

# Local Replication of SAP Systems on Microsoft SQL Environments Using Hitachi Replication Manager on Hitachi Virtual Storage Platform

Implementation Guide

*By Archana Kuppuswamy*

*November 2011*



## Feedback

Hitachi Data Systems welcomes your feedback. Please share your thoughts by sending an email message to [SolutionLab@hds.com](mailto:SolutionLab@hds.com). Be sure to include the title of this white paper in your email message.

# Table of Contents

<b>Solution Components .....</b>	<b>4</b>
Hardware Components .....	6
Software Components .....	7
<b>Solution Implementation.....</b>	<b>12</b>
Configure the Storage Area Network .....	12
Configure Storage for SAP ERP Server.....	14
Configure Servers and the Operating Environment .....	15
Configure Replication using Hitachi Replication Manager .....	16
Replicate the SAP ERP Production Server .....	32
Backup and Restore the SAP ERP system using Replication Manager.....	36
<b>Appendix A— Configuration Definition File.....</b>	<b>43</b>
Configuration Files for SAP ERP Production Server .....	43
Configuration Files for SAP ERP Off-host Server .....	44
<b>Appendix B— Assigning Authorizations for SQL server Log Ons After Replication .....</b>	<b>44</b>
<b>Appendix C— Log on as a Service Permission Assignment .....</b>	<b>45</b>

# Local Replication of SAP Systems on Microsoft SQL Environments Using Hitachi Replication Manager on Hitachi Virtual Storage Platform

## Implementation Guide

Most SAP® customers rely on their IT environments to be available 24 hours a day, 7 days a week. Given their critical nature, most SAP deployments need a secondary copy of the production landscape's data.

One of the most powerful capabilities of an advanced storage infrastructure is the ability to create multiple copies of data with little effect on the production instance. These copies are used for a variety of purposes, such as backup, data mining, and test environments. This can be one of the most complex storage administration tasks. Introducing any process into a production SAP environment requires detailed planning and testing to ensure that the process does not impact production.

Hitachi Data Systems takes a holistic approach to SAP environments. The key to that approach is Hitachi Virtual Storage Platform. The advanced functionalities of Hitachi Virtual Storage Platform fulfill the complex and demanding requirements of an SAP implementation, such as data replication. Although data replication can be performed at the server level, this function is performed more effectively within the storage infrastructure.

This solution uses Hitachi Replication Manager to manage the replication of SAP production ERP instance. Hitachi Replication Manager uses Hitachi ShadowImage® Heterogeneous Replication. This functionality of Hitachi Virtual Storage Platform replicates the volumes within a specific storage system (local copying).

The Application Agent for Microsoft SQL Server extends how Replication Manager functions to include application awareness. This allows application resources to be managed using the Replication Manager interface. Application Agents allow Replication Manager to perform database backup and restore operation for Microsoft SQL Server databases.

All SAP solutions include an embedded database that runs on the selected operating systems. Microsoft Windows Server and Microsoft SQL Server support secure, reliable, and scalable SAP environments.

This white paper has different use cases. Each focuses on replication and backup to do the following:

- Replicate a SAP Production ERP instance on Microsoft Windows Server 2008 and Microsoft SQL Server 2008 and prepare the replicated copy for access by a secondary server.
- Use Replication Manager and the Application Agent for Microsoft SQL Server to perform database backup and restore operation for SQL server databases.

This guide provides step-by-step instructions for preparing the environment for replication, configuring replication, and implementing replication for off-host processing.

This is written for IT professionals charged with the storage, deployment, or administration of SAP systems on a Hitachi Virtual Storage Platform and Hitachi Compute Blade 2000 using Microsoft Windows Server 2008 and Microsoft SQL Server 2008.

This paper assumes the following:

- Familiarity with storage area network (SAN) technologies, tools, and operating practices
- Basic knowledge of Hitachi storage management software, including Hitachi Command Suite and Hitachi Dynamic Link Manager

## Solution Components

This solution includes SAP clients that access the SAP application infrastructure for on-host and off-host processing. The SAP application layer in turn, stores data in and accesses data from a Hitachi Virtual Storage Platform. Specifically, this solution uses the following:

- Hitachi Virtual Storage Platform
- Hitachi Computer Blade 2000—Chassis has the following on three server blades:
  - SAP Solution Manager
  - SAP ERP
  - SAP ERP off-host instance
- Hitachi ShadowImage® Heterogeneous Replication
- Storage Management Server

The SAP ERP, ERP off-host, and the SAP Solution Manager systems are installed on Microsoft Windows servers in the SAP Application and Database tier as a central system. This means that the SAP application and SAP database are installed on a single server.

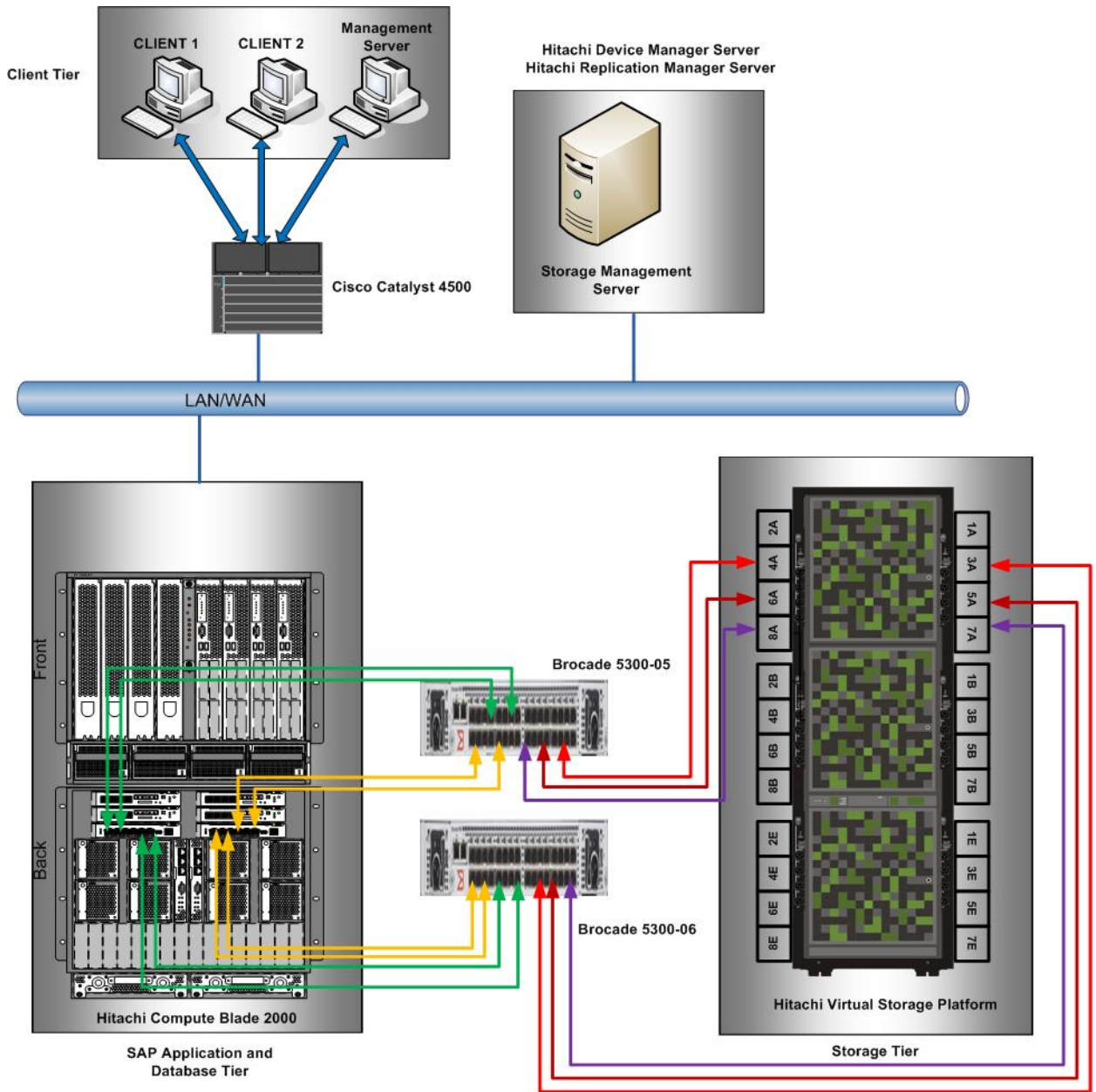
All the SAP application servers are connected to a Hitachi Virtual Storage Platform using two Brocade 5300 switches.

The solution includes a storage management server that provides management information in response to requests from the management clients.

Hitachi Replication Manager and Hitachi Device Manager (a pre-requisite program for the Hitachi Replication Manager) are installed on the storage management server. The Storage Management Console is used to access the Device Manager client and Replication Manager GUI.

In this solution, the SAP ERP host instance and SAP ERP off-host instance are the pair management servers that collect information including copy pair status and performance information for pair copy groups used by Replication Manager for pair operation. The command control interface and the Hitachi Device Manager agent are installed on each of these pair management servers. By installing the Command Control Interface and Device Manager agent, you can manipulate copy pairs from Replication Manager. Also install the Application Agent for Microsoft SQL Server on the SAP ERP host instance and SAP ERP off-host instance to perform the backup and restore operation for SQL server database.

Figure 1 illustrates the environment used to validate this solution in the Hitachi Data Systems lab.



**Figure 1**

“Hardware Components” and “Software Components” describe the components required to deploy this solution.

## Hardware Components

Table 1 describes the hardware used to deploy this solution in the Hitachi Data Systems lab.

**Table 1. Tested Deployment Hardware**

<i>Hardware</i>	<i>Quantity</i>	<i>Configuration</i>	<i>Role</i>
Hitachi Virtual Storage Platform	1	8 Fibre Channel ports used 2 pair of front-end directors 2 pair of back-end directors 64×300GB 10k RPM SAS drives 64GB cache	Primary storage
Hitachi Compute Blade 2000 chassis	1	8-blade chassis 2 Fibre Channel switch modules 2×management modules 8×cooling fan modules 4×power supply modules	Server blade chassis
Hitachi Compute Blade 2000 server blade	1	2×8 Core processor with 256GB of memory	SAP Solution Manager server
Hitachi Compute Blade 2000 server blade	1	2×8 Core processor with 256GB of memory	SAP ERP server
Hitachi Compute Blade 2000 server blade	1	2×8 Core processor with 256GB of memory	SAP ERP off-host server
Brocade 5300 SAN Fibre Channel switch	2	14×4Gb/sec Fibre Channel ports	SAN switch

### *Hitachi Virtual Storage Platform*

The Hitachi Virtual Storage Platform is the first 3D scaling storage platform designed for all data types. Its storage architecture flexibly adapts for performance, capacity, and multi-vendor storage. Combined with the unique Hitachi Command Suite management platform, it transforms the data center.

- **Scale Up**—Meet increasing demands by dynamically adding processors, connectivity, and capacity in a single unit. Provide the highest performance for both open and mainframe environments.
- **Scale Out**—Meet multiple demands by dynamically combining multiple units into a single logical system with shared resources. Support increased demand in virtualized server environments. Ensure safe multi-tenancy and quality of service through partitioning of cache and ports.
- **Scale Deep**—Extend storage value by virtualizing new and existing external storage systems dynamically. Extend the advanced functions of Hitachi Virtual Storage Platform to multivendor storage. Offload less demanding data to external tiers to save costs and to optimize the availability of tier one resources.

For more information, see [Hitachi Virtual Storage Platform](#) on the Hitachi Data Systems website.

## Hitachi Compute Blade 2000

Hitachi Compute Blade 2000 is an enterprise-class blade server platform. It features the following:

- A balanced system architecture that eliminates bottlenecks in performance and throughput
- Configuration flexibility
- Eco-friendly power-saving capabilities
- Fast server failure recovery using a N+1 cold standby design that allows replacing failed servers within minutes

For more information, see [Hitachi Compute Blade Family](#) on the Hitachi Data Systems website.

## Software Components

Table 2 lists the software used to test this solution in the Hitachi Data Systems lab

**Table 2. Tested Deployment Software**

<i>Software</i>	<i>Version</i>
Hitachi Storage Navigator	Microcode dependent
Hitachi Command Suite	7.1.0-01
Hitachi Replication Manager	7.1.0-01
Hitachi Device Manager	7.1.0-01
Hitachi Command Control Interface (CCI)	01-24
Hitachi ShadowImage® Heterogeneous Replication	Licensed feature available with Hitachi Virtual Storage Platform
Hitachi Replication Manager Application Agent for Microsoft SQL Server	7.1.0-01
Device Manager Agent	7.1.0-01
Hitachi Dynamic Provisioning	Licensed feature available with Hitachi Virtual Storage Platform
Hitachi Dynamic Link Manager Advanced	6.0.1.0.804
SAP ERP IDES	ERP 6.0 Support Release 1 (SR1) with Enhancement Pack 4 IDES, Upgraded SAP Kernel
SAP Solution Manager	7.0 Enhancement Package 1 on SP 25
SAP Graphical User Interface	7.2
Microsoft Windows Server	2008 R2 (no service packs)
Microsoft SQL Server	2008 R2 (no service packs)

### *Hitachi Storage Navigator*

Hitachi Storage Navigator is the integrated, web-accessible graphical management interface for the Hitachi Virtual Storage Platform firmware and software features. Use it to take advantage of all of the features of the Virtual Storage Platform.

Use Hitachi Storage Navigator to do the following:

- Map security levels for SAN ports and virtual ports
- Inter-system path mapping
- Logical unit (LDEV) creation and expansion
- Online volume migrations
- Configure and manage Hitachi replication products
- Perform online microcode updates and other system maintenance functions
- Integrate SNMP with enterprise management systems

### *Hitachi Command Suite*

Hitachi Command Suite manages virtualized storage and server infrastructures. With new levels of usability, workflow, performance, scalability, and private cloud enablement, Hitachi Command Suite lets you build sustainable infrastructures with leading storage technologies. It helps you flexibly align with changing business requirements and maximize return on IT investments.

For this solution, Hitachi Command Suite was used to create LDEVs and dynamic pools for the SAP Solution Manager instance and SAP ERP 6.0 Enhancement Pack 4 ABAP instance. It was used also to assign the newly created LDEVs to host groups.

For installation and configuration information, see *Hitachi Command Suite Software User Guide* (MK-90HC172), which was shipped with your product.

### *Hitachi Replication Manager*

Hitachi Replication Manager centrally manages the replication of storage system volumes in large-scale system configurations.

Replication Manager reduces the workload involved in management tasks, such as protecting and restoring system data. It uses the volume replication functionality of Hitachi storage systems to replicate the volumes within a specific storage system (local copying) or across multiple storage systems (remote copying).

Hitachi Replication Manager provides the following features:

- Centralized management of the replication environment
- Integrated database backup management
- Visual representation of replication structures
- Immediate notification of error information

## *Hitachi Device Manager*

Hitachi Device Manager integrates the management of disk resources and for configuring the storage system hardware. It helps to run and manage a system with multiple storage systems. Replication Manager performs copy pair operations and other operations on volumes of storage systems that are managed by Device Manager.

Device Manager provides the following features:

- Centralized management of storage subsystems
- Storage resource management by logical group and resource group
- Linkage with CCI
- Automated processing using the command line
- Support for the industry standard SMI-S interface

## *Application Agent for Microsoft SQL Server*

Application Agent for Microsoft SQL Server allows Hitachi Replication Manager to perform database backup and restore operation on Microsoft SQL Server databases. The agent internally manages the relationship between backup objects and their associated logical units within the storage systems, the relationship between the primary and secondary volumes, and the backup history.

Microsoft SQL Server provides an API called Virtual Backup Device Interface (VDI). This API integrates with the Application Agent for Microsoft SQL Server to support backup and restore operations, including a full range of hot and snapshot backup capabilities.

This solution installs Application Agent for Microsoft SQL Server on the SAP ERP server and the SAP ERP off-host server.

The architecture in this implementation guide uses Microsoft Windows 2008 R2 (no service packs) and Microsoft SQL Server 2008 R2 (no service packs) with Application Agent 7.0.0-01.

Verify that Application Agent supports the operating system version and database application version combination. Replication Manager identifies the database application running on each host based on the installed version of Application Agent.

---

**Note**— Do not install a version of Application Agent on a host that does not have the correct version of the database application installed.

---

## *Hitachi Device Manager Agent*

The Hitachi Device Manager agent runs on a host server to collect and report information about that host server and the storage system, and report that data to the Device Manager server. In addition, the Device Manager agent instructs Hitachi Command Control Interface to perform copy pair operations in response to requests from Replication Manager and provide Device Manager with host information.

The Device Manager agent collects the following and reports it to the host server:

- Host machine information, such as host names, IP addresses, HBA WWN, and iSCSI name
- Information about LDEVs allocated to the host, such as LDEV number, storage system, LUN, and LDEV type.
- Information about file system allocated to the host, such as file system types, mount points, and usage.
- Copy pair information, such as pair types and statuses.

Installing the Device Manager agent on a host also installs the Replication Manager agent on that host. The Replication Manager agent communicates with the Replication Manager server to collect information and configure host settings. Replication Manager uses this information for displaying and managing the pair information.

This solution installs the Device Manager agent on the SAP ERP host server and the SAP ERP off-host server.

### *Hitachi ShadowImage® Heterogeneous Replication*

Hitachi ShadowImage® Heterogeneous Replication is a storage-based solution that creates RAID-protected duplicate volumes within Hitachi Virtual Storage Platform products. ShadowImage Heterogeneous Replication primary volumes (P-VOLs) contain the original data. Up to nine secondary volumes (S-VOLs) can be created as copies.

On Hitachi Virtual Storage Platform, ShadowImage Heterogeneous Replication is used to implement clones, a full copy of the primary data. The clone is available to be used by secondary applications. The unique value of working with a clone is that any operation on the clone has no effect on the primary data.

Detailed information on using Shadow Image Heterogeneous Replication is in *Hitachi Command Control Interface User and Reference Guide* (MK-90RD7010).

### *Hitachi Dynamic Provisioning*

On Hitachi storage devices, Hitachi Dynamic Provisioning provides wide striping and thin provisioning functionalities.

Using Hitachi Dynamic Provisioning is like using a host-based logical volume manager (LVM), but without incurring host processing overhead. It provides one or more wide-striping pools across many RAID groups. Each pool has one or more dynamic provisioning virtual volumes (DP-VOLs) of a logical size you specify of up to 60TB created against it without allocating any physical space initially.

Deploying Hitachi Dynamic Provisioning avoids the routine issue of hot spots that occur on logical devices (LDEVs). These occur within individual RAID groups when the host workload exceeds the IOPS or throughput capacity of that RAID group. This distributes the host workload across many RAID groups, which provides a smoothing effect that dramatically reduces hot spots.

Hitachi Dynamic Provisioning has the benefit of thin provisioning. Physical space assignment from the pool to the DP-VOL happens as needed using 42MB pages, up to the logical size specified for each DP-VOL. There can be a dynamic expansion or reduction of pool capacity without disruption or downtime. An expanded pool can be rebalanced across the current and newly added RAID groups for an even striping of the data and the workload.

For more information, see the [Hitachi Dynamic Provisioning datasheet](#) and [Hitachi Dynamic Provisioning](#) on the Hitachi Data Systems website.

### *Hitachi Dynamic Link Manager Advanced*

Hitachi Dynamic Link Manager Advanced combines all the capabilities of Hitachi Dynamic Link Manager and Hitachi Global Link Manager into a comprehensive multipathing solution. It includes capabilities such as the following:

- Path failover and failback
- Automatic load balancing to provide higher data availability and accessibility.

For more information, see [Hitachi Dynamic Link Manager](#) on the Hitachi Data Systems website.

### *SAP Software*

This solution uses several SAP software packages:

- SAP ERP software for enterprise resource planning (ERP) provides role-based access to crucial data, applications, and analytical tools. It is a flexible, open technology platform that can leverage and integrate SAP and non-SAP systems, delivering a comprehensive set of integrated, cross-functional business processes.
- SAP Solution Manager is a centralized toolset that facilitates technical support for distributed systems. It has functionality that covers all key aspects of solution deployment, operation, and continuous improvement.
- The SAP Microsoft Management Console provides a common framework for system management. It integrates tools in the SAP MMC with snap-ins for standardized access to functions. Use the SAP Systems Manager snap-in to monitor, start, or stop the SAP system centrally from the SAP Microsoft Management Console.

### *Microsoft SQL Server*

Microsoft SQL Server is a high performance database. This solution used Microsoft SQL Server 2008 R2 Enterprise Edition.

Microsoft SQL Server Management Studio is an environment to access, configure, manage, administrate, and develop all components of SQL Server.

# Solution Implementation

Deploying this solution requires these following steps:

1. [Configure the storage area network.](#)
2. [Configure storage for SAP ERP server.](#)
3. [Configure servers and the operating environment.](#)
4. [Configure replication using Replication Manager.](#)
5. [Replicate the SAP ERP system.](#)
6. [Backup and restore the SAP ERP system using Replication Manager.](#)

There are details about each of these steps in the following sections.

Your implementation checklist may vary, based on your environment and your requirements.

## Configure the Storage Area Network

Each server blade has two Fibre Channel mezzanine card installed. These cards are connected internally to the Fibre Channel switch modules located in the Hitachi Compute Blade 2000 chassis. Connect eight inter-switch links from the switch modules to the Brocade 5300 switches. Connect the switches to six ports of the Hitachi Virtual Storage Platform storage system.

When deploying an SAP system, isolate the storage used by the SAP Solution Manager server, the SAP ERP server, and the SAP ERP off-host server from each other in a SAN by the use of zones and host groups. Configure each connection with zones on fabric switches, according to the manufacturer's guidelines. In addition, follow these recommended practices:

- Use World Wide Port Name (WWPN) identification for all zoning configuration.
- Connect a minimum of two HBAs per server for multipath high availability.
- Disable all unused switch ports to increase security.
- Configure ports for point-to-point topology.
- Set ports to a specific speed. Do not use the auto negotiate setting.
- Use single initiator zoning.

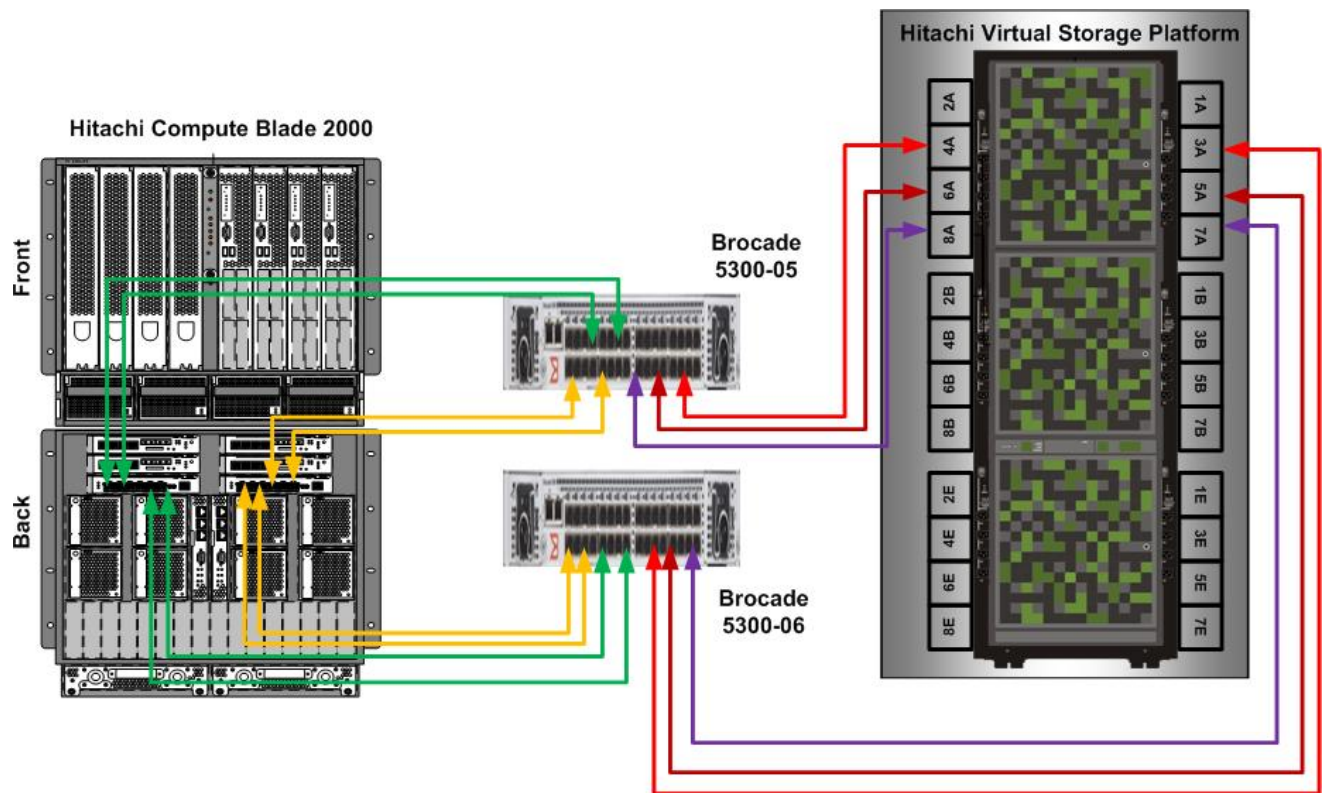
Table 2 lists the path configurations used in this solution.

**Table 2. Path Configuration**

<i>Initiator</i>	<i>Host HBA No.</i>	<i>Switch</i>	<i>Zone Name</i>	<i>Storage System Port (Target)</i>
SAP Solution Manager	HBA 1 Port 1	Brocade 5300-1	SAP_SOLMAN_HBA1_1_VSP_3A	VSP 3A
SAP Solution Manager	HBA 2 Port 2	Brocade 5300-2	SAP_SOLMAN_HBA2_2_VSP_4A	VSP 4A

<i>Initiator</i>	<i>Host HBA No.</i>	<i>Switch</i>	<i>Zone Name</i>	<i>Storage System Port (Target)</i>
SAP ERP	HBA 1 Port 1	Brocade 5300-1	SAP_ERP_HBA1_1_VSP_5A	VSP 5A
SAP ERP	HBA 2 Port 2	Brocade 5300-2	SAP_ERP_HBA2_2_VSP_6A	VSP 6A
SAP ERP Off-Host	HBA 1 Port 1	Brocade 5300-1	SAP_ERP_OFFHOST_HBA1_1_VSP_7A	VSP 7A
SAP ERP Off-Host	HBA 2 Port 2	Brocade 5300-2	SAP_ERP_OFFHOST_HBA2_2_VSP_8A	VSP 8A

Figure 2 shows the storage network configuration of the SAP instances. This solution uses six connections from the SAP instances to the Hitachi Virtual Storage Platform. This includes two HBA connections to each of the SAP instances.



- ↔ Two Zones: SAP ERP Server HBA 1 and Port 5A  
SAP ERP Server HBA 2 and Port 6A
- ↔ Two Zones: SAP ERP Off-Host Server HBA 1 and Port 7A  
SAP ERP Off-Host Server HBA 2 and Port 8A
- ↔ Two Zones: SAP Solution Manager Server HBA 1 and Port 3A  
SAP Solution Manager Server HBA 2 and Port 4A
- ↔ Interswitch Links from Fibre Channel Switch Module 4
- ↔ Interswitch Links from Fibre Channel Switch Module 5

Figure 2

## Configure Storage for SAP ERP Server

Use Hitachi Dynamic Provisioning to provision the storage for the SAP ERP server.

For the detailed steps on how to configure the storage on the Hitachi Virtual Storage Platform, see [Deploying SAP on Microsoft SQL 2008 Environments Using the Hitachi Virtual Storage Platform](#).

Use standard LDEVs for storing the transactional logs of the SAP ERP server. Use dynamic provisioning volumes (DP-VOLs) for all the other logical volumes of the SAP ERP server.

To make sure that the failure of a disk that contains a data file does not cause the loss of the transactional logs needed to recover the data file, store the transactional logs on separate disks from the data file disks.

Create the dynamic provisioning pool SAP\_ERP\_HOST for the SAP database for the SAP ERP server. Configure the RAID groups for the dynamic provisioning pool as RAID-5 (3D+1P).

All drives are 300GB 10k RPM SAS drives. Use a total of two RAID groups for the dynamic provisioning pool SAP\_ERP\_HOST, giving the pool a storage capacity of 1.6TB. Configure six DP-VOLs in the dynamic provisioning pool and map them to the storage ports as LDEVs.

Table 3 lists storage configuration details for the LDEVs to be created for the SAP ERP server in the SAP\_ERP\_HOST pool. Map all LDEVs to storage ports 5A and 6A.

**Table 3. LDEV Storage Configuration for the SAP ERP Server**

LDEV	Host LUN	Size (GB)
00:01:50	00	200
00:01:51	01	100
00:01:53	03	125
00:01:54	04	125
00:01:55	05	125
00:01:56	06	125

Use one RAID-5 (3D+1P) group to store the SAP transaction logs. All drives are 300GB 10k RPM SAS drives. This gives the RAID group storage capacity of 900GB. Carve one LDEV of 100GB out of the RAID group to store the Microsoft SQL Server 2008 transactional logs for the SAP ERP server. The corresponding host LUN is 02 and LDEV is 01:52.

Table 4 lists the file system layout details for the SAP ERP server.

**Table 4. File System Layout for SAP ERP Server**

Host LUN	File System Mount Point	Usage
00	C:\	Host operating system and Microsoft SQL Server 2008 installation files
01	S:\usr\sap	File system for SAP binaries, SAP transactions
02	L:\<SID>LOG	SAP transaction log

Host LUN	File System Mount Point	Usage
03	M:\<SID>DATA	SAP data 1
04		SAP data 2
05		SAP data 3
06		SAP data 4

Use basic disks for the drive M mount points on SAP ERP server. Do not to configure the Microsoft SQL data files and transactional log files as dynamic disks as the Application Agent for Microsoft SQL does not support dynamic disks.

## Configure Servers and the Operating Environment

Use the same hardware, software, and storage configuration for SAP Solution Manager as described in [Deploying SAP on Microsoft SQL 2008 Environments Using the Hitachi Virtual Storage Platform](#). This has more information about installation and configuration of the SAP Solution Manager servers and the client servers.

After completing “Configure Storage for SAP ERP Server,” install and configure the SAP ERP server in a dedicated environment by following the steps in [Deploying SAP on Microsoft SQL 2008 Environments Using the Hitachi Virtual Storage Platform](#). Also, upgrade the SAP kernel and the SAP Microsoft Management Console (SAP MMC) to the latest release following the instructions in the same document.

Deploy the SAP ERP off-host server following the same steps used for the SAP ERP server. The underlying RAID configuration, RAID type, and disk type for the storage remain the same for the off-host server.

The SAP ERP off-host server is the same as the SAP ERP production server in terms of hardware, storage, operating system, and software configuration—with one possible difference. Depending on the type of off-host processing being preformed, the off-host SAP ERP server and Microsoft SQL server may require the same or different system identifier (SID) as the production SAP ERP server and Microsoft SQL server. For this reason, focusing on replication this solution does the following:

- Replicate the off-host SAP system with the same SID as the production SAP system. Use this scenario when you need to have a backup copy of the production instance.
- Replicate the off-host SAP system with a different SID as the production SAP. Use this scenario when you need to have multiple copies of data from the production instance for purposes such as testing, training, development systems, refreshing QA, reporting, and data mining environments.

### *Install and Configure Hitachi Dynamic Link Manager Advanced*

Hitachi Virtual Storage Platform supports active-active multipath connectivity. To obtain maximum availability, design and implement your host-storage connections so that at least two unique paths exist from the host to the storage system. Hitachi Data Systems recommends the use of dual SAN fabrics, multiple HBAs and host-based multipathing software when deploying SAP systems. This solution uses Hitachi Dynamic Link Manager Advanced for the multipathing software.

Your choice of load-balancing algorithm depends on the specific environment and access patterns of the application. In most cases, the extended round robin algorithm provides the best overall performance. In some environments, such as an environment shared with other applications, one of the other algorithms might give the best overall performance.

To install Hitachi Dynamic Link Manager Advanced on the SAP ERP host and off-host server follow these steps:

1. Insert the installation media (for example, CD-ROM) for the Hitachi Dynamic Link Manager Advanced into the proper I/O device.
2. Run **Setup.exe** in the HDLM\_Windows folder on the installation media. Follow the on-screen instructions to complete the installation.

## Configure Replication using Hitachi Replication Manager

Configure replication using Replication Manager to replicate the current data from the SAP ERP server to the SAP ERP off-host server. The following are the preliminary steps that need to be completed to set up the environment to replicate the data using Replication Manager. The configuration for this solution involves the following steps:

1. Install Hitachi Command Control Interface.
2. Configure Command Devices.
3. Install and configure the Device Manager agent.
4. Install the Application Agent.
5. Refresh host and storage system from the Device Manager Web Client.
6. Refresh the configuration information in Replication Manager.
7. Setup the Site for the replication in Replication Manager.
8. Register and setup Application Agent as information source.
9. Adding the application server to the site.
10. Create copy pairs using Replication Manager.
11. Creating My Copy Groups and checking copy pair statuses for a copy group.

### *Install Hitachi Command Control Interface*

To install Hitachi Command Control Interface on the SAP ERP server and the SAP ERP off-host server, follow these steps:

1. Insert the installation media (for example, CD-ROM) for the Hitachi Command Control Interface into the proper I/O device.
2. Run **Setup.exe** on the installation media. Follow the on-screen instructions to complete the installation.

3. Verify installation of the latest version of Hitachi Command Control Interface by typing the following command at a command prompt from the Open Remote Copy manager installation directory (C: \HORCM\etc):

```
raidqry -h
```

The output looks something like the following:

```
Model   : RAID-Manager/WindowsNT  
Ver&Rev: 01-24-03/06  
Usage   : raidqry [options] for HORCM
```

### *Configure Command Devices*

A command device is a dedicated logical volume on the storage system that functions as the interface to the storage system from the host. The command device accepts commands from the host that are executed on the storage system.

Before doing these steps, create a 50MB LDEV for the command device from the RAID group used to store the Microsoft SQL Server 2008 transactional logs. Associate this LDEV to the host group for the host connection using Hitachi Storage Navigator. See “Configure Storage for SAP ERP Server” for instructions on how to create an LDEV for command device and associate this LDEV to the host group.

Convert the LDEV to a command device in Hitachi Storage Navigator by following these steps:

1. Click Logical Devices in the Explorer area.
2. In the right area on the **LDEVs** tab, select the LDEV to be converted to command device.
3. Click **More Actions Options** and then click **Edit Command Device**.

The Edit Command Devices dialog box opens.

4. In the **Edit Command Devices** dialog box, click the **Enable** option.
5. Click **Finish**.
6. Click **Apply**.

Repeat these steps to create another LDEV for the SAP ERP off-host server from the RAID group used to store the Microsoft SQL Server 2008 transactional logs of the SAP ERP off-host server. Then, map the LDEV to the host group and convert it to a command device so that Hitachi Command Control Interface can use it to configure replication between the ERP host and the off-host server.

The command device must be defined and configured as a raw device with no file system and no mount operation.

## *Install and Configure Hitachi Device Manager Agent*

To install Hitachi Device Manager agent on the SAP ERP host server, follow these steps:

1. Do one of the following:
  - Insert the Hitachi Device Manager agent CD-ROM for the specific version of Device Manager Web Client installed.
  - Download the Device Manager agent installation file from Device Manager Web client.  
To download the Device Manager agent from the Device Manager Web client, follow these steps:
    - (1) Open the Device Manager Web client in a browser.
    - (2) Click **Tools – Download** from the Global Tasks bar and download the Device Manager agent for Windows.
2. Start the installation.
  - (1) Double-click **setup.exe** to start the installation of Hitachi Device Manager. Find setup.exe in the Agent\Windows folder on the CD-ROM.  
  
If installing from the Device Manager Web client, extract the installation files from the downloaded compressed file, and then double-click setup.exe from the installation file folder that contains the extracted files in a folder named Windows .  
  
The **Welcome to the installer for the Hitachi Device Manager Agent** window opens.
  - (2) Click **Next**.  
  
The License Agreement window opens.
  - (3) Read the license terms, click **I accept the terms in the license agreement**, and then click **Next**.  
  
The **Choose Install Folder** dialog box opens.
  - (4) Only change the installation folder of the device manager agent when necessary. Then, click **Next**.  
  
After clicking **Next**, the **Configuration of Windows Firewall** dialog box opens.
  - (5) Click **Yes** and then click **Next**.  
  
The **Setting Up the Agent Service Account** dialog box opens.
  - (6) Click **No** and then click **Next**.  
  
The **Ready to Install the Program** dialog box opens.
  - (7) Click **Install**.  
  
A series of dialog boxes display, indicating the installation status. After a successful installation, a dialog box opens prompting you to set up Device Manager.

3. Setup Device Manager.

- (1) Click **Yes**.

The **Specifying Server Information** dialog box opens.

- (2) Enter the Device Manager server information and then click **Next**.

Use the information for server hosting Device Manager.

**Table 5. Device Manager Server Hosting Information**

<i>Item</i>	<i>Enter this Value</i>	<i>Comment</i>
IP Address or Host Name	IP address for the Device Manager server	
Port Number	2001	Default value
User Id	HaUser	Default value
Password	haset	Default value

If the connection with the server is successful, the **Connection Verification** window and then **Specifying the Execution period HiScan command** dialog box opens.

- (3) Use the default value for the execution period for the Hiscan command. Then, click **Next**.

The Hiscan command reports host information to the Device Manager server. Specifying the execution period for the HiScan command registers exeHiScan.bat as a window task.

The **Specifying the setup of RAID Manager** dialog box opens.

- (4) If Device Manager is linked with Command Control Interface and is managing copy pairs, specify the information needed to use Command Control Interface by clicking **YES. Select the install drive and then setup the RAID Manager**.

- (5) Supply this information for Command Control Interface:

**Table 6. Command Control Interface Information**

<i>Item</i>	<i>Enter or Click this Value</i>	<i>Comment</i>
Installation Drive	Enter the drive on which Command Control Interface is installed	
Central Management Method	Click <b>Enable</b>	This manages copy pairs on the host on which the Device Manager agent is installed

- (6) Click **Next** and then click **OK**.

Repeat the steps to setup Device Manager agent on the SAP ERP off-host server.

## *Install the Application Agent for Microsoft SQL Server*

To install the Application Agent for Microsoft SQL Server database on the SAP ERP host server follow these steps:

1. Download the installation files.
  - (1) Log on to Windows as a member of the administrators group where you plan to install the Application Agent.
  - (2) Open Replication Manager in a browser.
  - (3) Click **Go – Download** from the Global Tasks bar and download **Application Agent**.
2. Install Application Agent.
  - (1) After that download completes, double-click the Application Agent installation file.
  - (2) In the **Welcome...** dialog box, click **Next**.
  - (3) Type the customer information in the **User Name** and **Company Name** text boxes on the **Customer Information** dialog box, and then click **Next**.
  - (4) Choose the **Destination Location** for the Application Agent files. Use **Browse** to navigate to the file folder. When finished, click **Next**.
  - (5) Select the components to install or uninstall using Select Features.
    - Clear the selection for **Component for Exchange**.
    - Select **Component for SQL**.When finished, click **Next**.

The **Start Copying Files** dialog box opens.
  - (6) Review your settings before proceeding with the file copying.
    - To change any setting, click **Back**.
    - To use these settings, click **Next** to begin copying files.The **Setup Status** window appears, displaying the progress of the operation.
  - (7) The **Replication Manager - Application Agent Setup** window opens. Enter the **User name** and **Password** in the respective fields, for an account that has Administrator permissions and the “Log on as a service” permission and click **Next**.
  - (8) Assign Administrator user the permission to log on as a service following the steps in “Appendix C—Log on as a Service Permission Assignment.”

When the installation finishes, the **InstallShield Wizard Complete** opens.
  - (9) Restart Windows, choosing **Yes, I want to restart my computer now**.
  - (10) Click **Finish** button.

Repeat the steps to setup the Application Agent for Microsoft SQL Server database on the SAP ERP off-host server.

## *Refresh Host and Storage System from the Device Manager Web Client*

After the installation of the Device Manager agent on SAP ERP and SAP ERP off-host server, the server information automatically registers in Device Manager. To verify the details on the Device Manager web client, follow these steps.

1. In the **Global Tab** area, click **Resources**.
2. In the Navigation area, click **Hosts**. Expand the Object tree and then click **Windows**.
3. In the Application area, compare the corresponding SAP ERP host and SAP ERP off-host information with these host details: WWN, IP address, OS, and capacity details.

Refresh the SAP ERP host from the Device Manager web client to make sure the latest information is transferred from the server to Device Manager using the following steps:

1. In the **Global Tab** area, click **Resources**.
2. In the **Navigation** area, click **Hosts**. Expand the Object tree and then click **Windows**.
3. In the **Application** area, click **SAP ERP host** and click **Refresh Hosts**.

The **Refresh Hosts** dialog box displays the message “Refreshing the selected hosts will take several minutes. Do you want to continue?”

4. Select the **Go to Data Collection Task Status** check box and click **OK**.
5. On the **Global Tab** area, in **Administration** and under **Data Collection Tasks**, verify completion of the **Refresh Hosts** task has the status **Completed**.

Repeat the steps above to refresh the SAP ERP off-host server.

Execute the **Refresh Storage System** task to send the latest information about the storage system allocated with SAP ERP host and off-host servers to Device Manager. Follow the steps below in the **Device Manager** web client:

1. On the **Global Tab** area, click **Resources**.
2. In the **Navigation** area, click **Storage Systems** and then click the corresponding storage system.
3. In the **Application** area, from the **Actions** list, click **Refresh Storage System**.

The **Refresh Storage Systems** dialog box displays the message “Refreshing the selected storage system will take several minutes. Do you want to continue?”

4. Select the **Go to Data Collection Task Status** check box and click **OK**.
5. On the **Global Tab** area, in **Administration** and under the **Data Collection Tasks**, verify completion of the **Refresh Storage System** task has the status **Completed**.

## *Refresh the Configuration Information in Replication Manager*

Replication Manager has its own database with information about managed resources. This database can be refreshed at a preset interval or at any time manually to apply the storage system information acquired using the Device Manager Agent.

To minimize effects on operation, carefully determine a refresh interval and start time in Replication Manager while machine use is not heavy. When the Device Manager database is set to refresh its information periodically, set the Replication Manager database so it refreshes information after the Device Manager database refreshes.

To set the Replication Manager database automatic refresh settings, follow these steps:

1. From the **Global Task** bar of the Device Manager web client, click **Tools**, and then click **Replication Manager**.

**Replication Manager** opens in a browser window.

2. From the **Explorer** menu, click **Settings** and then click **Refresh Setting**.

The **Refresh Setting** window opens.

3. Click the **Configuration Setting** link.

The **Configuration Setting** window opens.

4. For the information source to have its automatic refresh settings changed, click **Edit Setting**.

The **Edit Interval of Refresh Configuration** dialog box opens.

5. Set and apply a refresh interval and refresh start time.

To refresh the configuration information manually for the information source in the Replication Manager, follow these steps:

1. From the **Explorer** menu, click **Settings** and then click **Refresh Setting**.

The **Refresh Setting** window opens.

2. Click the **Configuration Setting** link.

The **Configuration Setting** window opens.

3. Select the Information Source check box for each information source you want to refresh (for example, the local Hitachi Device Manager), and then click **Refresh Configuration**.

The **Refresh Configuration** dialog box opens.

4. Review the message and then perform the refresh.

When processing finishes, a dialog box opens saying that the configuration information is acquired.

5. In the **Configuration Setting** window, confirm the update of the **Last Refresh** time.

## Setup the Site in Replication Manager

In a complex replication environment, storage systems could be located at many sites. In such cases, it is recommended to create logical sites whenever necessary by grouping resources. Grouping resources based on the actual sites simplifies resource management as it enables to use a graphical user interface for management. It is recommended to follow these steps to setup the site for replication using Hitachi Replication Manager:

To add a site:

1. From the **Explorer** menu, click **Shared Views** and then **Sites**.

The **Sites** window opens.

2. Click **Add Site**.

The **Add Site** dialog box opens.

3. Type the information about the site you want to add, and then add the sites.

Create a site named *SAP\_Replication\_MSSQL*.

This site displays in the **Sites** window after adding it.

After adding the site *SAP\_Replication\_MSSQL*, specify the resources for this site, as follows:

- Add the SAP ERP Host Server and SAP ERP Off-host Server to a Site
- Add the Storage System to a Site
- Add the Pair Management Servers to a Site

### *Add the SAP ERP Host Server and SAP ERP Off-host Server to a Site*

Follow these steps to add the SAP ERP host server and SAP ERP off-host server to a site:

1. From the **Explorer** menu, click **Shared Views** and then click **Sites**.

The **Sites** window opens.

2. Expand the object tree, and then click *SAP\_Replication\_MSSQL* in the **Site List**.

The window for *SAP\_Replication\_MSSQL* opens.

3. Click the **Hosts** link.

The **Hosts** window opens.

4. Click **Add Hosts**.

The **Add Hosts** dialog box opens.

5. Select and add the SAP ERP host and SAP ERP off-host server.

The added hosts are displayed in the Hosts window.

### *Add the Storage System to a Site*

To add storage systems to a site, follow these steps:

1. From the **Explorer** menu, click **Shared Views** and then **Sites**.

The **Sites** window opens.

2. Expand the object tree, and then click **SAP\_Replication\_MSSQL** under **Sites**.

The window for **SAP\_Replication\_MSSQL** opens.

3. Click the **Storage Systems** link.

The **Storage Systems** window opens.

4. Click **Add Storage Systems**.

The **Add Storage Systems** dialog box opens.

5. Select and add the **SAP\_ERP\_HOST** storage system to be added.

This solution uses Hitachi ShadowImage® Heterogeneous Replication to make a local copy for the SAP ERP host and SAP ERP off host server only using the same storage system.

The added storage systems display in the **Storage Systems** window.

### *Add the Pair Management Servers to a Site*

To add pair management servers to a site:

1. From the **Explorer** menu, click **Shared Views** and then click **Sites**.

The **Sites** window opens.

2. Expand the object tree, and then click **SAP\_Replication\_MSSQL** under **Sites**.

The window for that site opens.

3. On the **Resource List** pane, click the **Pair Configurations** link.

The **Pair Configurations** window opens.

4. Click **Add Hosts**.

The **Add Hosts** dialog box opens.

5. Select and add the SAP ERP host and SAP ERP off-host server

The added pair management servers display in the **Pair Configurations** window.

## *Register and Configure Application Agent as Information Source*

Use Hitachi Replication Manager to manage information about resources managed by Hitachi Device Manager. Before you can use Replication Manager to manage resources, you must register an information source. For the host and backup server, use the instances of Application Agents as a registered information source in Replication Manager.

To register the Application Agent of the SAP ERP host and the SAP ERP off-site host, follow these steps:

1. Have the following information concerning the SAP ERP host server and SAP ERP off-site host server:
  - The host name of the SAP ERP host server and the SAP ERP off-host server
  - The IP address or host name of the production server where the agent is running
  - Host type (database or backup server) Use one of the following for the host type while registering the application agent:
    - For the SAP ERP host database server, database server
    - For the SAP ERP off-host database server, the backup server.

For both servers:

- The port number used for communication with Replication Manager is 24041.
  - The configuration type is a physical host.
2. Open Replication Manager in a browser window.
  3. From the **Explorer** menu, click **Administration** and then click **Information Source**.  
The **Information Source** window opens.
  4. Expand the object tree, and then click **Application Agent**.  
The **Application Agent** window opens.
  5. Click **Add Agent**.  
The **Add Application Agent** dialog box opens.
  6. Enter the Application Agent information gathered in step 1. Do this for the SAP ERP host the first time you do this.
  7. Click **OK** to register the instance of Application Agent.

A confirmation dialog box with information about the new instance displays.

8. Review the information and click **Confirm**.

Upon successful registration, a completion dialog box displays.

9. Click **Close** to finish registration.

The information about the instance of Application Agent displays.

After registering the Application Agent of the SAP ERP host server, repeat step 1 to step 9 to register the Application Agent of the SAP ERP off-host server.

After registering the Application Agent instances, follow these steps to configure the Application Agent instances:

1. From the **Explorer** menu, click **Administration** and then click **Information Source**.

The **Information Source** window opens.

2. Expand the object tree, and then click **Application Agent**.

The **Application Agent** window opens.

3. Select the server from the **Application Agent Setting** list.

4. Click **Setup Agent**.

The **Setup Application Agent** window opens.

5. In **Target Instance** of the **Server Options** tab, manually set up the HORCM instances managing the primary and secondary volumes.

- For the SAP ERP host server, select **Instance 0**.
- For the SAP ERP off-host server, select **Instance 1**.

6. In the **Server Options** tab and in the **Backup server** area, click **Manage all replicas with the single server**.

From the **Local and Remote Replications** list, for the SAP ERP host server, click the SAP ERP off-host server for the backup server.

This option is not available when registering the Application Agent on the backup server. In this case, *do not perform this step*.

7. Enter the default Hitachi Command Control Interface installation path: c: \HORCM
8. On the **SQL Options** tab, configure Microsoft SQL Server instances with the settings in Table 7 and then click **Add**:

**Table 7. Microsoft SQL Server Instance Settings**

<i>Value</i>	<i>Setting</i>
SQL Instance Name	Enter default
VDI Meta File Generation Timeout	Use default (3600sec)
VDI Meta File Location	Use default
Restoration with stand-by status	Enable
Undo Log File Location	Location of the transactional log file: L:\MRMLOG1

9. Use the default settings on the **Replica options** tab, and then click **OK**.

A dialog box summarizing all the tab settings displays.

10. Check the settings and then click **Confirm**.

Except for Step 6, repeat these steps to setup the Application Agent for Microsoft SQL on the backup server. Do not do Step 6 when registering the Application Agent for the backup server.

Once an instance of Application Agent is registered and the pair configuration for primary and secondary volumes are set up, the application discovery process proceeds and the resource information is collected or refreshed. Application discovery is the process by which Replication Manager identifies the resources associated with an application server and the back-up server where the replicas are to be stored.

### *Adding Application Server to the Site*

After completing the setup of the Application Agent as an information source, add the application server to the site.

To add application servers to a site, follow these steps:

1. From the **Explorer** menu, click **Shared Views** and then click **Sites**.

The **Sites** window opens.

2. Expand the object tree, and then click **SAP\_Replication\_MSSQL** in the **Site List**.

The **SAP\_Replication\_MSSQL** window opens.

3. Click the **Applications** link.

The **Applications** window opens.

4. Click **SQL Server Applications**.

5. Click **Add Hosts**.

The **Add Hosts** dialog box opens.

6. Select the SAP ERP host server that is registered as Application Agent, and then click **OK** to add the application server to the *SAP\_Replication\_MSSQL* site.

The SAP ERP host server displays in the **Hosts** list.

7. Click the SAP ERP host server in the **Hosts** list to see more details.
8. In **Instances**, click **Default Instance** to see the underlying host database.
  - Clear the check boxes for the master, model, msdb database, and tempdb database
  - Verify the selection of the SAP ERP Microsoft SQL database.
9. Click **OK**.

### *Create Copy Pairs using Replication Manager*

Use Hitachi Replication Manager to create copy pair configuration definitions (*horcm.conf* file) after registering a new pair group and defining a list of volume pairs to assign to the pair groups. After creating a copy pair configuration definition file, Replication Manager does an initial `pair create` operation between the primary volumes (PVOL) and secondary volumes (SVOL).

---

**Note**— Do not use storage system operation management software while creating a copy pair configuration definition. This includes Hitachi Device Manager, Hitachi Command Control Interface, Storage Navigator, and Business Continuity Manager. Performing concurrent operations on a volume, copy group, or copy pair specified in that definition may cause errors when Replication Manager executes tasks.

---

### *Select the Default Instance*

To select the default instance, do the following:

1. From the **Explorer** menu, click **Shared Views** and then click **Sites**.

The **Sites** window opens.
2. Expand the object tree and then, in the **Site List**, click **SAP\_Replication\_MSSQL**.

The **SAP\_Replication\_MSSQL** window opens.
3. Click the **Applications** link.

The **Applications** window opens.
4. Expand the object tree, click **SQL Server Applications**, and then click **SAP ERP host applications**.

The host summary information displays.
5. Select the **Default Instance** check box of **SAP ERP host applications**. Click **Pair Management** in the bottom right of the **Application** area.

The Pair Configuration Wizard starts with **2. Pair Association** displayed.

### Create the Pair Group

To create a new pair group, do the following:

1. In the **Copy Topology** area, click **Add Group**.

The **Add Pair Group** dialog box opens.

2. For the **Pair Group Name**, type *SAP\_Replication\_MSSQL\_PG*. For the **Copy Type**, click **SI**. Then, click **OK** to register the new pair group.

The registered pair group displays in the **Copy Topology** pane.

3. In the **Pairs** area under **Detail of pair-group-name** area, select the Microsoft SQL data files and transactional log files of SAP ERP host server for replication.

4. On the **Criteria** tab in the **Candidate List** area, click **Secondary** as the volume type.

5. In the **Select Volume** area, do the following:

- For **Site**, click *SAP\_Replication\_MSSQL*
- For the SAP ERP off-host server, click the **Storage System**.

6. Click **Apply**.

The filtered list of candidate volumes displays on the **Result** tab.

7. From the tree structure on the **Results** tab, select the LUNs hosting the Microsoft SQL data files and transactional log files of the SAP ERP off-host server to assign as secondary volumes for the new copy pairs.

You can select multiple volumes on the **Result** tab.

8. Click **Add**.

The selected volumes are assigned as secondary volumes and the defined copy pair displays in the **Pair List** area.

9. Click **Next** to continue creating the copy pair configuration definition.

10. On the **3. Group Management** page of the Pair Configuration Wizard, click **Create Group** button.

The **Create Group** dialog box opens.

### Create Copy Group

To create the copy group, follow these steps:

1. For **Group Name**, type *SAP\_Replication\_MSSQL\_CG*.
2. Enter the details in Table 8 for the primary server:

**Table 8. Primary Server Details**

<i>Item</i>	<i>Value</i>
Site Detail	SAP_Replication_MSSQL
Server Name	SAP ERP host name
HORCM instance	0
UDP Port	11000

3. Enter the details in Table 9 for the secondary server.

**Table 9. Secondary Server Details**

<i>Item</i>	<i>Value</i>
Site Detail	SAP_Replication_MSSQL
Server Name	SAP ERP off-host name
HORCM instance	1
UDP Port	11001

4. Use the default setting, **Auto**, for **MU Number**.
5. Click **OK** to create a new copy group. The created copy group displays in the **Copy Group** pane.

### Associate the Pair Group

To associate the pair group with the new copy group, do the following:

1. On the **3. Group Management** page of the Pair Configuration Wizard, in the **Pair Group** area select *SAP\_Replication\_MSSQL\_PG* to be associated with the copy group *SAP\_Replication\_MSSQL\_CG* and then click **Apply**.

The copy pairs belonging to the associated pair group are displayed in the **Pair List** area.

2. Click **Next**.

The tasks that correspond to specific copy groups display on the **4. Task Management** page.

3. Click **Next**.

A dialog box summarizing all the tab settings display on the **5. Confirm** page.

4. Check the settings that will be applied. Then select the check box **Yes, I have confirmed the above information and wish to create pair configuration** and then click **Confirm**.

The message “Create Task for “Pair Configuration” completed successfully” displays on the **6. Finish** page.

5. Click **Finish**.
6. From the **Explorer** menu, click **Tasks**.

The **Tasks** window opens.

7. Monitor the status of the task type “modify file + create.” Wait for the status of this task to change to **Success**.

After completing the task, verify there is a `horcm0.conf` file for the SAP ERP host and there is a `horcm1.conf` file for the SAP ERP off-host server in the `c:\Windows` folder.

### *Creating My Copy Groups and Checking Copy Pair statuses for a Copy Group*

Register `SAP_Replication_MSSQL_CG` using My Copy Groups to visualize pair configurations in a topological view and check the relationship between copy groups and the copy pair status.

To create My Copy Groups and check the copy pair status, do the following:

1. From the **Explorer** menu, click **My Groups** and then **My Copy Groups**.

The **My Copy Groups** window opens.

2. Click **Edit My Copy Groups**.

The **Edit My Copy Groups** dialog box opens.

3. In the list, select `SAP_Replication_MSSQL_CG`.
4. Click **OK** to update **My Copy Groups**.

The information displayed in the **My Copy Groups** window refreshes.

5. Use **My Copy Groups** to check the configuration and status of `Replication_MSSQL_CG`.

After the Refresh Pair Status - My Copy Groups task completes, **Pair State** has the status **Pair (PAIR)**.

- To manually refresh the copy pair status for `Replication_MSSQL_CG` in **My Copy Groups** before the task completes, do the following:
  - (1) Click **Refresh My Copy Groups**.
  - (2) Click **Yes, I have confirmed above information and wish to refresh pair status**.
  - (3) Click **Confirm**.
- After the **Refresh Pair Status - My Copy Groups** task completes, click `Replication_MSSQL_CG` in the **My Copy Groups** to check its status to verify it is **Pair (PAIR)**.

## Replicate the SAP ERP Production Server

The SAP ERP system deployment consists of the following:

- SAP binaries
- Microsoft SQL Server installation files
- Data files and transaction log files

Deploy the SAP ERP binary files and Microsoft SQL Server installation files on a LUN that is separate from any LUN containing database data. This solution only replicates the Microsoft SQL Server data and transactional log files.

Before replicating a SAP system, complete a normal backup of the production data. Use this backup to recover the data in the event data loss during the execution.

Install the SAP backup license on the production instance. This copies the backup license to the off-host server after the replication. The following instructions show how to replicate the SAP production server for both cases:

- Replicate the SAP System with the Same SID
- Replicate the SAP System with a Different SID

To refresh the data from the SAP ERP system during either replication scenario, perform the “Create the Replica” task again. This performs the following:

- A pair-resync operation between the PVOLs and SVOLs
- Freezes database on the primary server
- A split of the pairs
- A thaw processes on the database ends.

### *Replicate the SAP System with the Same SID*

“Unmount File System,” “Open the SAP ERP host applications,” and “Create the Replica” in this part are also used by “Replicate the SAP System with a Different SID.”

#### *Unmount File System*

To unmount the file systems containing the off-host server’s database data and transactional log files, do the following:

1. On the SAP ERP off-host server, open the SAP Microsoft Management Console (SAP MMC), right-click the SAP ERP off-host SID, and click **Stop**.

The **SAP System Shutdown** dialog box opens.

2. Click **Soft**, and then click **OK**.

The **Webservice Authentication** dialog box opens.

3. Type the user ID and password for the SAP SID administrator and then click **OK**.
4. Using the Microsoft Windows disk management system utility, unmount those file systems containing the off-host server's database data and transactional log files.
  - In the Disk Management area, right-click each disk containing the database and transactional log files, and then click **Offline**.

### *Open the SAP ERP host applications*

To open the SAP ERP host applications, do the following:

1. Open the Replication Manager browser.
2. From the **Explorer** menu, click **Shared Views** and then Sites.

The Sites window opens.
3. Expand the object tree and then, in the **Site List**, click *SAP\_Replication\_MSSQL*.

The **SAP\_Replication\_MSSQL** window appears
4. Click the **Applications** link.

The **Applications** window opens.
5. Expand the object tree and click **SQL Server Applications**. Select **SAP ERP host applications**.

The Host summary information opens.

### *Create the Replica*

To create the replica, do the following:

1. Select **Default Instance** and then click **Create Replica**.

The **Create Replica Wizard** opens.
2. On the **1. Select Target** page, click **Create new task**, click **Local** for the **Replica location**, and then click **Refresh**.
3. In the Replica Source area, click *PRD* for the **SAP ERP host Database Name** under **User Database**, and then click **Next**.

The **2. Setup Options** page displays with the various backup options.
4. Type *SAP\_Replication\_SameSID* for the **Replica Label**, accept the default values, and then click **Next**.

The **3. Set Schedule** page displays.
5. Click **Execute immediately** and then click **Next**.

The **4. Confirm** page displays.
5. Review the replica settings. When finished, select the **Yes, I have confirmed the above information and wish to create replica** check box and then click **Confirm**.

6. From the **Explorer** menu, click **Tasks**.

The **Tasks window** opens.

7. Check the status of the Task Type “Create Replica (SQL)”. When finished, the **Status** is *Success*.

Follow the steps in “Creating My Copy Groups and Checking Copy Pair statuses for a Copy Group” to check for the copy pair status. Click *Replication\_MSSQL\_CG* in **My Copy Groups** to verify its status is **Split** (PSUS or Hold).

### *Verify the SAP ERP Off-host Server is Functional*

After the successful replication of the SAP database data, perform the following to verify that the SAP ERP off-host instance is functional:

1. Mount the file system containing database data on the off-host server using the Windows disk management tool.
  - In the **Disk Management** area, right-click each disk containing the transactional log file and database files and then click **Online**.

After mounting the file system on the off-host server, the system provides a new drive letter for the disk containing transactional log files and data files. During the subsequent replication, it keeps the original drive letters for the data and log files.

2. Change the drive letter back to the original drive letter used for the disks containing the transactional logs and data files.
  - Right-click the drive, click **Change Drive Letter and Paths**, and then type the original drive letter.
3. Log on to the Microsoft SQL Server Management Studio and restart the MSSQLSERVER service on the off-host server.
4. To assign the necessary authorizations for the SQL server logons, execute the script file *user\_restore.sql*. Refer to “Appendix B—Assigning Authorizations for SQL server Log Ons After Replication” for details on using the script file *user\_restore.sql*.
5. Assign the necessary SQL server authorizations for the copied database:
  - Click **New Query** to execute the script *user\_restore.sql*.
6. To start the SAP instance from SAP MMC, right-click the SAP off-host SID and then click **Start**.  
The **SAP System Start** dialog box opens.
7. Click **OK**.

The SAP ERP system on the off-host is now available for off-host processing with same SID using the latest data from the production SAP ERP system.

### *Replicate the SAP System with a Different SID*

Start by completing “Unmount File System,” “Open the SAP ERP host applications,” and “Create the Replica” in “To refresh the data from the SAP ERP system during either replication scenario, perform the “Create the Replica” task again. This performs the following:

- A pair-resync operation between the PVOLs and SVOLs
- Freezes database on the primary server
- A split of the pairs
- A thaw processes on the database ends.

Replicate the SAP System with the Same SID.” This replaces the steps in “Verify the SAP ERP Off-host Server is Functional.”

After the successful replication of the SAP database data, perform the following to verify that the SAP ERP off-host instance is functional:

1. Mount the file system containing database data on the off-host server using the Windows disk management tool.

- In the **Disk Management** area, right-click each disk containing the transactional log file and database files and then click **Online**.

After mounting the file system on the off-host server, the system provides a new drive letter for the disk containing transactional log files and data files.

2. Change the drive letter back to the original drive letter used for the disks containing the transactional logs and data files.

- Right-click the drive, click **Change Drive Letter and Paths**, and then type the original drive letter.

During the subsequent replication, it keeps the original drive letters for the data and log files. As the database and transactional log files copy from the production server, the directory and the file name for the database and transactional log file points to the SAP ERP production server.

3. Manually change the directory names and file names for the data files and transactional log files to the original names used before the replication on the off-host server.
4. From Microsoft SQL Server Management Studio, restart the MSSQLSERVER service on the off-host server.
5. After copying the database between the two SAP systems, execute the script file **user\_change.sql** to assign the necessary SQL server user authorizations. Refer to “Appendix B—Assigning Authorizations for SQL server Log Ons After Replication” for details on using the script file **user\_change.sql**.
6. Log on to the Microsoft SQL Server Management Studio on the off-host server.
7. Assign the necessary authorizations for the SQL server logons for the copied database:
  - Click **New Query** and run the script **user\_change.sql** to assign the necessary authorizations for the SQL server logins for the copied database.
8. Start the SAP instance using SAP MMC:
  - Right-click the SAP off-host SID and then click **Start**.  
The **SAP System Start** dialog box opens.
9. Click **OK**.

10. Log on as a SAP user on the off-host SAP ERP server.
11. Install the Development system license for the SAP off-host server using the transaction `sl i cense`.

The SAP ERP system on the off-host is now available for off-host processing with a different SID than the production SAP ERP system using the latest data from the production SAP ERP system.

## Backup and Restore the SAP ERP system using Replication Manager

Before doing any of the following, setup the environment for replication as described in “Configure Replication using Hitachi Replication Manager” and perform a backup “Create the Replica” as described in “Replicate the SAP System with the Same SID”.

---

Note — Before restoring a replica from Replication Manager, stop the SAP instance using SAP MMC so the database is not online with the SAP ERP host.

---

Use one of the following instances when doing a backup and restore using Replication Manager

- Backup and Point-in-time Restore to Last Replica using Hitachi Replication Manager
- Backup and Roll-forward Restore using Hitachi Replication Manager Replica to the Last Transactional Log Backup
- Backup and Roll-forward Restore using Hitachi Replication Manager and Transactional Log Backup with a Specified Recovery Time
- Backup and Restore using Hitachi Replication Agent Application Agent Command Line Interface

### *Backup and Point-in-time Restore to Last Replica using Hitachi Replication Manager*

Use backup and restore to the last complete replica when you want to restore the replica and the transaction logs without committing the outstanding transactions.

### *Start the Restore Replica Wizard*

To start the Restore Replica Wizard, perform the following steps:

1. In the Replication Manager, From the **Explorer** menu, click **Shared Views** and then Sites.  
The **Sites** window opens.
2. Expand the object tree, and then select `SAP_Replication_MSSQL` in the **Site List**.  
The **SAP\_Replication\_MSSQL** window appears
3. Click the **Applications** link.  
The **Applications** window opens.

4. Expand the object tree and click **SQL Server Applications** and then click the **SAP ERP Host Applications**.

The summary information for the selected server displays.

5. Select the **Default Instance** and then click **Restore Replica**.

The Restore Replica wizard opens.

### *Start the Replica Restoration*

To use the Restore Replica wizard, follow these steps:

1. On the **1. Select Target** page in the **Restore Target** area, click **User Database**, and then click **PRD**. This is the SAP ERP Host Database.

The selected object and subordinate components are listed.

2. Click **Next**.

The **2. Setup Options** page displays.

3. Click *This Database server* for **Target Server** and *Original SQL instance* for **Target Instance**.

4. Click *Point-in-time Restore* for the **Restore Mode**.

5. Click **Next**.

The **3. Confirm** page displays.

6. Confirm that your settings are correct and click **Confirm**.

7. From the **Explorer** menu, click **Tasks**.

The Tasks window opens.

8. Verify the status of the task type *Restore Replica (SQL)*. Wait for task to complete with the status **Success**.

Check for the copy pair status from the **My Copy Groups** while the restore replica task executes.

- Click the copy group registered in the **My Copy Groups**, click **Refresh Copy Group** from **My Copy Groups**, and monitor the status of the pairs.

The “**Restore Replica**” task does the following in the background in this order:

1. It performs a `pairresync -restore` (reverse synchronization) from the SVOL to the PVOL. The Pair State is **Copying (RCPY)** during this time
  - After completing the reverse copy, the volumes changes to **PAIR** mode.
2. It performs a `pairsplit` with the volumes going to the **Split (PSUS or Hold)** mode.

Verify the status of the SQL database for the SAP ERP host server and start the SAP instance as follows:

1. Log on to the Microsoft SQL Server Management Studio on the SAP ERP host server.  
The SAP ERP host database is in the online status.
2. Start the SAP instance from SAP MMC:
  - Right-click the SAP host SID, and then click **Start**.  
The **SAP System Start** dialog box opens.
3. Click **OK**.

The SAP ERP host server is restored from the last replica taken using Hitachi Replication Manager. This is equivalent to restoring the database from the last full backup.

### *Backup and Roll-forward Restore using Hitachi Replication Manager Replica to the Last Transactional Log Backup and Restore*

A “roll-forward restore” restores the replica and then commits any outstanding database transactions stored in the transaction logs. This is equivalent to restoring the database from the last full database backup and applying all the transactional log backups taken until the point in time the system crashed.

To perform the transactional log backup, follow these steps:

1. Create destination using Microsoft SQL Server Management Studio.
  - (1) Log on to the Microsoft SQL Server Management Studio on the SAP ERP host server.  
In the object explorer click the server name to expand the server tree.
  - (2) Expand **Server Objects**, and right-click **Backup Devices**.
  - (3) Click **New Backup Device**. The **Backup Device** dialog box opens.
  - (4) Type a device name.
  - (5) For the destination, click **File** and enter the full path of the file.
  - (6) To define the new device, click **OK**.
2. Create and start the transactional log backup on the SAP server.
  - (1) Log on to the SAP server using the user and password details from the SAP GUI.
  - (2) Go to transaction DB13, DBA Planning Calendar.
  - (3) Click **Jobs**, expand the object tree, and click **DBA Planning Calendar**.
  - (4) From the **Action Pad**, click **Transactional log backup**.  
**Schedule a New Action** page opens.
  - (5) In the section **Select the Backup Devices for logbackup of SAP Database**, click the backup device for transactional log backup that was created.
  - (6) Click **Execute Immediately**.

3. Click **DBA log** to check the status of the transactional log backup.

Check for a successful backup.

4. Schedule the transactional log backup to run every 30 minutes.

To perform the roll-forward restore using replica task to restore the SAP ERP host SQL database, follow these steps:

1. Launch the Restore Replica Wizard.

- (1) In the Replication Manager, from the **Explorer** menu, click **Shared Views**, and then click **Sites**.

The **Sites** window opens.

- (2) Expand the object tree, and then, in **Site List**, click *SAP\_Replication\_MSSQL*.

The **SAP\_Replication\_MSSQL** window appears

- (3) Click the **Applications** link.

The **Applications** window opens.

- (4) Expand the object tree and select **SQL Server Applications**. Click **SAP ERP Host Applications**.

The Host summary information for the server displays.

- (5) Select the **Default Instance** check box of the SAP ERP host applications, and then click **Restore Replica**.

The Restore Replica Wizard launches.

2. Complete the Restore Replica Wizard.

- (1) On the **1. Select Target** page, select the **Restore Target** from the tree structure, and then click PRD under **User Database**. This lists the selected object and its subordinate components.

- (2) Click **Next**.

The **2. Setup Options** page displays.

- (3) On **Setup Options**, do the following:

- For **Target Server**, click *This Database server a*
- For the **Target Instance**, click *Original SQL instance*

- (4) Click **Restore Mode Roll-forward Restore** with **Restores data from the loading status**.

- (5) Click **Next**.

The **3. Confirm** page displays.

- (6) Confirm that your settings are correct and then click **Confirm**.

3. Use the Task Lists window to view the results of the Restore Replica task.

(1) From the **Explorer** menu, click **Tasks**.

The **Tasks** window opens.

(2) Verify the task type status of “Restore Replica (SQL)” and wait for task to complete with the status “success.”

(3) Check the copy pair status from **My Copy Groups**. Click the copy group registered in My Copy Groups and refresh the pair status of that copy group.

The copy pair’s pair state should display as **Split (PSUS or Hold)**.

The preceding steps only restore the SQL database.

To perform the actual roll-forward operation, perform the following steps using Microsoft SQL Server Management Studio to apply the transactional log backup:

1. Log on to the Microsoft SQL Server Management Studio on the SAP ERP host server.

The SAP ERP host database status is “restoring.”

---

**Note:** If the Restore Replica Task was executed with the **Restore Mode Roll-forward Restore** option set to **Restores data from the standby status** in Microsoft SQL Server Management Studio, the status of the SAP ERP host database should be **Read Only** mode.

---

2. In the Object explorer, right click the SAP ERP host database in Restoring status, point to **Tasks**, and then click **Restore**.

3. Click **Transaction Log**. The **Restore Transaction Log** dialog box opens.

The **Select the transactional log backups to restore** area has all the transaction log backups.

4. Click the default value to restore all the transactional log backups.

5. For **Restore To**, click **Point in time**.

6. Use the default value for all the other settings.

7. Click **OK**.

When finished, a message opens that say, “Restore of the database *PRD* completed successfully.”

8. Start the SAP instance from SAP MMC:

▪ Right-click the SAP host SID, and then click **Start**.

The **SAP System Start** dialog box opens.

9. Click **OK**.

## *Backup and Roll-forward Restore using Hitachi Replication Manager and Transactional Log Backup with a Specified Recovery Time*

To perform the roll-forward restore using Hitachi Replication Manager and transactional log backup with a specified recovery time, repeat the same steps as used in “Backup and Roll-forward Restore using Hitachi Replication Manager Replica to the Last Transactional Log Backup and Restore” with one difference. When doing the roll-forward operation, set a specific date and time for **Restore To** instead of using default values.

This allows restoring to certain specific point-in-time.

## *Backup and Restore using Hitachi Replication Agent Application Agent Command Line Interface*

The Application Agent command line interface can be used to perform backup and restore operations instead of the Hitachi Replication Manager GUI.

This provides the overall idea and steps how to perform the backup and roll-forward restore using command line interface commands without the details. Refer to the *Hitachi Command Suite Replication Manager Software Application Agent CLI Reference Guide* for the details on each command.

To perform a backup using the command line interface, follow these steps:

1. Log on to the SAP ERP host server. Open a command prompt window.
2. Stop the SAP instance on the SAP ERP off-host server and unmount the database and transactional log files on the SAP ERP off-host server.
3. Type and run this command: `CD C:\Program Files (x86)\HITACHI\DRM\bin`
4. Register the SQL Server parameters using with this command: `drmsql init default`.

Type the inputs in Table 10:

**Table 10. SQL Server Registration Parameters**

<i>Text Box</i>	<i>Type the Following</i>
<b>VDI metafile storage (optional)</b>	Leave blank
<b>VDI generation timeout interval (in seconds)</b>	3600
<b>UNDO file storage directory</b>	L: \MRMLOG1
<b>Transaction log backup file storage directory</b>	E: \SAP_LogBackup

5. Run this command: `drmsql backup default`.

Record the backupid number provided in the output of `drmsqlbackup` command.

This command backs up an SQL server database to a secondary volume.

6. Backup the transactional logs on the SAP ERP host server every 30 minutes by running this command: `drmsql logbackup default`.

This command backs up the transactional log and save the backup files in `e:\SAP_LogBackup`.

To perform a restore using the command line interface, follow these steps:

---

**Note:** Using the command line interface, the roll-forward restore can only be performed using the complete transactional log backup. The roll-forward restore with specified recovery time is not supported.

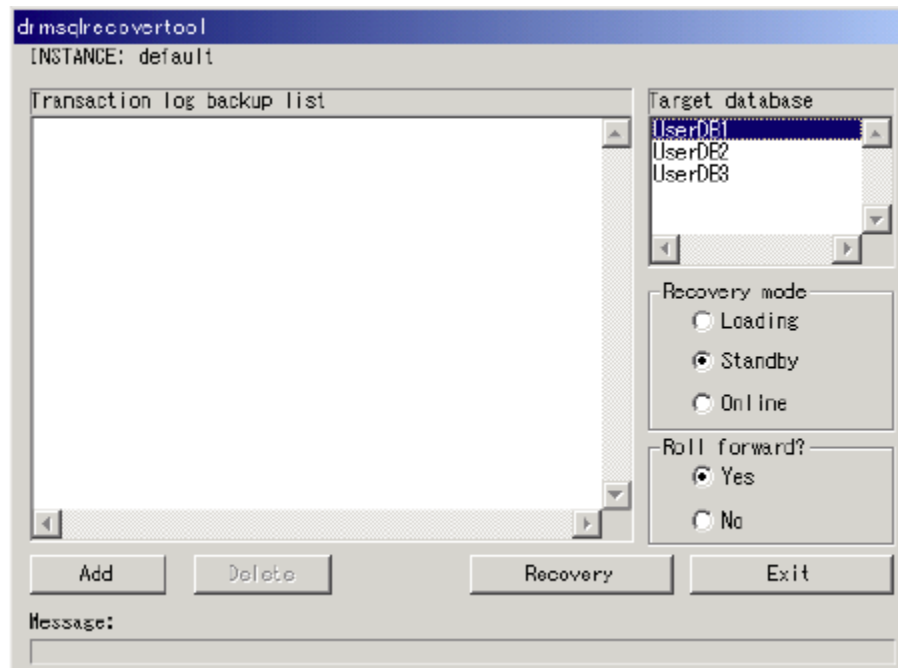
---

1. Make sure the SAP instance is stopped on the SAP ERP host server.
2. Run this command to restore the SQL sever database from the backup to the primary volume and to leave the SAP ERP host database in restoring status: `drmsql restore backupid -resync [Backup ID]`

This command uses backup ID number that was recorded in the Step5 during the backup. .

3. To recover the database by applying the transactional log backup, run this command: `drmsql recover tool default`

Figure 3 shows the `drmsqlrecovertool` dialog box that opens when running `drmsql recovertool`.



**Figure 3**

- Click **Add** to browse and add transactional log files.
  - For the **Recovery mode** option, click **Loading**, **Standby**, or **Online**, depending on the state that needs to be applied after recovery.
    - **Loading**— Changes the status of the database to loading
    - **Standby**— Uses the database in the standby (read-only) mode
    - **Online**— Uses the database in the read and write mode
4. For the **Roll forward** option, click **Yes**.

5. Click **Recovery**.

The SAP ERP host server is recovered to the last transactional log backup.

6. Start the SAP instance from SAP MMC:

- Right-click the SAP host SID, and then click **Start**.

The **SAP System Start** dialog box opens.

7. Click **OK**.

The Application Agent command line interface can be used along with the Hitachi Replication Manager graphical user interface to perform a roll-forward restore instead of performing the restore task using the Microsoft SQL Server Management Studio.

## Appendix A—Configuration Definition File

When creating copy groups on the Hitachi Replication Manager graphic user interface, a configuration definition file is created on the corresponding host and off-host server in c:\Windows. The details of the configuration definition files as follows:

- **HORCM\_MON**—Contains information need to monitor a HORCM instance, such as IP address, HORCM instance or service, pooling interval for monitoring paired volumes, and timeout period for communication with remote server.
- **HORCM\_CMD**—Contains device path information about the command device.
- **HORCM\_LDEV**—Defines the storage sub-system device address for the paired logical volume names.
- **HORCM\_INST**—Network address of the remote server.

### Configuration Files for SAP ERP Production Server

```
#FileName: horcm0.conf
#/****** For HORCM_MON *****/
HORCM_MON
#ip_address      service    poll(10ms)    timeout(10ms)
SAPMS08          horcm0      1000          3000
#/****** For HORCM_CMD *****/
HORCM_CMD
#dev_name        dev_name
\\.\Physical Drive8
#/****** For HORCM_LDEV *****/
HORCM_LDEV
#dev_group       dev_name      Serial #      CU: LDEV(LDEV#)  MU#
SAP_Replication_MSSQL_CG  P_152-162_0070  53101        01:52            0
SAP_Replication_MSSQL_CG  P_153-163_0071  53101        01:53            0
SAP_Replication_MSSQL_CG  P_154-164_0072  53101        01:54            0
SAP_Replication_MSSQL_CG  P_155-165_0073  53101        01:55            0
SAP_Replication_MSSQL_CG  P_156-166_0074  53101        01:56            0
#/****** For HORCM_INST *****/
HORCM_INST
#dev_group       ip_address    service
SAP_Replication_MSSQL_CG  SAPMS10      horcm1
```

## Configuration Files for SAP ERP Off-host Server

```
#FileName: horcm1.conf
#/****** For HORCM_MON*****/
HORCM_MON
#ip_address      service      poll (10ms)  timeout (10ms)
SAPMS10         horcm1       1000        3000
#/****** For HORCM_CMD*****/
HORCM_CMD
#dev_name        dev_name
\\.\Physical Drive7
#/****** For HORCM_LDEV *****/
HORCM_LDEV
#dev_group       dev_name      Serial #     CU: LDEV(LDEV#)  MU#
SAP_Replication_MSSQL_CG  P_152-162_0070  53101       01:62            0
SAP_Replication_MSSQL_CG  P_153-163_0071  53101       01:63            0
SAP_Replication_MSSQL_CG  P_154-164_0072  53101       01:64            0
SAP_Replication_MSSQL_CG  P_155-165_0073  53101       01:65            0
SAP_Replication_MSSQL_CG  P_156-166_0074  53101       01:66            0
#/****** For HORCM_INST *****/
HORCM_INST
#dev_group       ip_address    service
SAP_Replication_MSSQL_CG  SAPMS08      horcm0
```

## Appendix B—Assigning Authorizations for SQL server Log Ons After Replication

To assign the necessary authorizations to log on to the SQL server of the copied database after replication, refer to *SAP Note 551915—R/3 won't start after database restore or database copy*.

In this solution the SAP ERP host and the off-host are MCOD (multi-schema) systems. All the tables in such systems belong to user 'sid' (the system ID in lower case).

According to Case 2, MCOD to MCOD in SAP Note 551915, there are two cases handled by separate scripts.

1. The SID is the same: Use script `user_Restore.sql`.
2. The SID is different: Use script `user_change.sql`.

To assign the necessary SQL server authorizations after the replication, do the following:

- Replicate the SAP system with the same SID: run `user_Restore.sql`
- Replicate the SAP system with different SIDs: run `user_change.sql`.

Follow the steps provided in Case 2, MCOB to MCOB, of this SAP Note to execute these scripts successfully. Check the following while executing the scripts:

1. Verify that there is a local Windows account `SAPMssXPUser` that is member of the local group "Administrators."
2. Check the registry key setting `HKEY_LOCAL_MACHINE\SOFTWARE\SAP\<SID>\AdmUser` to verify it contains a string with the value `DOMAIN\sidadm`. If this key does not exist, create it.
3. Open the script and replace variables described in the header of the script.
4. Execute the script.
5. Check that the script ran correctly.

After executing the scripts successfully, complete the remaining steps in the section "Replicate the SAP System with the Same SID" and "Replicate the SAP System with a Different SID" to continue with the post replication steps.

Refer to these SAP Notes on the procedure for copying a SQL server database and restoring it:

- SAP Note 151603, Copying an SQL Server database
- SAP Note 193816, Restore with SQL Server

## Appendix C—Log on as a Service Permission Assignment

To assign the Windows administrator user the log on as service permission, do the following:

1. From the Windows Task Bar, click **Start, Control Panel, Administrative tools**, and then **Local Security policy**.  
This opens the **Local Security Policy** window.
2. Expand **Local Policies** in the Explorer pane.
3. Click **User Rights Assignment**.
4. From the right pane, double-click **Log on as a service**.  
The **Log on as a service Properties** window opens.
5. Click **Add User or Group**.  
This opens the **Select User or Groups** window.
6. In **Enter the object names to select**, type the Windows administrator user account to which to assign permission.
7. Click **OK**.
8. On the **Log on as a service Properties** window, click **Apply** and then click **OK**.

## Hitachi Data Systems Corporation

---

*Hitachi is a registered trademark of Hitachi, Ltd., in the United States and other countries. Hitachi Data Systems is a registered trademark and service mark of Hitachi, Ltd., in the United States and other countries. All other trademarks, service marks and company names mentioned in this document are properties of their respective owners.*

*SAP, SAP ERP, and SAP Solution Manager are the trademarks or registered trademarks of SAP AG in Germany and in several other countries.*

*Notice: This document is for informational purposes only, and does not set forth any warranty, expressed or implied, concerning any equipment or service offered or to be offered by Hitachi Data Systems Corporation*

© Hitachi Data Systems Corporation 2011. All Rights Reserved. AS-112-00, November 2011

### **Corporate Headquarters**

750 Central Expressway,  
Santa Clara, California 95050-2627 USA  
[www.HDS.com](http://www.HDS.com)

### **Regional Contact Information**

**Americas:** +1 408 970 1000 or [info@hds.com](mailto:info@hds.com)  
**Europe, Middle East and Africa:** +44 (0) 1753 618000 or [info.emea@hds.com](mailto:info.emea@hds.com)  
**Asia Pacific:** +852 3189 7900 or [hds.marketing.apac@hds.com](mailto:hds.marketing.apac@hds.com)