.

1. Using the Veritas NetBackup Administration Console, click **Master Server** in the upper left pane and click **Create Policy.**
2. Click the option for the type of backup policy you need to create. For this solution, click the **Oracle** option, and then click **Next.**
3. Type a **Policy name** and, under **Selection**, click the option for the policy type to be created.

Figure 27



Backup Policy Configuration Wizard

Policy Name and Type
Specify the policy name and backup type

Policy name:

Oracle-Snapshot_Mount_Backup

Selection:

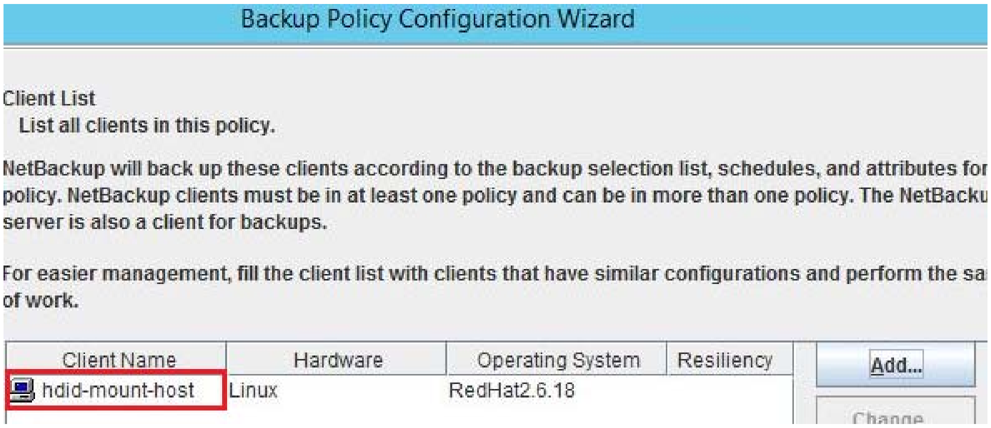
○ Protect registered instances and databases

○ Protect instance groups

● Clients for use with scripts or templates

4. Click **Add** and add the new Oracle client.

Figure 28



Backup Policy Configuration Wizard

Client List
List all clients in this policy.

NetBackup will back up these clients according to the backup selection list, schedules, and attributes for policy. NetBackup clients must be in at least one policy and can be in more than one policy. The NetBacku server is also a client for backups.

For easier management, fill the client list with clients that have similar configurations and perform the sa of work.

Client Name	Hardware	Operating System	Resiliency
hdid-mount-host	Linux	RedHat2.6.18	

5. Specify backup selection and backup type.

   In this example, the whole database is selected with **Full Backup** and **Differential Incremental Backup** as a backup type. Backup settings can be changed or configured, based on your environment.

6. Specify the following as needed in your environment:
   - A schedule backup window
   - Backup frequency and retention policy
   - Backup scheduled windows

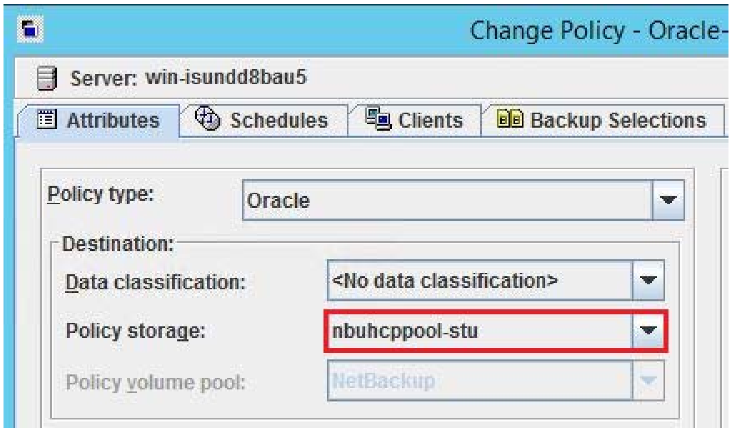
7. To create the policy, click **Finish**.

8. Set the storage unit.

   (1) Click the **Attributes** tab.

   (2) Under **Destination**, click the **nbuhcppool-stu** storage unit for **Policy storage**.

Figure 29



Policy type: Oracle

Destination:

Data classification: <No data classification>

Policy storage: nbuhcppool-stu

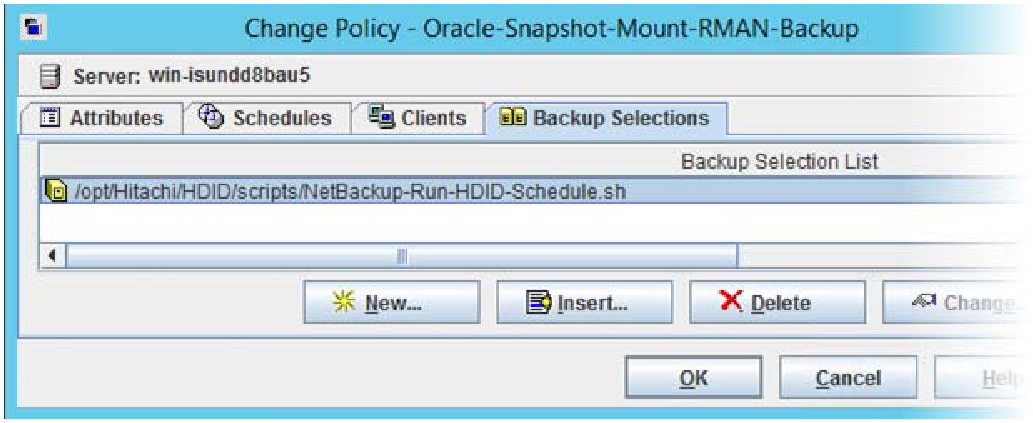
Policy volume pool: NetBackup

9. Set the backup selection

   (1) Click the **Attributes** tab

   (2) Under **Backup Selections**, click **New** to add the script present on hdid-mount-host.

Figure 30



Backup Selection List

/opt/Hitachi/HDID/scripts/NetBackup-Run-HDID-Schedule.sh

This solution uses the script NetBackup-Run-HDID-Schedule.sh to trigger a Hitachi Data Instance Director policy to do the following:

- Backup the Oracle database using Hitachi Thin Image
- Mount the Thin Image snapshot mounted on the mount host

This is NetBackup-Run-HDID-Schedule.sh:

```
#!/bin/bash

# Description: NetBackup-Run-HDID-Schedule.sh: This script is used to trigger
HDID policy to backup Oracle RAC database using Hitachi thin image and mount the
Hitachi thin image snapshot. The 'After Mount' script NetBackup-
Oracle_Full_Backup.sh in the HDID policy to back up mounted Oracle database to
HCP using NetBackup

ssh hdid-hcp-oracle-02 '/opt/Hitachi/HDID/bin/triggerbackup -p HDIDDB-Policy'
>> /oracle/Oracle-BackupLogs/$(date
+"%m_%d_%Y_%H_%M_%S")_HDID_TriggerBackup.log

#End of Script
```

The output from NetBackup-Run-HDID-Schedule.sh is logged in the destination log directory.

When the policy trigger using NetBackup-Run-HDID-Schedule.sh is successful, Data Instance Director does the following:

- Displays this message: **Activated 1 backup operation**
- Starts to execute this policy

```
[root@hdid-mount-host]# cat /oracle/Oracle/BackupLogs/
01_19_2017_07_45_41_HDID_TriggerBackup.log

Activated 1 backup operation
```

The Data Instance Director policy that uses NetBackup-Oracle_Full_Backup.sh, a different script, runs after mounting (see “Define the Hitachi Data Instance Director Policy,” starting on page 24). The difference is that the policy using NetBackup-Oracle_Full_Backup.sh does the backup of the Thin Image snapshot mount of the Oracle database to Hitachi Content Platform using Veritas NetBackup.

This is NetBackup-Oracle_Full_Backup.sh, which is used in the Data Instance Director policy after mounting (Figure 10 on page 25).

```
#!/bin/bash

#  Description: NetBackup-Oracle_Full_Backup.sh : This script is used to backup
Oracle database Hitachi Thin Image snapshot mount to HCP storage


#Export Oracle variables

ORACLE_HOME=/oracle/database/app/12.1.0/product

ORACLE_SID=HDIDDB1

ORACLE_TARGET_INIT_FILE=$ORACLE_HOME/dbs/init$ORACLE_SID.ora

NOW=/oracle/Oracle-BackupLogs/$(date +"%m_%d_%Y_%H_%M_%S")

export ORACLE_HOME ORACLE_SID ORACLE_TARGET_INIT_FILE NOW


#Mount the HTI snapshot Oracle database and take RMAN full backup
```

```
su oracle -c "

$ORACLE_HOME/bin/rman target 'sys/sys' nocatalog msglog
${NOW}_Database_Backup.log <<EOF

run {

startup mount pfile='/oracle/database/app/12.1.0/product/dbs/initHDIDDB1.ora';

ALLOCATE CHANNEL ch00 TYPE 'SBT_TAPE' PARMS 'SBT_LIBRARY=/usr/openv/netbackup/
bin/libobk.so64';

ALLOCATE CHANNEL ch01 TYPE 'SBT_TAPE' PARMS 'SBT_LIBRARY=/usr/openv/netbackup/
bin/libobk.so64';

SEND 'NB_ORA_CLIENT=hdid-mount-host,NB_ORA_SID=HDIDDB1,NB_ORA_SERV=win-
isundd8bau5,NB_ORA_POLICY=Oracle-Snapshot-Mount-RMAN-Backup';

# Backup Full Database

BACKUP INCREMENTAL LEVEL=0 FORMAT 'bk_d%d_u%u_s%s_p%p_t%t' DATABASE;

# Backup Archived Logs

BACKUP FORMAT 'arch_d%d_u%u_s%s_p%p_t%t' ARCHIVELOG ALL DELETE INPUT;

# Control File Backup

BACKUP FORMAT 'ctrl_d%d_u%u_s%s_p%p_t%t' CURRENT CONTROLFILE;

RELEASE CHANNEL ch00;

RELEASE CHANNEL ch01;

}

EOF"
```

Note — Your environment script variables and RMAN backup strategy can be changed in this script.

NetBackup-Run-HDID-Schedule.sh and NetBackup-Oracle_Full_Backup.sh are on the hdid-mount-host machine in /opt/Hitachi/HDID/scripts.

Tune Veritas NetBackup with Hitachi Cloud Storage

Use these procedures to tune Veritas Netback for use with Hitachi Cloud Storage.

Tunable Parameters

Lab testing shows that these parameters have proven to be most effective when tuning Veritas NetBackup with Hitachi Cloud Storage. This is not an exhaustive list of all parameters available..

There are several NetBackup parameters with misleading names, which do not do what the name indicates. It is strongly recommended that, for a production deployment, have a NetBackup expert configure the system.

Disk Pool Properties

These are tuning suggestions for the disk pool properties.

- **Limit I/O Streams**. Select to limit the number of read and write jobs for each volume in the disk pool. A job may read backup images *or* write backup images. By default, there is no limit. It is recommended that no limit be set, as there is only one volume in a cloud disk pool.

Storage Unit Properties

These are tuning suggestions for the storage unit properties.

- **Maximum Concurrent Jobs**. This is the maximum number of jobs that can run concurrently for a particular storage unit. Each job may take multiple connections to the storage unit, so the maximum jobs is one factor in total concurrent connections, but is not the only factor.

  For cloud storage the maximum number of concurrent HTPP connections, set it equal to the following:

  Maximum concurrent jobs × maximum HTTP connections per job

  Calculate the maximum connections per job by the following:

  (WRITE_BUFFER_SIZE)/(Chunk size)

  Use these numbers in your calculations:

  - The **Hitachi Content Platform** chunk size is 256 MB. The default WRITE_BUFFER_SIZE is 1024 MB. By default, there may be up to 4 HTTP connections per job.
  - The **Hitachi Command Suite** chunk size is 1 MB. The default WRITE_BUFFER_SIZE is 100 MB. By default, there may be up to 100 HTTP connections per job.

  Tune the maximum concurrent jobs and WRITE_BUFFER_SIZE to get the correct balance of NetBackup jobs and concurrent connections. The chunk size is not tunable.

- **Maximum Fragment Size**. The fragment, in this case, refers to a directory in the Hitachi Content Platform or Hitachi Command Suite bucket. By setting this value, you can control the maximum number of objects (Veritas NetBackup Cloud Connector chunks) that may be stored in any one directory.

  If you are connecting NetBackup to **Hitachi Command Suite**, the chunk size is 1 MB. So, setting the maximum fragment size to 1000 MB results in 1000 files per directory.

  If connecting to **Hitachi Content Platform**, the chunk size is 256 MB. So, setting the maximum fragment size to 256000 MB results in 1000 files per directory.

  In Hitachi Data System testing, backup performance was notably faster when using larger numbers for testing. NetBackup would not store more than 1000 objects (chunks) in a directory, so it is recommended that you set this to 1000 × chunk size.

Global Attributes

These are tuning suggestions for the global attributes.

- **Maximum jobs per client**. This setting applies to how many jobs can run on any single client at a time.

  Setting this too high may overwhelm your clients. Setting this too low negatively affects performance if you are operating with small number of clients.

  If you are doing performance testing and want to reach the maximum number of jobs, set this to the following, at least:

  > (Maximum concurrent jobs)/(number of clients).

  In a production environment, set this to the number appropriate for your least capable client.

Media Server Scalable Storage Properties

These are tuning suggestions for the media server scalable storage properties.

- **Total available bandwidth**. This property allows you to limit the bandwidth consumed by a media server for cloud storage jobs. The value is specified in kilobytes per second. For best performance, specify the speed of your connection to the Hitachi Content Platform or Hitachi Command Suite.

  Change this setting to 1,048,576 KB/s when installed on a 10 GbE network. The default value of 102,400 KB/s is appropriate for a 1 GbE network.

  Lower settings may be appropriate for connections over a WAN.

- **Maximum concurrent jobs**. This limits the number of jobs the media server can run for a cloud storage server target.

  The actual maximum number of concurrent jobs is the sum of this property for each individual media server, not to exceed the number in the maximum concurrent jobs storage unit property, described above.

  The sum of all the media server settings should be equal to or greater than the storage unit setting, if performance testing.

Storage Server Properties

These are tuning suggestions for the storage server properties.

The prefix for Hitachi Command Suite properties is *HT*. The prefix for Hitachi Content Platform properties is *HCP*.

- **Media Servers**. Select the media servers that are able to run jobs for the storage server. Only media servers that support the cloud connector (7.7+) appear in the list.
- **RITE_BUFFER_SIZE and READ_BUFFER_SIZE**. These are very important settings, as they control the amount of write buffer and read buffer a job can consume. This number, divided by the chunk size for the storage server type, determines how many individual HTTP connections or threads a single job utilizes.
- For **Hitachi Content Platform**, with a chunk size 256 MB, this number defaults to 1073741824, which allows 4 connections per job.

  For **Hitachi Command Suite**, with a chunk size 1 MB, this number defaults to 104857600, which allows 100 connections per job.

Solution Execution

Execution of this solution consists of the following procedures:

- “Backup Oracle — Hitachi Data Instance Director Scheduled Snapshot (Hitachi Thin Image), Mount on Proxy Server” on page 47
- “Restore (Revert) Oracle Database Using Hitachi Data Instance Director and Recover Oracle Database with Manual Steps” on page 49
- “Backup 'Hitachi Thin Image Snapshot mount' from Proxy Server (hdid-mount-host) to Hitachi Content Platform using Veritas NetBackup” on page 52
- “Restore and Recover Backup (Oracle database) From Hitachi Content Platform Storage Through NetBackup Directly to the Application Host (hdid-hcp-oracle-02) ” on page 56

Backup Oracle — Hitachi Data Instance Director Scheduled Snapshot (Hitachi Thin Image), Mount on Proxy Server

This is how to backup Oracle database with a scheduled snapshot with Hitachi Thin Image on Hitachi Data Instance Director.

Snapshot and Mount

Hitachi Data Instance Director leverages Hitachi snapshot technology to create fast and space-efficient backups of Oracle databases. When used on Oracle databases, a snapshot for Hitachi Data Instance Director is available for Oracle databases in non-ASM, ASM, standalone, and RAC configurations.

A **storage snapshot** is a backup copy created at a particular point in time. Snapshots do not require an initial copy, as they are not stored as physical copies of blocks. They are stored as pointers to the blocks that existed when creating the snapshot. Because of this tight physical relationship, the snapshot is maintained on the same storage array as the original data.

The **snapshot** operation is used to trigger snapshots of entire volumes. Snapshots can be accessed using the **Restore** screen, where they can be mounted or used for reverting a volume to a previous state.

Ordinarily, when a snapshot is performed, the state of the snapshot consists of the exact state of the file system at the point in time at which the snapshot was triggered. This can be problematic when the snapshot is eventually restored, as some applications that were running at the time may not, for example, have flushed all their memory file buffers, and their data files on disk could be in an inconsistent state.

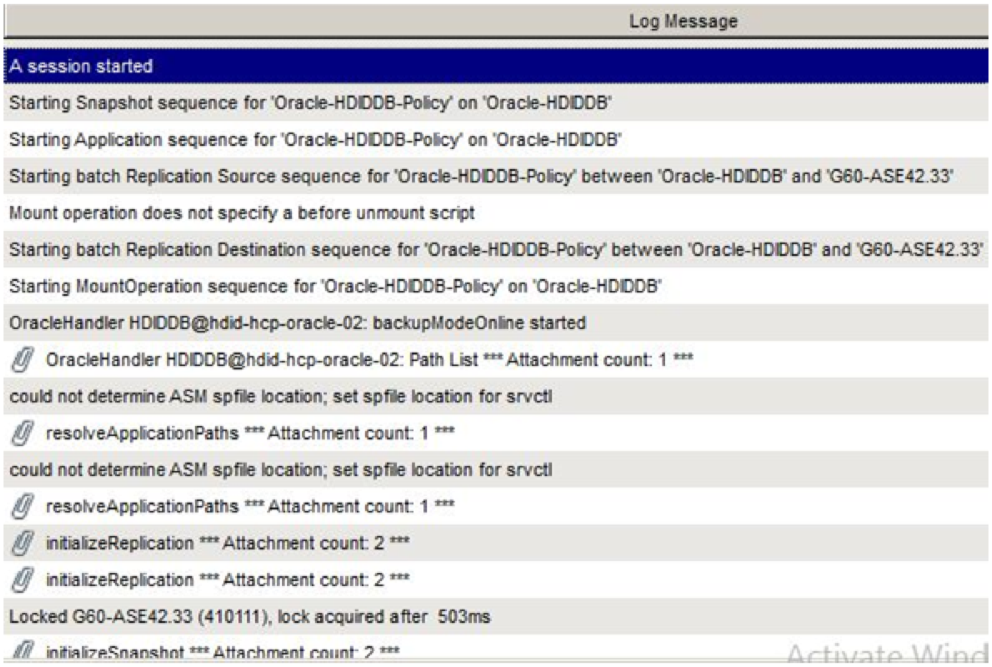
To resolve this, request certain applications to quiesce into a safe state prior to a snapshot being triggered, and then to restore their previous active state after the snapshot is triggered. This ensures their state during the snapshot is consistent and that they can run as expected if the snapshot is restored.

The **mount** option allows you to expose volumes or mount the selected snapshot or replication. This operation may take several minutes to complete. Hitachi Data Instance Director supports infrastructure to mount snapshots on the destination Oracle database.

The Hitachi Thin Image snapshot and mount of the Thin Image snapshot on the proxy server operation are executed based on the policy and schedule defined in the policy. See Deploy Hitachi Data Instance Director.

Log Manager allows you to filter, view, and manage Data Instance Director application logs. Hitachi Thin Image snapshot and mount operation logs of Oracle can be seen in Log Manager.

Figure 31

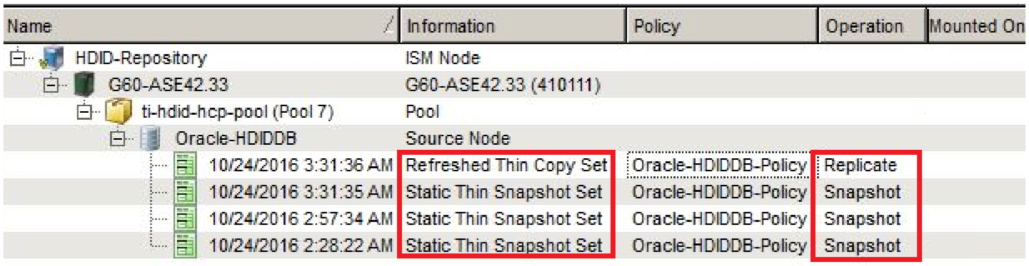


```
Log Message
A session started
Starting Snapshot sequence for 'Oracle-HDIDDB-Policy' on 'Oracle-HDIDDB'
Starting Application sequence for 'Oracle-HDIDDB-Policy' on 'Oracle-HDIDDB'
Starting batch Replication Source sequence for 'Oracle-HDIDDB-Policy' between 'Oracle-HDIDDB' and 'G60-ASE42.33'
Mount operation does not specify a before unmount script
Starting batch Replication Destination sequence for 'Oracle-HDIDDB-Policy' between 'Oracle-HDIDDB' and 'G60-ASE42.33'
Starting MountOperation sequence for 'Oracle-HDIDDB-Policy' on 'Oracle-HDIDDB'
OracleHandler HDIDDB@hdid-hcp-oracle-02: backupModeOnline started
OracleHandler HDIDDB@hdid-hcp-oracle-02: Path List *** Attachment count: 1 ***
could not determine ASM spfile location; set spfile location for srvctl
resolveApplicationPaths *** Attachment count: 1 ***
could not determine ASM spfile location; set spfile location for srvctl
resolveApplicationPaths *** Attachment count: 1 ***
initializeReplication *** Attachment count: 2 ***
initializeReplication *** Attachment count: 2 ***
Locked G60-ASE42.33 (410111), lock acquired after  503ms
initializeSnapshot *** Attachment count: 2 ***
```

On the **Storage – Managed Storage** screen, expand the tree for the policy Oracle-HDIDDB to see the snapshot, replicate, and mount details within this policy.

Once mounting a snapshot on the host, you can view all database files that are available in the mounted snapshot. In this case, all the ASM disk groups are shown mounted on hdid-mount-host host.

Figure 32



Name	Information	Policy	Operation	Mounted On
HDID-Repository	ISM Node			
G60-ASE42.33	G60-ASE42.33 (410111)			
ti-hdid-hcp-pool (Pool 7)	Pool			
Oracle-HDIDDB	Source Node			
10/24/2016 3:31:36 AM	Refreshed Thin Copy Set	Oracle-HDIDDB-Policy	Replicate	
10/24/2016 3:31:35 AM	Static Thin Snapshot Set	Oracle-HDIDDB-Policy	Snapshot	
10/24/2016 2:57:34 AM	Static Thin Snapshot Set	Oracle-HDIDDB-Policy	Snapshot	
10/24/2016 2:28:22 AM	Static Thin Snapshot Set	Oracle-HDIDDB-Policy	Snapshot	

For ASM snapshots, clicking **Mount in directory** mounts the snapshot on the ASM instance. You must have Oracle ASM configured on the mount host.

Once the mount operation completes, connect using the grid credentials and check the status of the diskgroups that are mounted on the proxy server (hdid-mount-host). You will find that diskgroups are in **mounted** state.

```
SQL>  select name,STATE from v$asm_diskgroup;

NAME                           STATE

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

OCR                            MOUNTED

FRADG                       MOUNTED

REDODG02                MOUNTED

REDODG01                MOUNTED

DATADG                     MOUNTED

APPDG                       MOUNTED
```

When a Thin Image snapshot is mounted using **Mount at original location**, the snapshot (disk groups) will have the same disk group name as the original database at the asmcmd command prompt. This number will be incremented if multiple snapshots are mounted to the same host.

Note — Snapshots cannot be mounted on the production server at the original location, because the location is already occupied by the original production database disk groups. If the original disk group is dropped, then you can only mount a snapshot at the original location. If we mount a snapshot at the original location, even after the location is already occupied by original production database disk groups, disk group names are mounted appended with "00000."

Restore (Revert) Oracle Database Using Hitachi Data Instance Director and Recover Oracle Database with Manual Steps

This is how to restore and recover an Oracle database using Hitachi Data Instance Director manually.

Perform Oracle Database Restore Using Hitachi Data Instance Director Revert

It is possible to revert (restore database) using a Hitachi Thin Image snapshot to a database server with Hitachi Data Instance Director. This describes the steps to perform complete recovery while the database is not open. You can recover all damaged data files in one operation.

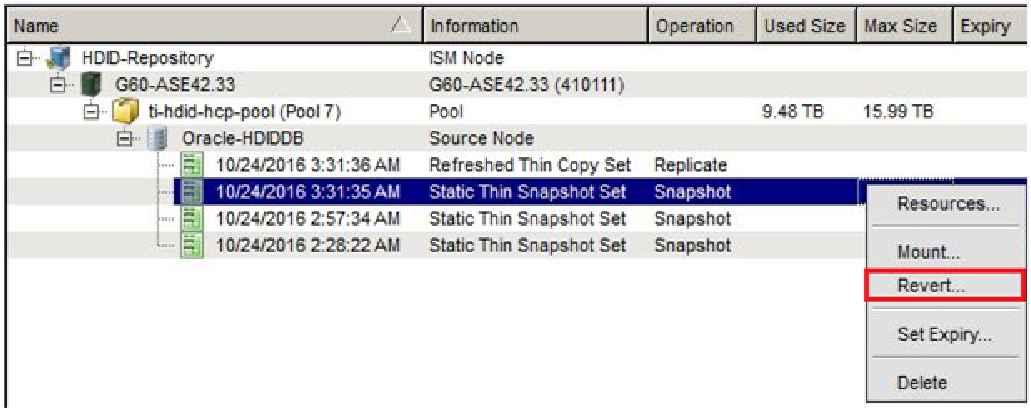
This option allows the snapshot to be used to revert the volume or volumes to a prior state, destroying any changes to data on those volumes that were made subsequent to the selected snapshot event. The revert operation may take several minutes to complete.

You can perform a revert from the **Storage – Managed Storage** screen or the **Restore – Browse Backups and Snapshot** screen, by right-clicking the required snapshot and clicking **Revert** from the menu.

The **Revert Warning and Confirmation** dialog box displays. To ensure you do not accidentally perform a revert, the text `REVERT` must be typed in uppercase prior to clicking **OK**.

The database is shut down prior to the reversion. Once reversion is complete, the database must be restarted manually by the database administrator, who needs to choose how to recover the database, such as point-in-time or last known point, among others.

Figure 33



Name	Information	Operation	Used Size	Max Size	Expiry
HDID-Repository	ISM Node				
G60-ASE42.33	G60-ASE42.33 (410111)				
ti-hdid-hcp-pool (Pool 7)	Pool		9.48 TB	15.99 TB	
Oracle-HDIDDB	Source Node				
10/24/2016 3:31:36 AM	Refreshed Thin Copy Set	Replicate			
10/24/2016 3:31:35 AM	Static Thin Snapshot Set	Snapshot			
10/24/2016 2:57:34 AM	Static Thin Snapshot Set	Snapshot			
10/24/2016 2:28:22 AM	Static Thin Snapshot Set	Snapshot			

Note — Clicking **Revert** overwrites the original database and destroys all data in that database.

Perform Complete Oracle Database Recovery with Manual Recovery Steps

Typically, a complete recovery of the database is performed when you want to revert an Oracle database to a baseline during an upgrade. The V$RECOVER_FILE view indicates which files need recovery. When a complete database recovery is performed, all available redo logs are used to recover the database to the current SCN.

Depending on the circumstances, the whole database or individual tablespaces or data files can be recovered.

The procedure assumes the following are available:

- The current control file
- Backups of all needed data files
- All necessary archived redo logs

To do a complete recovery using revert, do the following.

1. Identify the most recent database Hitachi Thin Image snapshot for the damaged database files.
2. Revert the Hitachi Thin Image snapshot of the Oracle database.

   (1) Start the **revert** operation.

   Database goes down after **revert** operation if database is in open state.

   ```
   [oracle@hdid-hcp-oracle-01]$ srvctl status database -d HDIDDB

   Instance HDIDDB1 is not running on node hdid-hcp-oracle-01

   Instance HDIDDB2 is not running on node hdid-hcp-oracle-02
   ```

(2) Connect to the database with administrator privileges. Then start a new instance and mount, but do not open the database, with this command:

```
SQL> startup mount
```

This is the result:

```
ORACLE instance started.

Total System Global Area 8.1336E+10 bytes

Fixed Size                  5294184 bytes

Variable Size            8589936536 bytes

Database Buffers         7.2478E+10 bytes

Redo Buffers              263139328 bytes

Database mounted.
```

(3) Issue a statement to recover the database. Enter the following recover commands.

```
SQL> RECOVER AUTOMATIC DATABASE;
```

The response is this:

```
Media recovery complete.
```

If no archived redo logs are required for complete media recovery, then the database applies all necessary online redo log files and terminates recovery.

3. After recovery terminates, open the database for use with this command:

```
SQL> ALTER DATABASE OPEN;
```

The response is the following:

```
Database altered.

[oracle@hdid-hcp-oracle-01]$ srvctl status database -d HDIDDB

Instance HDIDDB1 is running on node hdid-hcp-oracle-01

Instance HDIDDB2 is not running on node hdid-hcp-oracle-02

[oracle@hdid-hcp-oracle-01]$ srvctl start instance -d HDIDDB -i HDIDDB2

[oracle@hdid-hcp-oracle-01]$ srvctl status database -d HDIDDB

Instance HDIDDB1 is running on node hdid-hcp-oracle-01

Instance HDIDDB2 is running on node hdid-hcp-oracle-02
```

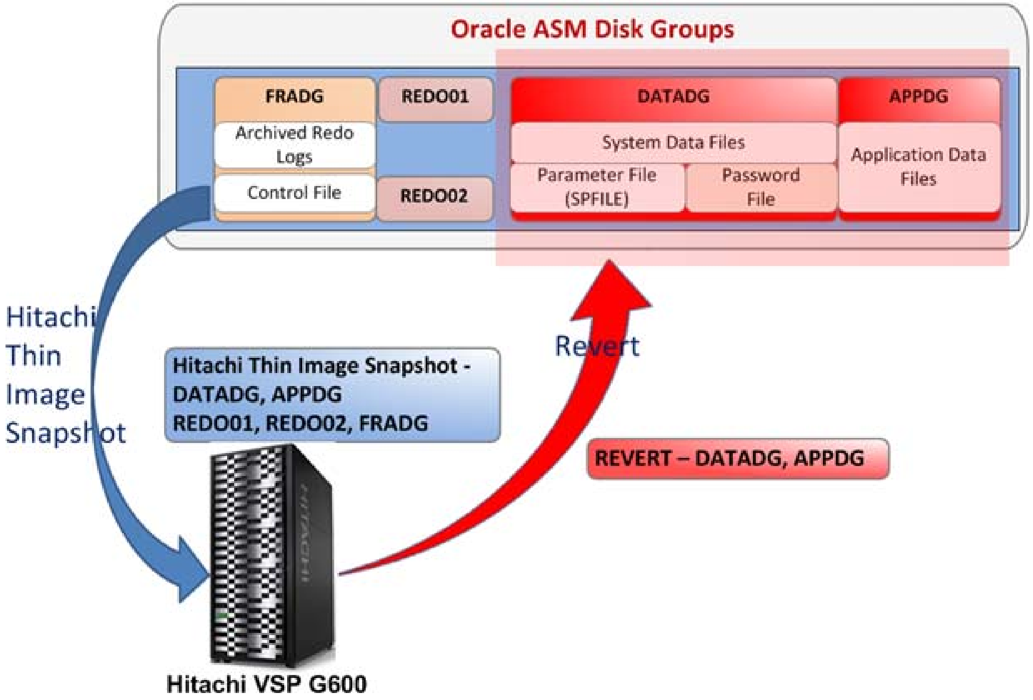
Hitachi Data Instance Director Operations Influence on Oractle ASM Disk Groups

This is the influence of Hitachi Data Instance Director operations on Oracle ASM disk groups.

- **SNAPSHOT —** Hitachi Data Instance Director, using the Hitachi Thin Image snapshot, takes a snapshot of the disk groups, including data files, redo logs, and archive log files.
- **MOUNT —** Use this to mount snapshots on the Oracle ASM configured mount host.
- **REVERT —** Hitachi Data Instance Director, using the Hitachi Thin Image **revert** operation, reverts disk groups, including data files only.

Figure 34 shows the Hitachi Data Instance Director snapshot, and revert operations.

Figure 34



Backup 'Hitachi Thin Image Snapshot mount' from Proxy Server (hdid-mount-host) to Hitachi Content Platform using Veritas NetBackup

You can execute an Oracle Database backup operation based on a schedule in Veritas NetBackup, or it can run following the **HDIDDB-Schedule** defined for the Hitachi Thin Image snapshot replication mount operation.

For this example on backing up an Oracle database to the Hitachi Content Platform storage, the following is true:

- The mount host is hdid-mount-host.
- HDIDDB is an Oracle database.
- The backup script is NetBackup-Oracle-Full_Backup.sh, found at /opt/Hitachi/HDID/scripts on the hdid-mount-host machine.

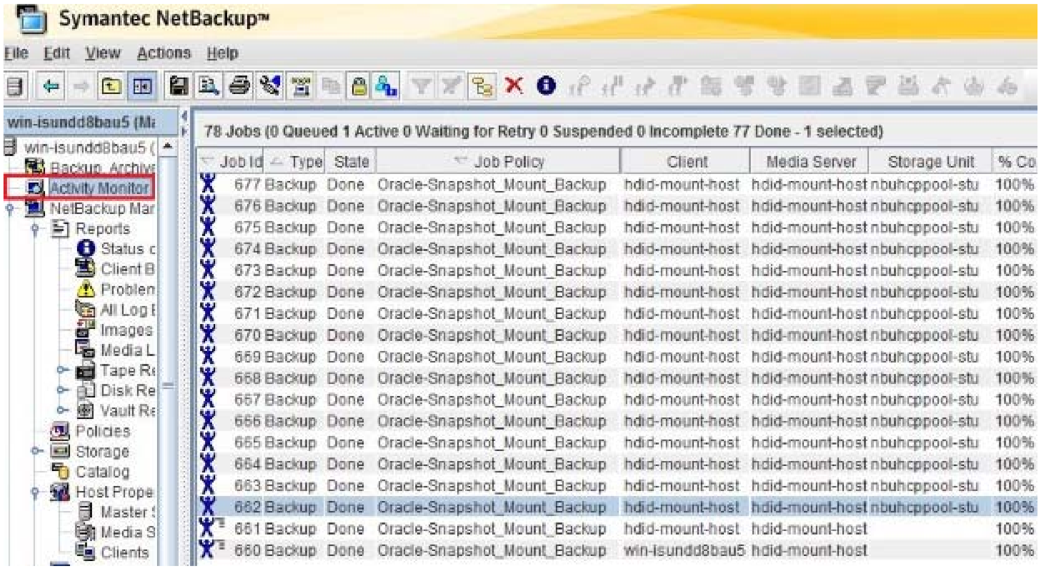
This operation backs up an Oracle database from the mount host (hdid-mount-host) to the Hitachi Content Platform storage, following the **HDIDDB-Schedule.**

Note — To have a consistent database backup image, the script in database goes into **mount** state during the backup operation.

To make a backup from the proxy server to Hitachi Content Platform using Veritas NetBackup, do the following.

1. From the NetBackup Administration Console, click **Activity Monitor.** The window lists the backup jobs of the backup operation.

Figure 35

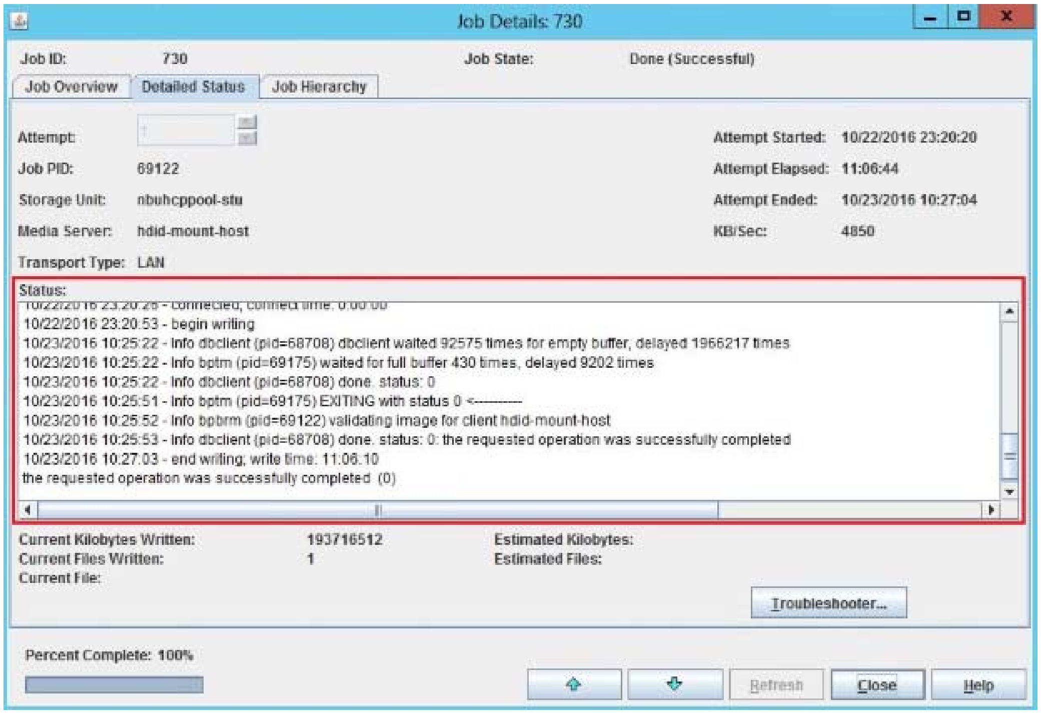


78 Jobs (0 Queued 1 Active 0 Waiting for Retry 0 Suspended 0 Incomplete 77 Done - 1 selected)

Job Id	Type	State	Job Policy	Client	Media Server	Storage Unit	% Co
677	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
676	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
675	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
674	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
673	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
672	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
671	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
670	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
669	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
668	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
667	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
666	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
665	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
664	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
663	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
662	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host	nbuhcppool-stu	100%
661	Backup	Done	Oracle-Snapshot_Mount_Backup	hdid-mount-host	hdid-mount-host		100%
660	Backup	Done	Oracle-Snapshot_Mount_Backup	win-isundd8bau5	hdid-mount-host		100%

2. To view details of the backup operation, click the backup operation ID to open the **Job Details** dialog box. On the **Detailed Status** tab, the status window provides details of the backup operation.

Figure 36



Job ID: 730 Job State: Done (Successful)

Attempt: 1
Job PID: 69122
Storage Unit: nbuhcppool-stu
Media Server: hdid-mount-host
Transport Type: LAN

Attempt Started: 10/22/2016 23:20:20
Attempt Elapsed: 11:06:44
Attempt Ended: 10/23/2016 10:27:04
KB/Sec: 4850

Status:

```
10/22/2016 23:20:28 - connected; connect time: 0:00:00
10/22/2016 23:20:53 - begin writing
10/23/2016 10:25:22 - Info dbclient (pid=68708) dbclient waited 92575 times for empty buffer, delayed 1966217 times
10/23/2016 10:25:22 - Info bptm (pid=69175) waited for full buffer 430 times, delayed 9202 times
10/23/2016 10:25:22 - Info dbclient (pid=68708) done. status: 0
10/23/2016 10:25:51 - Info bptm (pid=69175) EXITING with status 0 <----------
10/23/2016 10:25:52 - Info bpbrm (pid=69122) validating image for client hdid-mount-host
10/23/2016 10:25:53 - Info dbclient (pid=68708) done. status: 0: the requested operation was successfully completed
10/23/2016 10:27:03 - end writing; write time: 11:06:10
the requested operation was successfully completed  (0)
```

Current Kilobytes Written: 193716512
Current Files Written: 1
Current File:

Estimated Kilobytes:
Estimated Files:

Percent Complete: 100%

Verify Backup from Cloud Storage on Hitachi Content Platform

This is the procedure to carried out on the alternate Oracle client machine or on the source machine (hdid-hcp-oracle-02) machine.

To verify the backup from cloud storage on Hitachi Content Platform, do the following.

1. Install Veritas NetBackup Client on the Oracle client machine.
2. Create the **No.Restrictions** file on the NetBackup master server. The master server will allow the restore of data from the backup of one client to an alternate client only if you create this file.

   The NetBackup master server runs Microsoft® Windows Server® (`win`-isundd8bau5).The file path is the following:

   C:\Program Files\Veritas\NetBackup\db\altnames\No.Restrictions

   In case of a UNIX (Linux) operation system, path changes to this:

   /usr/openv/netbackup/db/altnames/No.Restrictions

3. Generate a security certificate for the Oracle client machine. This is needed to access the backup details and certain operations on the Oracle client machine.

Note — Generating a security certificate is a one-time activity.

Run the following command on the master server, depending on your environment:

- **Microsoft Windows Server:**

  install_path\NetBackup\bin\admincmd\bpnbaz -ProvisionCert client_name

- **UNIX (Linux):**

  /usr/openv/netbackup/bin/admincmd/bpnbaz -ProvisionCert client_name

The master server responds with the following. When asked if you want to continue, respond with this: **y**

```
c:\Program Files\Veritas\NetBackup\bin\admincmd>bpnbaz.exe -ProvisionCert hdid-
hcp-oracle-02

You will have to restart NetBackup services on configured NetBackup hosts after the
command comp

Do you want to continue(y/n)y

Setting up security on target host: hdid-hcp-oracle-02 - Certificate deployed
successfully

The file: DeploySecurityCerts.progress has been updated in the current directory
with results of

Operation completed successfully.
```

4. Browse the Oracle backups by running below command on the Oracle client machine,

   /usr/openv/netbackup/bin/bplist -S <master server> - C <Oracle source client name> -t 4 -I -R /

This command lists Oracle database backups on the Hitachi Content Platform storage with the hdid-mount-host host. The following is an example list.

```
oracle@hdid-hcp-oracle-02 bin]$ ./bplist -S win-isundd8bau5 -C hdid-mount-host -t 4
-I -R /

/ctrl_dHDIDDB_u0grihgfd_s16_p1_t925417965

/arch_dHDIDDB_u08rihgd0_s8_p1_t925417888

/arch_dHDIDDB_u0crihgd0_s12_p1_t925417888

/arch_dHDIDDB_u0frihgd0_s15_p1_t925417888

/arch_dHDIDDB_u0brihgd0_s11_p1_t925417888

/arch_dHDIDDB_u0drihgd0_s13_p1_t925417888

/arch_dHDIDDB_u0arihgd0_s10_p1_t925417888

/arch_dHDIDDB_u09rihgd0_s9_p1_t925417888

/arch_dHDIDDB_u0erihgd0_s14_p1_t925417888

/arch_dHDIDDB_u07rihgcv_s7_p1_t925417887

/bk_dHDIDDB_u05rihg89_s5_p1_t925417737

/bk_dHDIDDB_u06rihg89_s6_p1_t925417737
```

```
/bk_dHDIDDB_u02rihg89_s2_p1_t925417737

/bk_dHDIDDB_u04rihg89_s4_p1_t925417737

..........................

..........................

..........................

/bk_dHDIDDB_u03rihg89_s3_p1_t925417737

/bk_dHDIDDB_u01rihg89_s1_p1_t925417737
```

Restore and Recover Backup (Oracle database) From Hitachi Content Platform Storage Through NetBackup Directly to the Application Host (hdid-hcp-oracle-02)

Perform the restore and recover of the Oracle database through the Veritas NetBackup recovery wizard, which can be run on the Oracle client machine. Or, the recovery can be performed manually.

Restore and Recover Oracle Database Using Veritas NetBackup Recovery Wizard

To restore and recover the Oracle Database using the Veritas NetBackup recovery wizard, do the following.

1. Open the Backup, Archive, and Restore interface with the Oracle user.

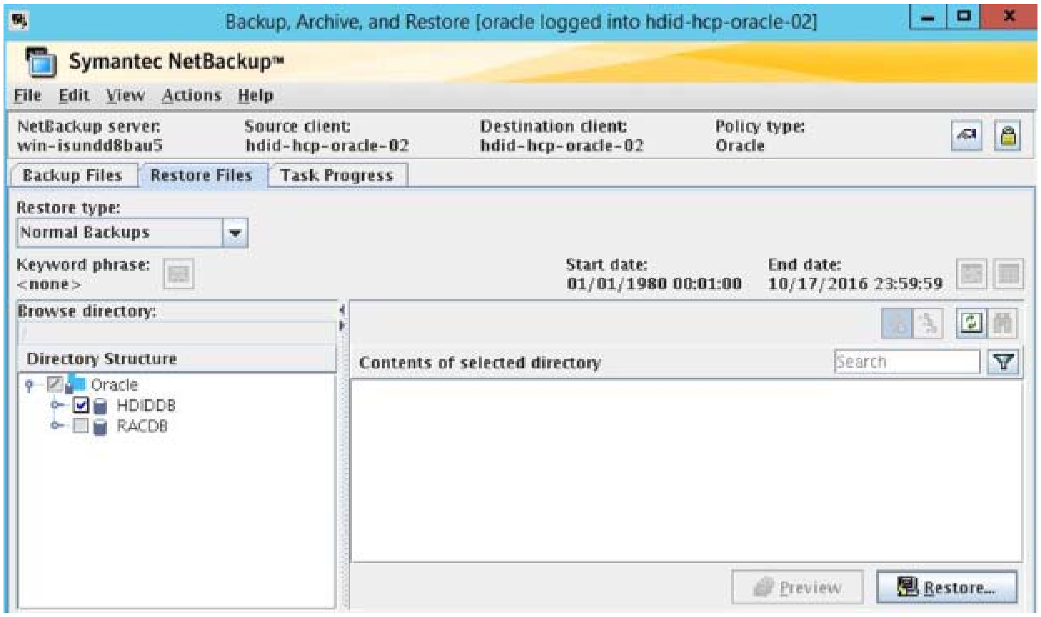
   ```
   [oracle@hdid-hcp-oracle-02]$ /usr/openv/netbackup/bin/jnbSA &
   ```

2. Select the Restore operation,

   (1) On UNIX, click the **Restore Files** tab. In the **Restore Type** list, click **Normal Backups**. In the left pane, click the Oracle instance. This wizard recovers the whole Oracle database using RMAN.

   (2) From the **Actions** menu, click **Restore**.

Figure 37



Backup, Archive, and Restore [oracle logged into hdid-hcp-oracle-02]

Symantec NetBackup™

NetBackup server: win-isundd8bau5

Source client: hdid-hcp-oracle-02

Destination client: hdid-hcp-oracle-02

Policy type: Oracle

Restore type: Normal Backups

Keyword phrase: <none>

Start date: 01/01/1980 00:01:00

End date: 10/17/2016 23:59:59

Browse directory:

Directory Structure

☑ Oracle

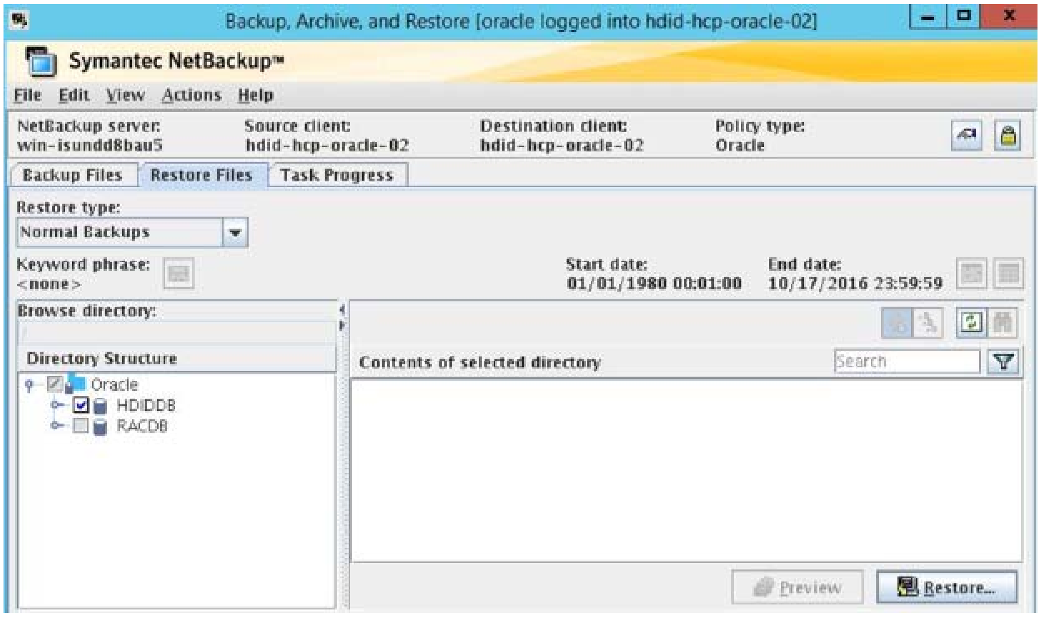
☑ HDIDDB

□ RACDB

(3) Provide target Oracle database logon credentials.

(4) Select the **Restore** check box and the **Recover** check box.

Figure 38



Backup, Archive, and Restore [oracle logged into hdid-hcp-oracle-02]

Symantec NetBackup™

NetBackup server: win-isundd8bau5

Source client: hdid-hcp-oracle-02

Destination client: hdid-hcp-oracle-02

Policy type: Oracle

Restore type: Normal Backups

Keyword phrase: <none>

Start date: 01/01/1980 00:01:00

End date: 10/17/2016 23:59:59

Browse directory: /

Directory Structure

- ☑ Oracle
  - ☑ HDIDDB
  - □ RACDB

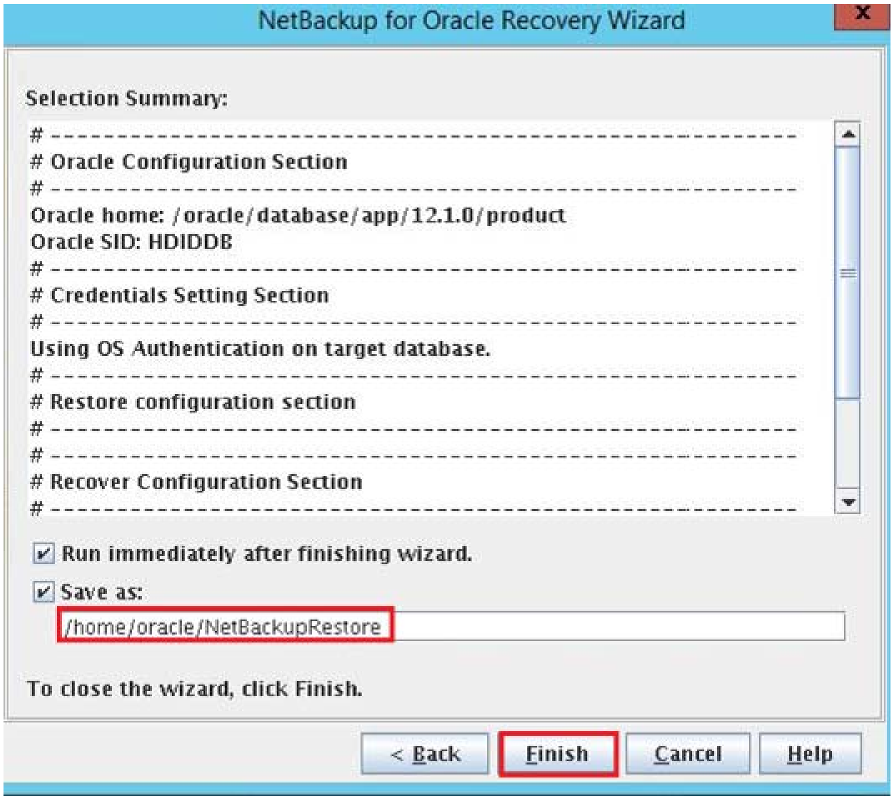
(5) Click **Use most recent backup set**. You can specify a different backup to restore, based on the required backup set.

(6) Select the **Recover to last committed transaction** check box to recover the Oracle database to last committed transactions. Otherwise, you can select recover the Oracle database to a point in time limits.

(7) To start the restore and recovery of an Oracle database select the **Run immediately after finishing wizard** check box and click **Save as** to store the script at the operating system location.

(8) Using the stored script, manually perform the restore and recovery operation.

Figure 39



Selection Summary:

```
# ------------------------------------------------------------
# Oracle Configuration Section
# ------------------------------------------------------------
Oracle home: /oracle/database/app/12.1.0/product
Oracle SID: HDIDDB
# ------------------------------------------------------------
# Credentials Setting Section
# ------------------------------------------------------------
Using OS Authentication on target database.
# ------------------------------------------------------------
# Restore configuration section
# ------------------------------------------------------------
# ------------------------------------------------------------
# Recover Configuration Section
# ------------------------------------------------------------
```

☑ Run immediately after finishing wizard.

☑ Save as: /home/oracle/NetBackupRestore

To close the wizard, click Finish.

3. To view progress of an Oracle database restore and recovery, click **Yes** on the next screen of the wizard.

Restore and Recover an Oracle Database Manually Using Veritas NetBackup

This example uses the following values. Use the values for your environment.

- **Master Server** — win-isundd8bau5
- **Oracle source client** — hdid-hcp-oracle-02

To manually restore and recover an Oracle database using Veritas NetBackup, do the following.

1. Browse the Oracle backups by running the **bplist** command either on the master server or the Oracle destination client:

   ```
   oracle@hdid-hcp-oracle-02 bin]$ ./bplist -S win-isundd8bau5 -C hdid-mount-host -t 4 -I -R /
   ```

2. From the output, find the name of the controlfile **backuppiece** starting with the following:

   ctrl_dHDIDDB_u0grihgfd_s16_p1_t925417965

   Using this information, you can inform RMAN and NetBackup exactly which control file that NetBackup needs to restore.

3. In **nomount** mode, restore the control file.

```
SQL> startup nomount
```

The system responds with the following:

```
ORACLE instance started.

Total System Global Area 8.1068E+10 bytes

Fixed Size                  7653432 bytes

Variable Size            3.4628E+10 bytes

Database Buffers         4.6171E+10 bytes

Redo Buffers              260780032 bytes
```

4. Run the **rman** command to restore the control file to a temporary location without affecting your production location.

```
RMAN> run {

ALLOCATE CHANNEL ch00

TYPE 'SBT_TAPE'

PARMS 'SBT_LIBRARY=/usr/openv/netbackup/bin/libobk.so64';

SEND 'NB_ORA_SERV=win-isundd8bau5, NB_ORA_CLIENT=hdid-mount-host';

restore controlfile to '/home/oracle/NetBackup/Oracle/cntrl.bak' from
'ctrl_dHDIDDB_u0grihgfd_s16_p1_t925417965';

release channel ch00;

}

using target database control file instead of recovery catalog
```

The system responds with the following:

```
allocated channel: ch00

channel ch00: SID=7921 instance=RACDB1 device type=SBT_TAPE

channel ch00: Veritas NetBackup for Oracle - Release 7.7.3 (2016051915)

sent command to channel: ch00

Starting restore at 17-OCT-16

channel ch00: restoring control file

channel ch00: restore complete, elapsed time: 00:00:55

Finished restore at 17-OCT-16

released channel: ch00
```

5. Check the /home/oracle/NetBackup/Oracle/ directory to make sure the control file is restored (cntrl.bak).

6. Replicate the control file:

```
RMAN> run

{

replicate controlfile from '/home/oracle/NetBackup/Oracle/cntrl.bak';

}
```

The system responds with the following:

```
allocated channel: ORA_DISK_1

channel ORA_DISK_1: SID=7921 instance=HDIDDB1 device type=DISK

replicating control file

input file name=/home/oracle/NetBackup/Oracle/cntrl.bak

output file name=+FRADG/HDIDDB/CONTROLFILE/current.256.923642647
```

7. Mount the Oracle database.

```
SQL> alter database mount;
```

The system responds with the following:

```
Database mounted.
```

8. Run the restore script at the /home/oracle/NetBacupRestore location through the NetBackup restore wizard.

```
RMAN> RUN {

 ALLOCATE CHANNEL ch00

2>

3>      TYPE 'SBT_TAPE'

4>      PARMS 'SBT_LIBRARY=/usr/openv/netbackup/bin/libobk.so64';

5> ALLOCATE CHANNEL ch01

6>      TYPE 'SBT_TAPE'

7>      PARMS 'SBT_LIBRARY=/usr/openv/netbackup/bin/libobk.so64';

8> SEND 'NB_ORA_SERV=win-isundd8bau5, NB_ORA_CLIENT=hdid-mount-host';

9> RESTORE DATABASE;

10> RECOVER DATABASE;

11> RELEASE CHANNEL ch00;

12> RELEASE CHANNEL ch01;

13> }
```

The system responds with the following:

```
using target database control file instead of recovery catalog
allocated channel: ch00
channel ch00: SID=367 instance=HDIDDB1 device type=SBT_TAPE
channel ch00: Veritas NetBackup for Oracle - Release 7.7.3 (2016051915)

allocated channel: ch01
channel ch01: SID=373 instance=HDIDDB1 device type=SBT_TAPE
channel ch01: Veritas NetBackup for Oracle - Release 7.7.3 (2016051915)

sent command to channel: ch00
sent command to channel: ch01

Starting restore at 17-OCT-16
Starting implicit crosscheck backup at 17-OCT-16
Finished implicit crosscheck backup at 17-OCT-16

searching for all files in the recovery area
cataloging files...
cataloging done

List of Cataloged Files
=======================
File Name: +FRADG/HDIDDB/ARCHIVELOG/2016_10_17/thread_1_seq_49.490.925434045
File Name: +FRADG/HDIDDB/ARCHIVELOG/2016_10_17/thread_1_seq_50.492.925444823
..........................
..........................
File Name: +FRADG/HDIDDB/ARCHIVELOG/2016_10_16/thread_1_seq_48.488.925423713

channel ch00: starting datafile backup set restore
channel ch00: specifying datafile(s) to restore from backup set
channel ch00: restoring datafile 00004 to +DATADG/HDIDDB/DATAFILE/
undotbs1.267.925349353

channel ch00: reading from backup piece bk_dHDIDDB_u03rihg89_s3_p1_t925417737

channel ch01: starting datafile backup set restore

channel ch01: specifying datafile(s) to restore from backup set

channel ch01: restoring datafile 00006 to +DATADG/HDIDDB/DATAFILE/
users.266.925349353

channel ch01: reading from backup piece bk_dHDIDDB_u05rihg89_s5_p1_t925417737

channel ch00: piece handle=bk_dHDIDDB_u03rihg89_s3_p1_t925417737
tag=TAG20161016T202856

channel ch00: restored backup piece 1

channel ch00: restore complete, elapsed time: 00:01:05

channel ch00: starting datafile backup set restore

channel ch00: specifying datafile(s) to restore from backup set

..........................

..........................

channel ch01: restoring datafile 00001 to +DATADG/HDIDDB/DATAFILE/
system.265.925349257

channel ch01: reading from backup piece bk_dHDIDDB_u01rihg89_s1_p1_t925417737

channel ch00: piece handle=bk_dHDIDDB_u02rihg89_s2_p1_t925417737
tag=TAG20161016T202856

channel ch00: restored backup piece 1

channel ch00: restore complete, elapsed time: 00:01:05

channel ch01: piece handle=bk_dHDIDDB_u01rihg89_s1_p1_t925417737
tag=TAG20161016T202856

channel ch01: restored backup piece 1

channel ch01: restore complete, elapsed time: 00:01:05

Finished restore at 17-OCT-16

Starting recover at 17-OCT-16

starting media recovery

archived log for thread 1 with sequence 35 is already on disk as file +FRADG/
HDIDDB/ARCHIVELOG/2016_10_16/thread_1_seq_35.469.925380113

..........................

..........................
```

```
archived log for thread 1 with sequence 49 is already on disk as file +FRADG/
HDIDDB/ARCHIVELOG/2016_10_17/thread_1_seq_49.490.925434045

archived log file name=+FRADG/HDIDDB/ARCHIVELOG/2016_10_16/
thread_1_seq_35.469.925380113 thread=1 sequence=35

archived log file name=+FRADG/HDIDDB/ARCHIVELOG/2016_10_16/
thread_1_seq_36.470.925380349 thread=1 sequence=36

..........................

..........................

archived log file name=+REDO01/HDIDDB/ONLINELOG/group_3.263.925349415 thread=1
sequence=51

media recovery complete, elapsed time: 00:00:07

Finished recover at 17-OCT-16

released channel: ch00

released channel: ch01
```

9. Open the database in **resetlogs** mode. This command clears the online redo logs and resets the log sequence to 1:

   RMAN> alter database open resetlogs;

   The system responds with the following:

   ```
   Statement processed
   ```

10. Verify database mode.

    SQL> select open_mode from v$database;

    The system responds with the following:

    ```
    OPEN_MODE

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

    READ WRITE
    ```

Engineering Validation

This explains how the environment was validated.

Test Methodology

This summarizes the key observations from the test results with Hitachi Data Instance Director for Oracle Database 12c with Real Application Cluster, using Veritas NetBackup and Hitachi Content Platform (HCP).

Note — The recovery steps listed are specific to this test environment. Your recovery steps will vary, depending on your environment.

Database Configuration

These are the details of the configuration information of ASM database for a two-node Oracle Real Application Cluster.

```
[oracle@hdid-hcp-oracle-02]$ srvctl config database -d HDIDDB
Database unique name: HDIDDB
Database name: HDIDDB
Oracle home: /oracle/database/app/12.1.0/product
Oracle user: oracle
Spfile: +DATADG/HDIDDB/PARAMETERFILE/spfile.1238.925880877
Password file: +DATADG/HDIDDB/PASSWORD/pwdhdiddb.1244.925880549
Domain:
Start options: open
Stop options: immediate
Database role: PRIMARY
Management policy: AUTOMATIC
Server pools:
Disk Groups: DATADG,APPDG,REDO01,REDO02
Mount point paths:
Services:
Type: RAC
Start concurrency:
Stop concurrency:
OSDBA group: oinstall
OSOPER group: oper
Database instances: HDIDDB1,HDIDDB2
Configured nodes: hdid-hcp-oracle-01,hdid-hcp-oracle-02
Database is administrator managed
```

Test Case 1: Backup Oracle — Hitachi Data Instance Director Scheduled Snapshot (Hitachi Thin Image), Mount on Proxy Server

This test case validates performing an online database backup using Hitachi Data Instance Director and mount operation.

Test Case 2: Restore (Revert) Oracle database Using Hitachi Data Instance Director and Recover Oracle Database with Manual Steps

This test case validates the complete recovery of an Oracle Database using the Hitachi Data Instance Director REVERT operation and manual recovery steps.

Test Case 3: Backup Hitachi Thin Image Snapshot Mount From a Proxy Server (hdid-mount-host) to Hitachi Content Platform Using Veritas NetBackup

This test case validates performing an offline database backup using NetBackup to Hitachi Content Platform.

Test Case 4: Restore and Recover Backup (Oracle database) From Hitachi Content Platform Through Veritas NetBackup Directly to the Application Host

This test case validates the complete database restore and recovery of an Oracle Database, using the Veritas NetBackup restore and recover operation.

Test Results

These are the test results of protecting Hitachi Unified Compute Platform for Oracle Database 12c with Hitachi Data Instance Director, Veritas NetBackup, and Hitachi Content Platform.

TABLE 17. TEST EXECUTION SUMMARY

Test case	Result
Backup Oracle - Hitachi Data Instance Director Scheduled snapshot (Hitachi Thin Image), mount on the proxy server	Success
Restore (Revert) Oracle database using Hitachi Data Instance Director and Recover Oracle Database with manual steps	Success
Backup 'Hitachi Thin Image Snapshot mount' from proxy server to Hitachi Content Platform using Veritas NetBackup	Success
Restore and recover backup (Oracle database) from Hitachi Content Platform through NetBackup directly to application host	Success

For More Information

Hitachi Vantara Global Services offers experienced storage consultants, proven methodologies and a comprehensive services portfolio to assist you in implementing Hitachi products and solutions in your environment. For more information, see the Services website.

Demonstrations and other resources are available for many Hitachi products. To schedule a live demonstration, contact a sales representative or partner. To view on-line informational resources, see the Resources website.

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