

Veritas™ Cluster Server Agent for Hitachi/HP XP 3 Data Center Replication Configuration Guide

Windows Server 2003, Windows Server
2008

5.0

Veritas Cluster Server Agent for Hitachi/HP XP 3 Data Center Replication Configuration Guide

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Introducing the Veritas agent for Hitachi/HP XP 3 Data Center Replication

This chapter includes the following topics:

- [About the agent for Hitachi/HP XP 3 Data Center Replication](#)
- [Supported software for the Hitachi/HP XP 3 Data Center Replication agent](#)
- [Typical Hitachi/HP XP 3 Data Center Replication setup in a VCS cluster](#)
- [Hitachi/HP XP 3 Data Center Replication agent functions](#)

About the agent for Hitachi/HP XP 3 Data Center Replication

The Veritas agent for Hitachi/HP XP 3 Data Center Replication provides support for application failover and recovery. The agent provides this support in environments that use Hitachi/HP XP 3DC replication to replicate data between Hitachi/HP-XP arrays.

The Hitachi/HP XP 3DC agent supports the 3 Data Center (3DC) Multi-target configuration without the delta-resync feature enabled.

In a typical 3DC Multi-target implementation, data from the source volume is replicated synchronously to a nearby secondary site, and simultaneously, data from that same source volume is replicated asynchronously to a geographically remote site. This mode of operation protects production data against both local and wide-area disasters.

Figure 1-1 shows how the agent for Hitachi/HP XP 3 Data Center Replication supports this Multi-target mode of operation.

The agent supports Hitachi TrueCopy or HP XP CA (synchronous) between the production site and the first secondary site and Hitachi Universal Replication Journal or HP XP CA Journal (asynchronous) between the production site and the second secondary site.

The agent monitors and manages the state of replicated Hitachi/HP XP 3 Data Center Replication devices that are attached to VCS nodes. The agent ensures that the system that has the Hitachi/HP XP 3 Data Center Replication resource online also has safe and exclusive access to the configured devices.

For synchronous replication, the agent supports the DATA and NEVER replication fence levels.

Note: In Hitachi/HP XP 3 Data Center Replication Multi-target configuration, after the failover to the nearby secondary is complete, the configuration changes to a 3DC Cascaded mode of replication. The agent supports failover in this 3DC Cascaded configuration as well.

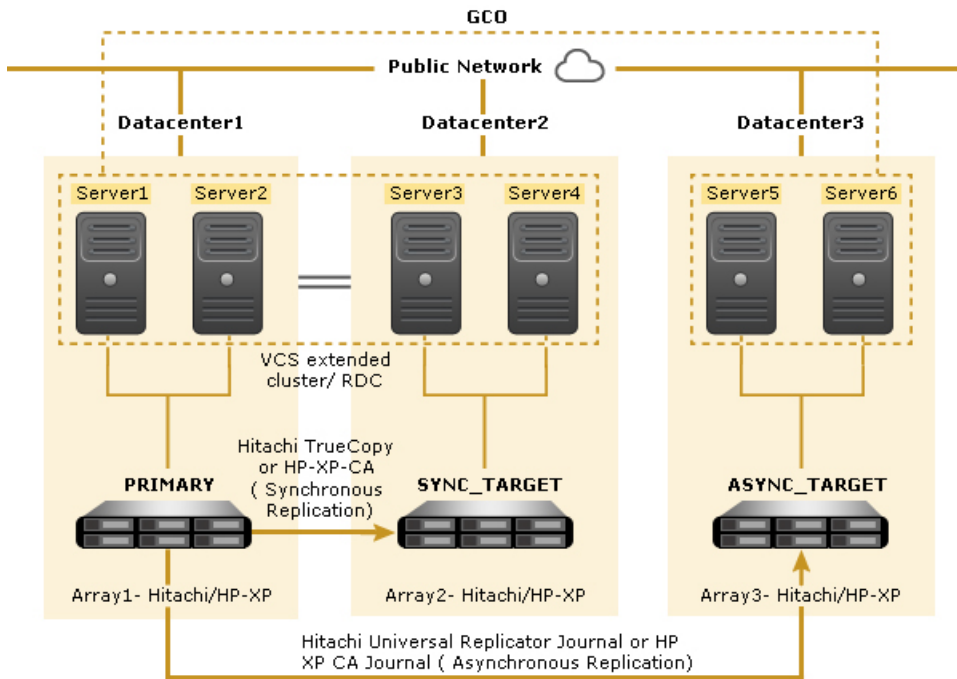
Supported software for the Hitachi/HP XP 3 Data Center Replication agent

For information on the software versions that the agent for Hitachi/HP XP 3 Data Center Replication supports, see the Symantec Operations Readiness Tools (SORT) site: <https://sort.symantec.com/agents>.

Typical Hitachi/HP XP 3 Data Center Replication setup in a VCS cluster

Figure 1-1 displays a typical cluster setup in a Hitachi/HP XP 3DC environment.

Figure 1-1 Typical clustering setup for the agent



The agent uses the following terminology:

- **PRIMARY:** The datacenter that serves as the production environment. This is typically a part of a VCS extended cluster or a VCS replicated data cluster.
- **SYNC_TARGET:** The datacenter to which the production data is replicated synchronously. This is typically a part of a VCS extended cluster or a VCS replicated data cluster.
- **ASYNC_TARGET:** The datacenter to which the production data is replicated asynchronously. This typically serves as the DR site. VCS Global Cluster Option (GCO) is configured between the production cluster (includes PRIMARY and SYNC_TARGET) and the DR cluster (includes ASYNC_TARGET).

Note: The agent supports the 3DC Multi-target configuration when there is no third link configured between SYNC_TARGET and ASYNC_TARGET, for example, a link to leverage the 3DC Delta Resync feature.

Clustering in a Hitachi/HP XP 3DC environment typically consists of the following hardware infrastructure:

- Datacenter 1 (PRIMARY), that is, the primary array (Array1) has one or more P-VOL hosts. A Fibre Channel or SCSI directly attaches these hosts to the Hitachi/HP-XP array that contains the TrueCopy/HP XP CA/HUR Journal P-VOL devices.
- Datacenter 2 (SYNC_TARGET), that is, the secondary array (Array2) has one or more S-VOL hosts. A Fibre Channel or SCSI directly attaches these hosts to a Hitachi/HP-XP array that contains the TrueCopy/HP XP CA (Synchronous) S-VOL devices. The S-VOL devices are paired with the P-VOL devices in the synchronous device group, in Array1. The S-VOL hosts and arrays must be at a distance that is appropriate for synchronous replication.
- Datacenter 3 (ASYNC_TARGET), that is, the remote secondary array (Array3) has one or more S-VOL hosts that belong to the asynchronous device group. A Fibre Channel or SCSI directly attaches these hosts to a Hitachi/HP XP array. These S-VOL devices are paired with P-VOL devices at Datacenter 1 (PRIMARY) using HUR Journal or HP XP CA Journal replication. These S-VOL hosts and arrays must be at a significant distance to survive a disaster at both Datacenter 1 and Datacenter 2.
- Network heartbeating between the two clusters to determine their health; this network heartbeating could be LLT or TCP/IP.
- In a replicated data cluster environment, comprising Datacenter 1 (PRIMARY) and Datacenter 2 (SYNC_TARGET), all hosts are part of the same cluster. You must connect them with the dual and dedicated networks that support LLT. In a global cluster environment at the Disaster-Recovery (DR) site, that is, Datacenter 3 (ASYNC_TARGET), you must attach all hosts in a cluster to the same Hitachi/HP-XP array.

Hitachi/HP XP 3 Data Center Replication agent functions

The VCS agent for Hitachi/HP XP 3 Data Center Replication monitors and manages the state of replicated devices that are attached to VCS nodes.

The agent performs the following functions:

online	<p>If the value of the DefaultMode attribute of the resource is PRIMARY or SYNC_TARGET, the online function considers the local devices of the synchronous device group to identify if failover is required. If the value of the DefaultMode attribute of the resource is ASYNC_TARGET, the online function considers the local devices of the asynchronous device group.</p> <p>If the state of all local devices is read-write enabled, the agent makes the devices writable by creating a lock file on the local host.</p> <p>The agent considers P-VOL devices writable and takes no action other than going online, regardless of their status.</p> <p>If one or more devices are not in a writable state, the agent takes appropriate actions depending on the DefaultMode attribute value of the resource to enable read-write access to the devices.</p> <p>See “About the Hitachi/HP XP 3 Data Center Replication agent's online function” on page 15.</p>
offline	<p>The agent removes the lock file that was created for the resource by the online function. The agent does not run any CCI commands because taking the resource offline is not indicative of an intention to give up the devices.</p>
monitor	<p>Verifies the existence of the lock file to determine the resource status. If the lock file exists, the agent reports the status of the resource as online. If the lock file does not exist, the agent reports the status of the resource as offline.</p> <p>If the value of the DefaultMode attribute of the ONLINE resource is SYNC_TARGET, the monitor function checks the state of the asynchronous device group on PRIMARY. If the state is PSUS, the monitor function initiates resynchronization of the Async link from a PRIMARY host where the VCS engine is running.</p> <p>The LinkMonitor and SplitTakeover attributes also impact the behavior of the monitor function. For more information, see the descriptions of the LinkMonitor and SplitTakeover attributes. See “Attribute definitions for the Hitachi/HP XP 3DC agent” on page 22.</p>
open	<p>Removes the lock file from the host on which this function is called. This functionality prevents potential concurrency violation if the group fails over to another node.</p> <p>Note that the agent does not remove the lock file if the agent starts after the following command:</p> <pre>hastop<-all -local> -force</pre>

clean	Determines if it is safe to fault the resource if the online entry point fails or times out. The main consideration is whether a management operation was in progress when the online thread timed out and was killed. If a management operation was in progress, it could potentially leave the devices in an unusable state.
info	<p>Reports the current role and status of the devices in the device group. This function can be used to verify the device state and to monitor dirty track trends.</p> <p>If the value of the DefaultMode attribute of the HTC3DC resource is PRIMARY or SYNC_TARGET, the role and status of the synchronous device group are reported. If the value of the DefaultMode attribute of the HTC3DC resource is ASYNC_TARGET, the role and status of the asynchronous device group are reported.</p>
action	<p>The agent supports the following actions using the <code>hares -action</code> command from the command line:</p> <ul style="list-style-type: none"> ■ <code>pairdisplay</code>—Displays information about all devices. Takes SYNC or ASYNC as action arguments. If the action argument is SYNC, executes the <code>pairdisplay</code> command for synchronous device group. If the action argument is ASYNC, then executes the <code>pairdisplay</code> command for the asynchronous device group. ■ <code>pairresync</code>—Takes SYNC or ASYNC as action arguments. If the action argument is SYNC, resynchronizes the S-VOL devices of the synchronous device group from the VCS command line after connectivity failures are detected and corrected. If the action argument is ASYNC, then it uses the asynchronous device group instead. ■ <code>pairresync-swaps</code>—Takes SYNC or ASYNC as action arguments. If the action argument is SYNC, promotes the S-VOLs to P-VOLs and resynchronizes the original P-VOLs of the synchronous device groups. If the action argument is ASYNC, it promotes the S-VOLs to P-VOLs and resynchronizes the original P-VOLs of the asynchronous device groups. ■ <code>localtakeover</code>—Makes the local devices write-enabled. If the action argument is SYNC, executes the <code>horctakeover</code> command for synchronous device groups. If the action argument is ASYNC, then executes the command for asynchronous device groups. If there is no action argument specified, it executes the command for sync group for SYNC_TARGET or for async group if default mode is ASYNC_TARGET.

About the Hitachi/HP XP 3 Data Center Replication agent's online function

If the value of the `DefaultMode` attribute of the resource is `PRIMARY` or `SYNC_TARGET`, the online function considers the local devices of the synchronous device group to identify if failover is required. If the `DefaultMode` attribute value of the resource is `ASYNC_TARGET`, the online function considers the local devices of the asynchronous device group.

If the state of all local devices is read-write enabled, the agent makes the devices writable by creating a lock file on the local host.

If the `DefaultMode` attribute value of the resource is `PRIMARY` or `SYNC_TARGET`, the agent checks the device status on the VCS node with `ASYNC_TARGET` as default mode. If the status of the asynchronous devices is `SSWS`, it indicates that the failback procedure must be executed on the `PRIMARY` node. If the `DefaultMode` attribute value of the resource is `SYNC_TARGET`, the agent logs an error message and returns. If it is `PRIMARY`, then agent executes failback in the following manner:

- Removes the synchronous device group pair.
- Resynchronizes the `PRIMARY` devices from `ASYNC_TARGET` devices.
- Executes `horctakeover` on asynchronous device group to reverse the roles.
- Creates the synchronous pair, which was removed earlier.

In a typical failover scenario, if one or more devices are not in a writable state, the agent runs the `horctakeover` command to enable read-write access to the devices. If `horctakeover` exits with an error (exit code > 5), for example due to a timeout, then the agent flushes and freezes the group to indicate that user-intervention is required to identify the cause of the error.

When there is a failover using the synchronous device group, if the `horctakeover` command returns 225 as the exit code and the fence level is `NEVER`, the agent tries to issue `pairresync -swaps` for the S-VOL devices in the synchronous device group.

For S-VOL devices in any state other than `SSUS` or `SSWS`, the agent runs the `horctakeover` command and makes the devices writable. The time required for failover depends on the following conditions:

- The health of the original primary.
- The RAID Manager timeouts as defined in the `horcm` configuration file for the device group.

The agent considers P-VOL devices writable and takes no action other than going online, regardless of their status.

If the S-VOL devices are in the COPY state, the agent runs the `horctakeover` command after one of the following:

- The synchronization from the primary completes.
- When the `OnlineTimeout` period of the entry point expires, the command `horctakeover` will not be executed, in which case the resource faults. The agent validates that the value of `OnlineTimeout` for the HTC3DC type is ≥ 10 seconds. If this value is set to less than 10 seconds, the agent logs an appropriate error message.

If the `DefaultMode` attribute value is `SYNC_TARGET`, after successful failover, the agent checks the status of devices belonging to asynchronous device group on PRIMARY node. If the status is `PSUS`, it resynchronizes the asynchronous device group by executing the `pairresync` command on PRIMARY node.

Installing and removing the agent for Hitachi/HP XP 3 Data Center Replication

This chapter includes the following topics:

- [Before you install the agent for Hitachi/HP XP 3 Data Center Replication](#)
- [Installing the agent for Hitachi/HP XP 3 Data Center Replication](#)
- [Removing the agent for Hitachi/HP XP 3 Data Center Replication](#)

Before you install the agent for Hitachi/HP XP 3 Data Center Replication

Set up your cluster. For information about installing and configuring VCS, see the *Veritas Cluster Server Installation Guide*.

Set up replication and the required hardware infrastructure.

See [“Typical Hitachi/HP XP 3 Data Center Replication setup in a VCS cluster”](#) on page 10.

Installing the agent for Hitachi/HP XP 3 Data Center Replication

You must install the Hitachi/HP XP 3 Data Center Replication agent on each node in the cluster. In global cluster environments, install the agent on each node in each cluster.

To install the VCS agent for Hitachi/HP XP 3 Data Center Replication

- 1 Log on to any node in the cluster.
 Ensure that the logged on user has the domain administrative privileges.
- 2 Download the Agent Pack from the Symantec Operations Readiness Tools (SORT) site: <https://sort.symantec.com/agents>.
 You can download the complete Agent Pack tar file or the individual agent tar file.
- 3 Uncompress the file to a temporary location.
- 4 If you downloaded the complete Agent Pack tar file, navigate to the directory containing the package for the platform running in your environment.

Windows 2003 x86	<code>cd1\windows\w2k3x86\vcs\replication\htc3dc_agent\agent_version\pkgs</code>
Windows 2003 (IA64)	<code>cd1\windows\w2k3IA64\vcs\replication\htc3dc_agent\agent_version\pkgs</code>
Windows 2003 (x64)	<code>cd1\windows\w2k3x64\vcs\replication\htc3dc_agent\agent_version\pkgs</code>
Windows 2008 IA64	<code>cd1\windows\w2k8IA64\vcs\replication\htc3dc_agent\agent_version\pkgs</code>
Windows 2008 x64	<code>cd1\windows\w2k8x64\vcs\replication\htc3dc_agent\agent_version\pkgs</code>

- 5 Double-click **vrtsvcstc3dc**.
 Follow the instructions that the install program provides, to complete the installation of the agent.
 The install program adds the agent types file automatically.

Removing the agent for Hitachi/HP XP 3 Data Center Replication

This section describes steps for uninstalling the agent. Do not attempt to remove the agent if service groups accessing the shared storage are online.

To remove the agent

- 1** Open the Windows Control Panel and click **Add or Remove Programs**.
- 2** Click **vrtsvcstc3dc** and click **Remove**.
- 3** Follow the instructions that the install program provides, to complete the uninstallation of the agent.
- 4** Click **Finish**.

Configuring the agent for Hitachi/HP XP 3 Data Center Replication

This chapter includes the following topics:

- [Configuration concepts for the Hitachi/HP XP 3 Data Center Replication agent](#)
- [Before you configure the agent for Hitachi/HP XP 3 Data Center Replication](#)
- [Configuring the agent for Hitachi/HP XP 3 Data Center Replication](#)

Configuration concepts for the Hitachi/HP XP 3 Data Center Replication agent

Review the resource type definition and attribute definitions for the agent.

Resource type definition for the Hitachi/HP XP 3DC agent

The resource type definition defines the agent in VCS.

```
type HTC3DC (  
    static keylist SupportedActions = { pairdisplay, pairresync,  
        localtakeover, pairresync-swaps }  
    static i18nstr ArgList[] = { BaseDir, GroupName, Instance,  
        SplitTakeover, LinkMonitor, User, Domain, Password,  
        AsyncGroupName, DefaultMode }  
    static int NumThreads = 1  
    str BaseDir = "C:\\\\HORCM\\etc"
```

```
str GroupName
int Instance
int SplitTakeover = 1
int LinkMonitor
str User
str Domain
str Password
str AsyncGroupName
str DefaultMode = "NONE"
temp str TargetFrozen
temp str OldState = ""
)
```

Attribute definitions for the Hitachi/HP XP 3DC agent

Following are the attributes associated with the agent:

BaseDir	Path to the RAID Manager Command Line interface. Type-dimension: string-scalar Default: C:\HORCM\etc.
GroupName (Synchronous device group name)	Name of the synchronous device group that the agent manages. Type-dimension: string-scalar
Instance	The Instance number of the synchronous and asynchronous device groups that the agent manages. Multiple device groups can have the same instance number. Do not define the attribute if the instance number is zero. Type-dimension: integer-scalar
AsyncGroupName (Asynchronous device group name)	The name of the asynchronous device group that the agent manages. You must set this attribute on all nodes of production and DR clusters. Type-dimension: string-scalar

DefaultMode	<p>This is the original mode or role of each data center. It can be either PRIMARY, SYNC_TARGET, or ASYNC_TARGET. You must set this attribute on each cluster node in production and DR clusters appropriately.</p> <p>Type-dimension: string-scalar</p> <p>Default: NONE</p>
SplitTakeover	<p>A flag that determines whether the agent permits a failover to S-VOL devices if the replication link is disconnected (when S-VOL devices are in the SSUS state) or the replication link is manually suspended (when P-VOL devices are in the PSUS state).</p> <p>See “About the SplitTakeover attribute for the agent” on page 24.</p> <p>Type-dimension: integer-scalar</p> <p>Default: 1</p>
User	<p>The domain user account under which HORCM Manager is started, if it is not running.</p> <p>Type-dimension: string-scalar</p>
Domain	<p>The domain for the account specified in the User field</p> <p>This user must have sufficient privileges to perform the HORCM commands.</p> <p>Type-dimension: string-scalar</p>
Password	<p>The password for the user account specified in the User field. This password must be encrypted using the encryption tool provided by VCS i.e. <code>vcscrypt-agent</code>.</p> <p>Type-dimension: string-scalar</p>

LinkMonitor

A flag that defines whether the agent periodically attempts to resynchronize the S-VOL side if the replication link is disconnected. The agent uses the `pairresync` command to resynchronize arrays.

The value 1 indicates that when the replication link is disconnected, the agent periodically attempts to resynchronize the S-VOL side using the `pairresync` command.

If the value of the LinkMonitor attribute is set to 2, the agent generates SNMP traps or alerts when the status of the attached P-VOL and S-VOL changes. If the status of the configured HTC device changes to PSUE, PSUS, SSUS, or SSWS, the agent generates an SNMP trap indicating that the resource health has gone down. For all other types of status changes of the configured HTC devices, the agent generates an SNMP trap indicating that the resource health has improved. An error or information type message is logged by the agent in the VCS High Availability engine log- "*The state of P-VOL/S-VOL devices in device group `device group name` has changed from `previous state` to `current state`.*"

Setting LinkMonitor does not affect the SplitTakeover behavior. However, you can minimize the time during which the P-VOL is in the PSUE state by setting the LinkMonitor attribute.

Type-dimension: integer-scalar

Default: 0

About the SplitTakeover attribute for the agent

The SplitTakeover attribute determines whether the agent permits a failover to S-VOL devices if the replication link is disconnected, (that is, if P-VOL devices are in the PSUE state) or if the replication is manually suspended, if SVOL devices are in SSUS state.

SplitTakeover attribute = 0

The default value of the SplitTakeover attribute is 0.

The default value indicates that the agent does not permit a failover to S-VOL devices if the P-VOL devices are in the PSUE state, or if SVOL devices are in SSUS state. If a failover occurs when the replication link is disconnected, data loss may occur because the S-VOL devices may not be in sync.

In a global cluster environment, if the agent at the P-VOL side detects the PSUE or PSUS state locally, it freezes the service group at the S-VOL side to prevent a failover. The agent unfreezes the service group after the link is restored and the devices are resynchronized.

If a device group is made up of multiple devices, then, in case of a link failure, the state of each device changes on an individual basis. This change is not reflected on the device group level. Only those devices to which an application made a write after a link failure change their state to PSUE. Other devices in the same device group retain their state to PAIR.

Note: Setting LinkMonitor does not affect the SplitTakeover behavior. However you can minimize the time during which the P-VOL is in the PSUE by setting the LinkMonitor attribute.

SplitTakeover attribute = 1

If the value of SplitTakeover is 1, the agent tries to make the SVOL devices writable, irrespective of the state of PVOL devices. Hence, even if there is a replication link failure, or the primary array fails, the agent attempts to failover to the S-VOL devices.

About the HTC configuration parameters

The Hitachi/HP XP 3DC agent uses RAID manager to interact with Hitachi devices. All information about the remote site is exchanged mainly over the network.

To obtain information on the remote cluster of the pair, mention the details of the remote site in the instance configuration file.

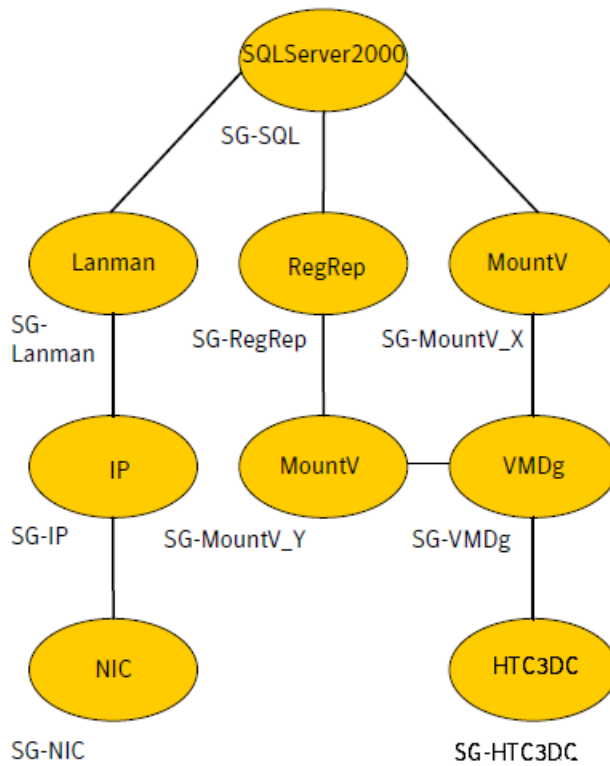
Update the HORCM_INST section of the configuration file.

Specify the value of the ClusterAddress attribute of the remote cluster in the lp_address field against the device group. Symantec recommends that you keep the ClusterService service group online on the same node, where the application service group is online.

Sample configuration for the Hitachi/HP XP 3DC agent

[Figure 3-1](#) shows a dependency graph of a VCS service group that has a resource of type HTC3DC.

Figure 3-1 VCS service group with resource type HTC3DC



You can configure a resource of type HTC3DC in the main.cf file as:

```

HTC3DC htc3dc (
    GroupName = vg01
    Instance = 1
    AsyncGroupName = vg02
    DefaultMode = ASYNC_TARGET
)

HTC3DC HTC3DC (
    BaseDir = "c:\\horcm\\etc"
    GroupName = vg01
    Instance = 1
    AsyncGroupName = vg02
    DefaultMode @PRIMARY_SYSTEM = PRIMARY
    DefaultMode @SYNC_TARGET_SYSTEM = SYNC_TARGET
)
  
```

Before you configure the agent for Hitachi/HP XP 3 Data Center Replication

Before you configure the agent, review the following information:

- Review the configuration concepts, which describe the agent's type definition and attributes.
See [“Configuration concepts for the Hitachi/HP XP 3 Data Center Replication agent”](#) on page 21.
- Verify that you have installed the agent on all systems in the cluster.
- Verify the hardware setup for the agent.
See [“Typical Hitachi/HP XP 3 Data Center Replication setup in a VCS cluster”](#) on page 10.
- Ensure that Hitachi RAID Manager / Command Control Interface (CCI) is installed on all the nodes at all sites.
- Make sure that the cluster has an effective heartbeat mechanism in place.
See [“About cluster heartbeats”](#) on page 27.

About cluster heartbeats

In a replicated data cluster, ensure robust heartbeating by using dual, dedicated networks over which the Low Latency Transport (LLT) runs. Additionally, you can configure a low-priority heartbeat across public networks.

In a global cluster, VCS sends ICMP pings over the public network between the two sites for network heartbeating. To minimize the risk of split-brain, VCS sends ICMP pings to highly available IP addresses. VCS global clusters also notify the administrators when the sites cannot communicate.

To minimize the chances of split-brain, use the steward process.

Hitachi/HP-XP arrays do not support a native heartbeating mechanism between the arrays. The arrays send a support message on detecting replication link failure. You can take appropriate action to recover from the failure and to keep the devices in a synchronized state. The Hitachi/HP XP 3DC agent supports those actions that can automate the resynchronization of devices after a replication link outage is corrected.

Configuring the agent for Hitachi/HP XP 3 Data Center Replication

You can adapt most clustered applications to a disaster recovery environment by:

- Setting up the initial 3 DC Multi-target replication configuration between the 3 datacenters.
- Synchronizing the devices
- Adding the Hitachi/HP XP 3 Data Center Replication agent to the service group

After configuration, the application service group must follow the dependency diagram.

Note: You must not change the replication state of devices primary to secondary and viceversa, outside of a VCS setup. The agent for Hitachi/HP XP 3 Data Center Replication fails to detect a change in the replication state if the role reversal is done externally.

Testing VCS disaster recovery support with Hitachi/HP XP 3 Data Center Replication

This chapter includes the following topics:

- [Testing service group migration from PRIMARY to SYNC_TARGET](#)
- [Failure scenarios at PRIMARY](#)
- [Production cluster failure](#)
- [Performing failback from ASYNC_TARGET](#)

Testing service group migration from PRIMARY to SYNC_TARGET

After you configure the VCS agent for Hitachi/HP XP 3 Data Center Replication, verify that the application service group that contains the HTC3DC resource can migrate to hosts at SYNC_TARGET.

To test the service group migration in a VCS extended cluster or an RDC

- 1 Fail over the application service group that contains the HTC3DC resource from the PRIMARY to the SYNC_TARGET.

Run the following command to switch the application service group from the PRIMARY node to the SYNC_TARGET node in the Replicated Data Cluster (RDC) or the VCS extended cluster.

```
# hagrps -switch app_group -sys sync_target_system
```

VCS brings the application service group online on the SYNC_TARGET node.

- 2 Verify that the devices that are managed by the HTC3DC resource at the SYNC_TARGET node are write-enabled.
The HTC3DC resource comes online.
- 3 Verify that the state of the synchronous device group is PAIR.
- 4 Verify that asynchronous replication link which was suspended due to a role change in the synchronous device group is resumed.
- 5 Verify that the original Multi-target configuration has now changed to Cascaded configuration, where the direction of replication is from SYNC_TARGET to PRIMARY to ASYNC_TARGET.

Failure scenarios at PRIMARY

[Table 4-1](#) lists the failure scenarios at the PRIMARY site and describes the behavior of VCS and the agent in response to the failure. This table also describes the steps you can take to verify disaster recovery.

Table 4-1 Failure scenarios at the PRIMARY site with VCS agent for Hitachi/HP XP 3DC

Failure scenario	Description and VCS response
Application failure at PRIMARY	<p>An application failure at the PRIMARY causes the application service group to fault. The application service group fails over to the SYNC_TARGET node in the VCS extended cluster (or RDC).</p> <p>VCS action:</p> <p>In the RDC environment, VCS does the following based on the AutoFailOver attribute for the faulted service group:</p> <ul style="list-style-type: none"> ■ 1—VCS automatically brings the faulted service group online at SYNC_TARGET. ■ 2—You must bring the service group online at SYNC_TARGET. <p>Agent response:</p> <ul style="list-style-type: none"> ■ The agent write-enables the devices at the SYNC_TARGET site. ■ The agent does the following: <ul style="list-style-type: none"> ■ Does a role reversal S-VOL to P-VOL of each device managed by the HTC3DC resource in the synchronous device group. ■ Starts replication from P-VOL devices on the SYNC_TARGET to the S-VOL devices at the PRIMARY. ■ Resynchronises the asynchronous device group from PRIMARY. <p>Verification steps:</p> <ul style="list-style-type: none"> ■ Verify that the devices at SYNC_TARGET became write-enabled and the state is PAIR. ■ Verify that the state of the synchronous device group is PAIR. ■ Verify that the asynchronous replication link which was suspended due to role change in synchronous device group is resumed. ■ Verify that the original Multi-target configuration is now changed to Cascaded configuration where the replication direction is from SYNC_TARGET to PRIMARY to ASYNC_TARGET.

Table 4-1

Failure scenarios at the PRIMARY site with VCS agent for Hitachi/HP XP 3DC (continued)

Failure scenario	Description and VCS response
Storage failure at PRIMARY	<p>Array failure at the PRIMARY node causes the service group to fault. The service group fails over to the SYNC_TARGET node in the VCS extended cluster (or RDC).</p> <p>VCS action:</p> <p>In the RDC environment, VCS does the following based on the AutoFailOver attribute for the faulted service group:</p> <ul style="list-style-type: none">■ 1—VCS automatically brings the faulted service group online at SYNC_TARGET.■ 2—You must bring the service group online at SYNC_TARGET. <p>Agent response:</p> <p>The agent does the following based on the SplitTakeover attribute of the HTC3DC resource:</p> <ul style="list-style-type: none">■ 1—The agent issues the <code>horctakeover</code> command to make the HTC3DC devices at SYNC_TARGET write-enabled. The S-VOL devices go into the SSWS state.■ 0—The agent faults the HTC3DC resource. <p>Verification steps:</p> <ul style="list-style-type: none">■ If the value of the SplitTakeOver attribute is 1, verify that the devices at SYNC_TARGET are now write-enabled and that the status of the synchronous device group is SSWS.■ The storage at PRIMARY is not available and hence, the mode of configuration is neither 3DC Multi-target nor 3DC Cascaded.

Table 4-1 Failure scenarios at the PRIMARY site with VCS agent for Hitachi/HP XP 3DC (*continued*)

Failure scenario	Description and VCS response
Host failure at PRIMARY	<p>All hosts at the PRIMARY site fail.</p> <p>Host failure at the PRIMARY causes the service group to fault. The service group fails over to the SYNC_TARGET node in the VCS extended cluster (or RDC).</p> <p>VCS action:</p> <p>In the RDC environment, VCS does the following based on the AutoFailOver attribute for the faulted service group:</p> <ul style="list-style-type: none"> ■ 1—VCS automatically brings the faulted service group online at SYNC_TARGET. ■ 2—You must bring the service group online at the SYNC_TARGET. <p>Agent response:</p> <ul style="list-style-type: none"> ■ The agent write-enables the devices at the SYNC_TARGET site. ■ The agent does the following: <ul style="list-style-type: none"> ■ Does a role reversal S-VOL to P-VOL of each device managed by HTC3DC resource in the synchronous device group. ■ Starts replication from P-VOL devices on the SYNC_TARGET to the S-VOL devices at the PRIMARY. ■ Resynchronises the asynchronous device group from PRIMARY. <p>Verification steps</p> <ul style="list-style-type: none"> ■ Verify that the devices at SYNC_TARGET became write-enabled and the state is PAIR. ■ Verify the status of the asynchronous replication link once the PRIMARY is up and running. ■ Verify that the asynchronous replication link which was suspended due to role change in synchronous device group is resumed. ■ Verify the original Multi-target configuration is now changed to Cascaded configuration once the PRIMARY node is up and running. In the Cascaded configuration, the replication direction is from SYNC_TARGET to PRIMARY to ASYNC_TARGET.

Table 4-1

Failure scenarios at the PRIMARY site with VCS agent for Hitachi/HP XP 3DC (continued)

Failure scenario	Description and VCS response
Replication link failure at PRIMARY	<p>The replication link between the PRIMARY and SYNC_TARGET arrays fails.</p> <p>For both the configuration types, when there is a replication link failure at the PRIMARY, the following links are monitored:</p> <ul style="list-style-type: none">■ If the resource is online on PRIMARY or SYNC_TARGET, then the synchronous link is monitored.■ If the resource is online at ASYNC_TARGET, then the asynchronous link is monitored. <p>VCS action: No action.</p> <p>Agent response: The Monitor function detects the replication link failure and takes the following action depending on the value of the LinkMonitor attribute:</p> <ul style="list-style-type: none">■ If LinkMonitor is set to 0, the agent takes no action.■ If LinkMonitor is set to 1, when the replication link is disconnected, the agent periodically attempts to resynchronize synchronous device group S-VOL devices using the pairresync command. <p>In case of a replication link failure, failover to SYNC_TARGET depends on the value of the SplitTakeover attribute at SYNC_TARGET:</p> <ul style="list-style-type: none">■ 1—The agent issues the horctakeover command to make the HTC3DC devices at SYNC_TARGET write-enabled. The S-VOL devices go into the SSWS state.■ 0—The agent faults the HTC3DC resource. <p>Verification steps: If the value of the LinkMonitor attribute is not set to 1, you must manually resynchronize the HTC3DC devices after the link is restored.</p> <p>To manually resynchronize the HTC3DC devices after the link is restored:</p> <ul style="list-style-type: none">■ You must initiate resync of S-VOL device using the agent's pairresync action where the HTC3DC resource is online.■ In case of failover to SYNC_TARGET, verify that the devices are write-enabled and the synchronous device group state is SSWS.

Production cluster failure

Production cluster failure indicates that all hosts and the storage at PRIMARY and SYNC_TARGET are down.

VCS action: VCS does the following based on the ClusterFailOverPolicy global service group attribute:

- Auto—VCS automatically brings the faulted application service group online at ASYNC_TARGET.

- Manual or Connected—No action. You must bring the application service group online at ASYNC_TARGET.

Agent response:

- The agent uses the asynchronous device group for failover.
- The agent does the following at ASYNC_TARGET, based on the value of the SplitTakeOver attribute of the HTC3DC resource:
 - 1—The agent issues the `horctakeover` command to make the HTC3DC devices write-enabled. The HTC3DC devices go into the SSWS (Suspend for Swapping with S-VOL side only) state.
 - 0—The agent takes no action and the resource faults.

Verification steps

- Verify that the devices are write enabled at the ASYNC target node and their status is SSWS.
 The configuration is neither in 3DC Multi-target mode nor in 3DC Cascaded mode since the storage at PRIMARY is not available.

Performing failback from ASYNC_TARGET

All the hosts and storage in the production cluster recover from failure and then initiate a failback by switching the application service group to the PRIMARY node.

The agent takes the following action:

- splits the SYNC replication link at SYNC_TARGET.
- resynchronizes all the data that was written at ASYNC_TARGET when the production cluster was down.
- makes all devices write-enabled at the PRIMARY.
- starts the replication to SYNC_TARGET.

The configuration is brought back to 3DC Multi-target configuration.

