Veritas™ Cluster Server Agent for EMC MirrorView Installation and Configuration Guide

VMware ESX

5.0

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Chapter 1

Introducing the EMC MirrorView VCS agent

This chapter contains the following topics:

About the MirrorView agent

The VCS enterprise agent for EMC MirrorView provides application failover support and recovery in environments employing MirrorView to replicate data between EMC CLARiiON arrays. It monitors and manages the state of replicated CLARiiON LUNs attached to VCS nodes. The agent ensures that the system where the MirrorView resource runs has safe and exclusive access to the configured devices.

You can use the agent in replicated data clusters and global clusters. The agent supports MirrorView in the synchronous mode and supports individual mirrors or consistent groups in asynchronous mode.

Configure EMC MirrorView for use with synchronous or asynchronous mode for replication. In asynchronous mode, you can replicate either individual LUNs or consistency groups. MirrorView can also replicate LUNs or metaLUNs. In synchronous mode, you cannot replicate consistency groups.

Supported software and hardware

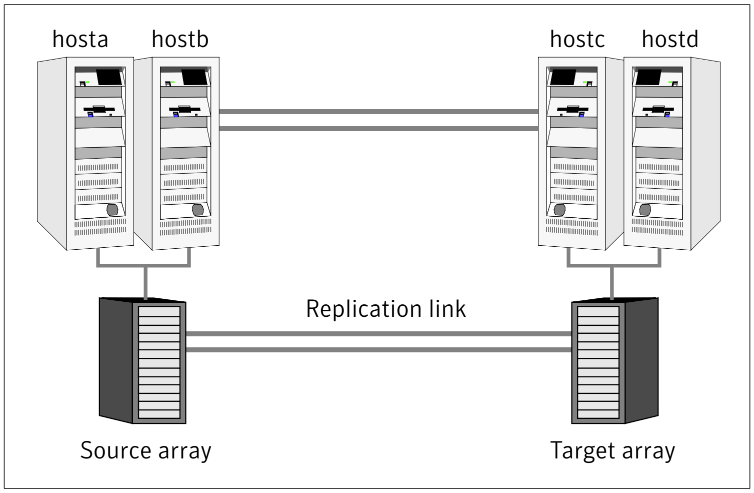
The EMC MirrorView agent supports VCS 5.0.

To determine the supported versions of NaviCLI and FLARE code that are on CLARiiON arrays, consult the EMC hardware compatibility list.

Typical MirrorView setup in a VCS cluster

Figure 1-1 displays a typical cluster setup in a MirrorView environment.

Figure 1-1 Clustering in a MirrorView environment



Clustering in a MirrorView environment typically consists of the following hardware infrastructure:

- The source array consists of one or more hosts with direct connection to a CLARiiON array. The array contains the mirror that is the primary image and the direct connection uses either SCSI or Fibre Channel.
- The target array consists of one or more hosts with a direct connection to another CLARiiON array. The array contains the mirror that is the secondary image and the connection uses either SCSI or Fibre Channel.
  The secondary image LUNs pairs with the mirrored LUNs in the source array. The target hosts and the array must be at a significant distance from the source side to survive a source-side disaster
- Network heartbeats using LLT or TCP/IP between the two data centers to determine their health.
  See “About cluster heartbeats” on page 18.
- In a replicated data cluster environment, all hosts are part of the same cluster. Connect them with dual, dedicated networks that support LLT.
- In a global cluster environment, you must attach all hosts in a cluster to the same CLARiiON array.

MirrorView agent functions

The VCS enterprise agent for EMC MirrorView monitors and manages the state of replicated CLARiiON LUNs attached to VCS nodes. Agent functions bring resources online, take them offline, and perform different monitoring actions. Agent functions are also known as entry points.

online	Creates a lock file on the local host. This lock indicates that the resource is online and makes the mirrors available for the application to use. The agent performs specific actions depending on the state of the mirrors. See "About the MirrorView agent's online function" on page 10.
monitor	Verifies that the lock file exists. If the lock file exists, the monitor entry point reports the status of the resource as online. If the lock file does not exist, the monitor entry point reports the status of the resource as offline.
offline	Removes the lock file on the host where the entry point is called.
open	Prevents potential concurrency violation if the service group fails over to another node by checking for the existence of the lock file. If Open detects the lock file, it waits until at least one of its parent resources is probed. If the parent resource is ONLINE, then the agent is calling Open in response to being restarted after it was killed or after HAD was killed. In either case, the agent does not remove the lock file. If the parent resource is OFFLINE, then the agent is being restarted in response to HAD being started, in which case Open removes the lock file and the agent reports OFFLINE. **Note:** The agent does not remove the lock file if the agent was started after a `hastop -force` command.
clean	Removes the lock file on the host where the entry point is called.
info	The info function gives the information about the mirrors (in case of synchronous mode of replication). It also gives information about the mirrors/group in case of asynchronous mode of replication. It uses the `-sync listsyncprogress` and `-async -list` or `-async listgroups` commands to get this information.
resynch	Performs a resynchronization action.

About the MirrorView agent's online function

The agent online function performs specific actions depending on the state of the mirrors.

Synchronous state

If the local mirror is the primary image, the agent creates a lock file on the local host. This lock indicates that the resource is online and makes the mirrors available for the application to use.

If one or more mirrors are not in the MIRRORED state, the agent promotes them into the MIRRORED state, which enables the application to use them.

- For secondary images in the synchronized state, the agent runs the `mirror -sync -promoteimage` command to promote the remote mirror. This command also converts the current primary to secondary.
- For secondary images in the CONSISTENT state, the agent waits to check if the image has transitioned to the SYNCHRONIZED state.

  If the images have transitioned to the SYNCHRONIZED state, the agent then runs the `mirror -sync -promoteimage` command to promote the remote mirror. This command also converts the current primary to secondary.

  If the image has not transitioned to the SYNCHRONIZED state, the agent checks if the remote array is accessible. If the remote array is accessible, then this condition indicates link failure—the image would be in a fractured condition.

In case of fracture:

- If the SplitTakeover attribute is set to 1, the agent forcibly promotes the secondary image.
- If the SplitTakeover attribute is set to 0, the agent does not try to promote the secondary image forcibly, and becomes the administrator’s decision.

Asynchronous state

You can configure the online function for either consistency groups or mirrors in asynchronous mode.

Consistency groups

If the mirrors in the consistency group on the local array are primary images, the agent creates a lock file on the local host to indicate that the resource is online. This lock makes the LUNs available for the application to use.

If one or more mirrors are not in the MIRRORED state, the agent checks to see if the remote array is accessible.

- If the remote array is not accessible, then the agent checks the value of the attribute SplitTakeover before proceeding with any further actions.
- If the SplitTakeover attribute is set to 1, the agent forcibly promotes the secondary image.

- If the SplitTakeover attribute is set to 0, the agent does not try to promote the secondary image forcibly, and becomes the administrator's decision.
- If the remote array is accessible, then the agent runs the `mirror -async -promotegroup` command to promote the remote group.
- In case of a successful promotegroup operation, the operation also converts the current primary to secondary.
- If the promotegroup operation is not successful, then the agent initiates a synchronization.
  The agent periodically checks if the group is SYNCHRONIZED. After a successful synchronization, the agent promotes the group using the `mirror -async -promotegroup` command. If the synchronization is not successful, the agent times out.

Mirrors

If the local image is the primary image, the agent creates a lock file on the local host. The lock indicates that the resource is online and makes the mirrors available for the application to use.

If one or more mirrors are not in the MIRRORED state, the agent checks to see if the remote array is accessible.

- If the remote array is not accessible, then the agent checks the value of the attribute SplitTakeover before proceeding with any further actions.
- If the SplitTakeover attribute is set to 1, the agent forcibly promotes the secondary image.
- If the SplitTakeover attribute is set to 0, the agent does not try to promote the secondary image forcibly, and becomes the administrator's decision.
- If the remote array is accessible, then the agent runs the `mirror -async -promoteimage` command to promote the remote mirrors.
- A successful promoteimage operation converts the current primary to secondary.

If the promoteimage operation is not successful, then the agent initiates a synchronization.

The agent periodically checks if the group is SYNCHRONIZED. After a successful synchronization, the agent promotes the secondary mirror using the `mirror -async -promoteimage` command. If the synchronization is not successful, the agent times out.

Configuring the MirrorView agent

This chapter contains the following topics:

Configuration concepts

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

MirrorView resource type definition

The resource type defines the MirrorView agent.

```
type MirrorView (
        static keylist SupportedActions = { resync }
        static int MonitorInterval = 300
        static int NumThreads = 1
        static int OfflineMonitorInterval = 0
        static int RestartLimit = 1
        static str ArgList[] = { NaviCliHome, LocalArraySPNames,
        RemoteArraySPNames, Mode, GrpName, MirNames, SplitTakeover }
        str NaviCliHome = "/opt/Navisphere/bin"
        str LocalArraySPNames[]
        str RemoteArraySPNames[]
        str Mode
        str GrpName
        str MirNames[]
        int SplitTakeover
        temp str VCSResLock
)
```

Attribute definitions for the MirrorView agent

This section describes the MirrorView agent attributes.

Required attributes

You must assign values to required attributes

NaviCliHome	Specifies the NaviCLI installation directory Type and dimension: string-scalar
LocalArraySPNames	Specifies the list of storage processors within the array to which the local hosts are connected. Can be names or IP addresses. Type and dimension: string-vector
RemoteArraySPNames	Specifies the list of storage processors within the array to which the remote hosts are connected. Can be names or IP addresses. Type and dimension: string-vector
Mode	Specifies the replication mode, which is either: `sync` or `async`. Type and dimension: string-scalar
GrpName	Specifies the name of the consistency group to which the mirrors belong. This function applies only if the mode is `async`. Type and dimension: string-scalar
MirNames	Specifies the list of individual mirrors that are a part of the replication relationship and managed by VCS. This attribute is ignored if you specify the GrpName attribute. Type and dimension: string-vector

SplitTakeover	Indicates whether VCS should forcefully promote a secondary to a primary. In case of a link-failure between the two arrays, the state of the mirror remains consistent or out-of-sync. Under such circumstances, if the application has to failover—due to disaster or user-driven action—mirrors are not in a SYNCHRONIZED state. If the value of the SplitTakeOver attribute is 1: ■ the agent fails over when it discovers link failures ■ the agent determines that mirrors are out of sync If the value of the attribute is 0, agent does not fail over and the administrator must to determine what to do. Type and dimension: integer-scalar

Internal attribute

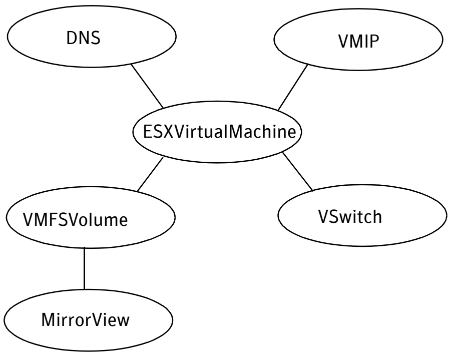
Do not modify internal attributes.

VCSResLock	The agent uses this attribute to guarantee serialized management in case of a parallel application. Do not modify this value. Type and dimension: temporary-string

Sample configuration

Figure 2-1 shows a VCS service group that has a resource of type MirrorView. The VMFSVolume resource depends on the MirrorView resource.

Figure 2-1 Dependency tree



Asynchronous mode

You can configure a resource of type MirrorView in the `main.cf` file. In this example, the resource is configured for asynchronous mode and consistency groups.

```
MirrorView mir (
    NaviCliHome = "/opt/Navisphere/bin"
    LocalArraySPNames @sys1= = { "Local_SP1_Name", "Local_SP1_IP" }
    LocalArraySPNames @sys2 = { "Local_SP2_Name", "Local_SP2_IP" }
    RemoteArraySPNames @sys1 = { "Local_SP2_IP", "Remote_SP2_Name" }
    RemoteArraySPNames @sys2= { "Local_SP1_IP", "Remote_SP1_Name" }

    Mode = async
    GrpName = consistency_grp1

    SplitTakeover = 0
    )
```

If you want set up asynchronous replication with individual mirrors—no consistency groups—replace the lines beginning with Mode and GrpName with:

```
    Mode = async
    MirNames = { "async_mir1", "async_mir2" }
    GrpName = ""
```

If you want to configure the resource for synchronous mode and specify the mirror names, replace the lines beginning with Mode and GrpName with:

```
Mode = sync
MirNames = { "sync_mir1", "sync_mir2" }
GrpName = ""
```

Before you configure the MirrorView agent

Before you configure the agent:

- Review the configuration concepts, which describe the agent's type definition and attributes.
  See "Configuration concepts" on page 14.
- Verify that the agent is installed on all systems in the cluster.
- Verify the hardware setup for the agent.
  See "Typical MirrorView setup in a VCS cluster" on page 9.
- Make sure the cluster has an effective heartbeat mechanism in place.
  See "About cluster heartbeats" on page 18.
- Set up system zones in replicated data clusters.
  See "About configuring system zones in replicated data clusters" on page 19
- Set up an effective heartbeat mechanism to prevent split-brain.
  See "About preventing split-brain" on page 19

About cluster heartbeats

In a replicated data cluster, robust heartbeating is accomplished through 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.

Heartbeat loss may occur due to the failure of all hosts in the primary cluster. In such a scenario, a failover may be required even if the array is alive. In any case, a host-only crash and a complete site failure must be distinguished. In a host-only crash, only the ICMP heartbeat signals a failure by an SNMP trap. No cluster failure notification occurs because a surviving heartbeat exists. This trap is the only notification to fail over an application.

About preventing split-brain

Split-brain occurs when all heartbeat links between the primary and secondary hosts are cut. In this situation, each side mistakenly assumes that the other side is down. Minimize the effects of split-brain by ensuring the cluster heartbeat links pass through similar physical infrastructure as the replication links so that if one breaks, so does the other.

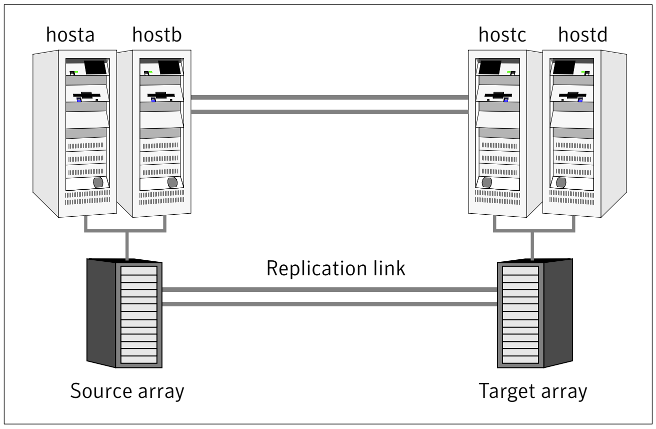
If it is physically impossible to place the heartbeats alongside the replication links, there is a possibility that the cluster heartbeats are disabled, but the replication link is not. A failover transitions the original source to source volumes and vice-versa. In this case, the application faults because its underlying volumes become write-disabled, causing the service group to fault. VCS tries to fail it over to another host, causing the same consequence in the reverse direction. This phenomenon continues until the group comes online on the final node. You can avoid this situation by setting up your infrastructure such that loss of heartbeat links also mean the loss of replication links.

About configuring system zones in replicated data clusters

In a replicated data cluster, you can prevent unnecessary failover or failback. VCS attempts to fail over applications within the same system zone before failing them over across system zones. Configure the hosts that are attached to an array as part of the same system zone to avoid unnecessary failover.

Figure 2-2 depicts a sample configuration where hosta and hostb are in one system zone, and hostc and hostd are in another system zone. Use the SystemZones attribute to create these zones.

Figure 2-2 Example system zone configuration



Global clusters do not require system zones because failover occurs on a remote cluster if all local targets have been exhausted.

As long as a secondary image is available, MirrorView sends the writes to the secondary image immediately in synchronous mode. It does so periodically in asynchronous mode.

If the period is too long, you can perform synchronization using the resync action. The supported resync action is defined in the MirrorView resource type.

Configuring the agent

You can adapt most of the applications that you configure in VCS to a disaster recovery environment by:

- Converting their LUNs to CLARiiON LUNs
- Synchronizing the mirrors
- Adding the EMC MirrorView agent to the service group

After configuration, the application service group must follow the diagram in Figure 2-1 on page 17.

Configuring the agent manually in a global cluster

Configuring the agent manually in a global cluster involves the following tasks.

To configure the agent in a global cluster

1. Start Cluster Manager and log on to the cluster.
2. If the agent resource type (MirrorView) is not added to your configuration, add it. From the Cluster Explorer **File** menu, choose **Import Types** and select /etc/VRTSvcs/conf/MirrorViewTypes.cf.
3. Click **Import**.
4. Save the configuration.
5. Add a resource of type MirrorView at the bottom of the service group.
6. Configure the attributes of the MirrorView resource.
7. If the service group is not configured as a global group, configure the service group using the Global Group Configuration Wizard. See the *Veritas Cluster Server User's Guide* for more information.
8. Change the ClusterFailOverPolicy from the default, if necessary. Symantec recommends keeping the default, which is Manual, to minimize the chance of failing over on a split-brain.

   Repeat step 5 through step 8 for each service group in each cluster that uses replicated data.

Configuring the agent manually in a replicated data cluster

Configuring the agent manually in a replicated data cluster involves the following tasks.

To configure the agent in a replicated data cluster

1. Start Cluster Manager and log on to the cluster.
2. If the agent resource type (MirrorView) is not added to your configuration, add it. From the Cluster Explorer **File** menu, choose **Import Types** and select /etc/VRTSvcs/conf/MirrorViewTypes.cf.
3. Click **Import**.
4. Save the configuration.
5. In each service group that uses replicated data, add a resource of type MirrorView at the bottom of the service group.

6. Configure the attributes of the MirrorView resource. Note that some attributes must be localized to reflect values for hosts that are attached to different arrays.
7. Set the SystemZones attribute for the service group to reflect which hosts are attached to the same array.

Chapter 3

Managing and testing clustering support for EMC MirrorView

This chapter contains the following topics:

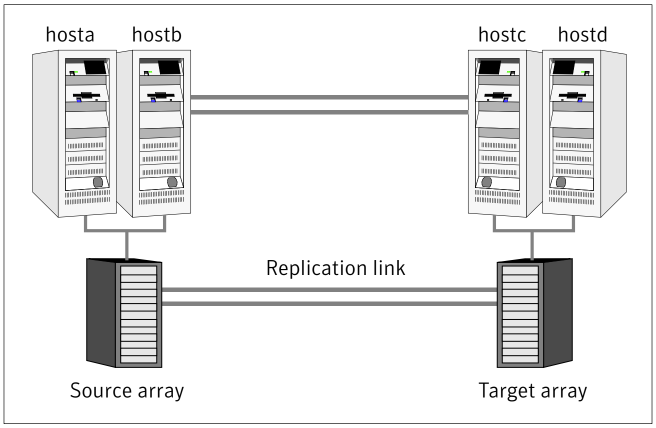
Typical test setup

A typical test environment includes:

- Two hosts (hosta and hostb) attached to the source CLARiiON array.
- Two hosts (hostc and hostd) attached to the target CLARiiON array.
- The application runs on hosta and devices in the local array are read-write enabled in the SYNCHRONIZED state.
- A replicated data cluster has two dedicated heartbeat links; a global cluster has one network heartbeat. The test scenario is similar for both environments.

Figure 3-1 depicts a typical test environment.

Figure 3-1 Typical test setup



Testing service group migration

Verify the service group can migrate to different hosts in the cluster.

To perform the service group migration test

1. Migrate the service group to a host that is attached to the same array. In the Service Groups tab of the Cluster Explorer configuration tree, right-click the service group.
2. Click **Switch To**, and click the system that is attached to the same array (hostb) from the menu.

The service group comes online on hostb and local image remains in the MIRRORED state.

3 Migrate the service group to a host that is attached to a different array. In the Service Groups tab of the Cluster Explorer configuration tree, right-click the service group.

4 Click **Switch To**, and click the system that is attached to the another array (hostc) from the menu.

The service group comes online on hostc and the role of the images there transition to primary.

5 Accumulate dirty tracks on the new source-side and update them back on the target:

```
hares -action mirrorview_res_name resync -sys hostc
```

The variable *mirrorview_res_name* represents the name of the MirrorView resource.

6 After the devices transition to a source SYNCHRONIZED state, migrate the service group back to its original host. In the Service Groups tab of the Cluster Explorer configuration tree, right-click the service group.

7 Click **Switch To**, and click the system on which the group was initially online (hosta).

The group comes online on hosta. The devices return to the RW/SYNCINPROG state at the array that is attached to hosta and hostb, and then eventually transition to the SYNCHRONIZED state.

Testing host failure

In this scenario, the host where the application runs is lost. Eventually all the hosts in the system zone or cluster are lost.

To perform the host failure test

1 Halt or shut down the host where the application runs (hosta).

The service group fails over to hostb and devices are in the SYNCHRONIZING state.

2 Halt or shut down hostb.

In a replicated data cluster, the group fails over to hostc or hostd depending on the FailOverPolicy in the cluster.

In a global cluster, a cluster down alert appears and gives you the opportunity to fail over the service group manually.

In both environments, the role of the devices changes from secondary to primary and starts on the target host.

3 Reboot the two hosts that were shut down.

4 Switch the service group to its original host when VCS starts. In the Service Groups tab of the Cluster Explorer configuration tree, right-click the service group.

5 Click **Switch To**, and click the system on which the service group was initially online (hosta).
The service group comes online on hosta and devices transition to the SYNCHRONIZING state and then to the SYNCHRONIZED state.

Performing a disaster test

Test how robust your cluster is in case of a disaster.

To perform a disaster test

1 Shut down all hosts on the source side and shut down the source array.
If you cannot shut down the source array, change the value of the RemoteArraySPNames in the target side to non-existent names and IP addresses. This action mimics a disaster scenario from the target's point of view.

2 In a replicated data cluster, the service group fails over to hostc or hostd if:
- All devices were originally SYNCHRONIZED.
- No synchronization was in progress at the time of disaster.

3 In a global cluster, the administrator is notified of the failure. The administrator can then initiate the failover.

Performing the failback test

You can set up your cluster for a failback test.

To perform the failback test for asynchronous mode with Consistency groups

1 Remove all the mirrors form the consistency group on the old primary.

2 Destroy the consistency group on the old primary.

3 Forcefully destroy the remote mirrors on the old primary.

4 Remove the LUNs from the storage group on the old primary.

5 Remove the mirrors from the consistency group on the new primary.

6 Add secondary images to each of the remote mirrors on the new primary.

7 Add the mirrors into the consistency group on the new primary.

8. Add the LUNs, where the secondary image resides, into the appropriate storage group on the old primary

Between step 5 and step 7, the LUNs become vulnerable to data corruption. For example, if one of the LUNs has sustained hardware damage and failed.

During this window, the mirrors are not a part of the consistency group. The writes to other mirrors that were a part of the consistency group are not stopped. This situation could result in data corruption.

To perform the failback test for synchronous and asynchronous mode with Individual mirrors

1. Forcefully destroy the remote mirrors on the old primary.
2. Remove the LUNs from the storage group on the old primary.
3. Add secondary images to each of the remote mirrors on the new primary.
4. Add the LUNs, where the secondary image resides, into the appropriate storage group on the old primary.

In either of the modes, the original contents of the old primary are lost.

Failure scenarios

Review the failure scenarios and agent behavior in response to failure.

All host or all application failure

Even if both arrays are operational, the service group fails over in the following conditions:

- All hosts on the source side are disabled.
- The application cannot start successfully on any source host.

In replicated data cluster environments, the failover can be automatic, whereas in global cluster environments failover requires user confirmation by default.

In both environments, multiple service groups can fail over in parallel.

Site disaster

In a total site failure, all hosts and the array are completely disabled, either temporarily or permanently.

In a replicated data cluster, site failure is detected the same way as a total host failure, that is, the loss of all LLT heartbeats.

In a global cluster, VCS detects site failure by the loss of all configured heartbeats.

A total disaster renders the devices on the surviving array in the FRACTURED state. If the SplitTakeover attribute is set to its default value of 1, the online entry point runs the 'promote' operation. If the attribute is set to 0, no takeover occurs and the online entry point times out and faults.

The online entry point detects whether any synchronization was in progress when the source array was lost. Since the target devices are inconsistent until the synchronization completes, the agent does not write-enable the devices, but it times out and faults. You must restore consistent data from a snapshot or tape backup.

Replication link failure

Before the MirrorView takes any action, it waits for the synchronization to complete in the following situations:

- The two arrays are healthy and the link that failed is restored.
- A failover is initiated while synchronization is in progress.

After the synchronization completes, the MirrorView runs the promote operation.

If the agent times out before the synchronization completes, the resource faults.

If the SplitTakeover attribute is set to 0, the agent does not attempt a promote operation, but it times out and faults. If you write-enable the devices manually, the agent can come online after it is cleared.

Setting up and running a fire drill

This chapter contains the following topics:

About fire drills

A fire drill procedure verifies the readiness of a disaster recovery configuration. This procedure is performed without stopping the application at the primary site and disrupting user access.

A fire drill is performed at the secondary site using a special service group for fire drills. The fire drill service group is identical to the application service group, but uses a fire drill resource in place of the replication agent resource. The fire drill service group uses a copy of the data used by the application service group.

In clusters employing EMC MirrorView, the MirrorView resource manages the replication relationship during a fire drill. Bringing the fire drill service group online demonstrates the ability of the application service group to come online at the remote site when a failover occurs.

For VMware, a fire drill can also be performed locally to generate a candidate for a “last-known good copy” of your application data. If the replicated data produced by the fire drill tests successfully, that copy is your last-known good copy.

Considerations for using MirrorView and SnapView together

MirrorView is an EMC software application that maintains a copy or image of a logical unit (LUN) at a separate location as a provision for disaster recovery. You can use this image in the event that a disaster disables the production image. The production image (the image that is mirrored) is called the primary image; the copy image is called the secondary image.

SnapView is a storage-system-based software application that enables you to create a copy of a LUN by using either clones or snapshots. A clone is an actual copy of a LUN and takes time to create, depending on the size of the source LUN. A clone is a full copy. A snapshot is a virtual point-in-time copy of a LUN and takes only seconds to create. A snapshot uses a copy-on-write principle.

Fire drills use SnapView in conjunction with MirrorView. The following are important considerations regarding the joint use of these applications:

- If a LUN is a MirrorView primary or secondary image, you cannot create a clone group for that image. Similarly, if a LUN is a member of a clone group as the source or clone, it cannot serve as a MirrorView primary or secondary image.
- If the MirrorView Synchronous option is installed, you can create a snapshot of the primary or secondary image. However, Symantec recommends that

you take a snapshot of a secondary image only if the state of the image is either SYNCHRONIZED or CONSISTENT. If the image is SYNCHRONIZING or OUT-OF-SYNC, the snapshot data is not useful.

- If the MirrorView Asynchronous option is installed, you can create a snapshot of the primary or secondary image. However, Symantec recommends that you take a snapshot of a secondary image only if the last update started has completed successfully. If the update did not complete successfully because the image is fractured or the update is still in progress, the snapshot data is not useful.

The VCS MirrorView fire drill agent, MirrorViewSnap, does not support clones because of these considerations.

About the MirrorViewSnap agent

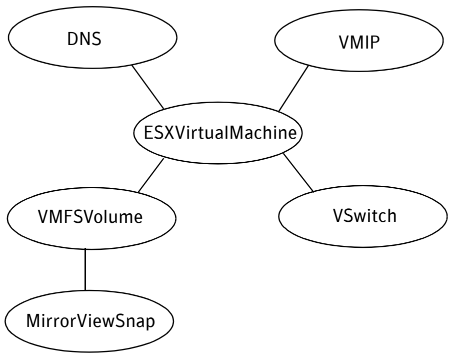
The MirrorViewSnap agent uses SnapView to take a snapshot of a source LUN and then makes the snapshot available to the secondary server. The MirrorViewSnap resource is configured in the fire drill service group.

Agent fire drill functionality

The MirrorViewSnap agent makes a local copy of the LUNs in the mirrors that are specified as part of the fire drill configuration. The agent resides at the bottom of the dependency tree because a snapshot of data must be made available before the application can use it.

Note: The MirrorViewSnap agent creates SnapView snapshots, not SnapView clones.

Figure 4-1 MirrorViewSnap agent dependency tree



A snapshot is a virtual LUN. When a secondary server views a snapshot, it is viewing point-in-time copy of a source LUN. You determine the point in time when you start a SnapView session. The session keeps track of the source LUN's data at a particular point in time. During a session, the production server can still write to the source LUN and modify data.

Agent prerequisites

Before initiating a fire drill, you must complete the initial setup for the MirrorViewSnap agent.

To set up the MirrorViewSnap agent

1. Establish the MirrorView relationship
2. Reserve sufficient unallocated LUNs in the reserved LUN pool
3. Install and enable the SnapView licence
4. Install the Navisphere CLI

After the initial setup is completed, VCS can:

- Take a snapshot
- Make the snapshot read-writable.
- Start the application, which is already running on the production cluster, to verify the production data

Agent operations

The MirrorViewSnap agent performs the following operations.

Online	Destroys any existing snapshot, takes a new snapshot of the LUNs in the mirror/consistency group, and then make it available for use. The Online entry point performs the following steps: ■ Destroys any existing snapshot. (If a snapshot already exists, it was taken as a part of a previous Online operation for the current MirrorViewSnap type of resource.) If the agent is performing an Online operation for the first time or if an existing snapshot was manually destroyed, you receive error messages in the log file that pertain to the inability to destroy the snapshot. You may safely ignore these messages. ■ Retrieves the state of the mirror/consistency group. If the mirror/consistency group is not in either SYNCHRONIZED/CONSISTENT state, the fire drill cannot continue. The agent logs an error and exits. ■ Creates the MirrorViewSnap object. ■ Takes the snapshot. In case of any error, the agent rolls back the changes for all the other mirrors. ■ Creates a lock file and exits.
Offline	Removes the lock file.
Monitor	Checks for the existence of the lock file. If the lock file exists, Monitor reports the state of the MirrorViewSnap resource as ONLINE. Otherwise, it reports the state as OFFLINE.

Open	Checks for the existence of the lock file. If Open detects the lock file, it waits until at least one of its parent resources is probed. If the parent resource is ONLINE, then the agent is calling Open in response to being restarted after it was killed or after HAD was killed. In either case, the agent does not remove the lock file. If the parent resource is OFFLINE, then the agent is being restarted in response to HAD being started, in which case Open removes the lock file and the agent reports OFFLINE.
Clean	Removes the lock file.

Agent resource type definition

The MirrorView Snap agent is represented by the MirrorViewSnap resource type in VCS.

```
type MirrorViewSnap (
    static keylist SupportedActions = { resync }
    static int MonitorInterval = 300
    static int NumThreads = 1
    static int OfflineMonitorInterval = 0
    static int OnlineTimeout = 600
    static int RestartLimit = 1
    static str ArgList[] = { StorageGrpName, TargetResName,
    NaviCliHome, LocalArraySPNames }
    str StorageGrpName
    str TargetResName
    str NaviCliHome = "/opt/Navisphere/bin"
    str LocalArraySPNames[]
    temp str Responsibility
)
```

Attribute definitions

Configure the following attributes to customize the behavior of the MirrorViewSnap agent.

TargetResName	Name of the resource managing the LUNs to be snapshot. Set this attribute to the name of the MirrorView resource if the data being snapshot is replicated. Set the attribute to the name of the ESXVirtualMachine resource if the data is not replicated. Type-Dimension: string-scalar
StorageGrpName	Name of the storage group to which you want to add the snapshot. The host that runs the fire drill must be a part of this storage group. Otherwise, the fire drill fails. Type-Dimension: string-scalar
Responsibility	For internal use only. Used by the agent to keep track of resynchonizing snapshots. Type-Dimension: temporary string

Before you configure the fire drill service group

Do the following before configuring the service group:

- Ensure that the application service group is configured with a MirrorView resource.
- Ensure that the infrastructure that takes snapshots is properly configured between the source and target arrays.

Configuring the fire drill service group

On the secondary site, the initial steps create a fire drill service group that closely follows the configuration of the original application service group. The fire drill service group also and a point-in-time copy of the production data. Bringing the fire drill service group online on the secondary site demonstrates the ability of the application service group to failover and come online at the secondary site should the need arise.

You can create the fire drill service group using the command line or Cluster Manager (Java Console.) The fire drill service group uses the point-in-time snapshot of the application data.

Creating and configuring the fire drill service group involves the following tasks:

- "Creating the fire drill service group" on page 36
- "Configuring resources for the fire drill service group" on page 37
- "Configuring resource attributes for the fire drill service group" on page 38
- "Enabling the FireDrill attribute" on page 38

See "Sample main.cf file including the fire drill service group" on page 40 for examples of service group configurations.

Creating the fire drill service group

This section describes how to use the Cluster Manager (Java Console) to create the fire drill service group and change the failover attribute to false so that the fire drill service group does not failover to another node during a test.

To create the fire drill service group

1. Open the Veritas Cluster Manager (Java Console).
2. Enter your login information for the cluster and then click **OK**.

3 Click the **Service Group** tab in the left pane and then click the **Resources** tab in the right pane.

4 Right-click the cluster in the left pane and then click **Add Service Group**.

5 In the Add Service Group dialog box, provide information about the new service group and then click **OK**.

- In Service Group name, enter a name for the fire drill service group
- Select systems from the Available Systems box and then click the arrows to add them to the Systems for Service Group box.

To disable the AutoFailOver attribute

1 Click the **Service Group** tab in the left pane and then select the fire drill service group.

2 Click the **Properties** tab in the right pane.

3 Click the **Show all attributes** button.

4 Double-click the **AutoFailOver** attribute.

5 In the Edit Attribute dialog box, clear the **AutoFailOver** check box.

6 Click **OK** to close the Edit Attribute dialog box.

7 Click the **Save and Close Configuration** icon in the tool bar.

Configuring resources for the fire drill service group

Add resources to the new fire drill service group to recreate key aspects of the application service group.

To add resources to the service group

1 In Cluster Explorer, click the **Service Group** tab in the left pane, click the application service group, and then click the **Resources** tab in the right pane.

2 Right-click the resource at the top of the tree, select **Copy** and click **Self and Child Nodes**.

3 In the left pane, click the fire drill service group.

4 Right-click the right pane, and then click **Paste**.

5 In the Name Clashes dialog box, specify a way for the resource names to be modified and then click **Apply**.
One way to modify the resource names is to insert an `FD_` prefix.

6 Replace the MirrorView resource with the MirrorViewSnap resource.

To delete the MirrorView resource, right-click the MirrorView resource and then click **Delete**.

7 Click **OK**.

See "Sample main.cf file including the fire drill service group" on page 40 for examples of service group configurations.

Configuring resource attributes for the fire drill service group

After copying resources to the fire drill service group, edit the resources so they will work properly with the snapshot data. You must modify the attributes to reflect the configuration at the secondary (remote) site. Bringing the service group online without modifying resource attributes might result in a cluster fault and an interruption in service.

To configure the fire drill service group

1 In Cluster Explorer, click the **Service Group** tab in the left pane, click the fire drill service group in the left pane, and then click the **Resources** tab in the right pane.

2 Edit resource attributes to reflect the configuration at the remote site.
For example, change the Mount resources so that they point to the volumes used in the fire drill service group.
To edit resource attributes, right-click a resource and then click **View>Properties View**. If a resource that you need to edit does not appear in the pane, click **Show All Attributes**

See "Sample main.cf file including the fire drill service group" on page 40 for examples of service group configurations.

Enabling the FireDrill attribute

You must edit certain resource types so they are FireDrill-enabled. Making a resource type FireDrill-enabled changes the way that VCS checks for concurrency violations. Typically, when FireDrill is not enabled, resources can not come online on more than one node in a cluster at a time. This behavior prevents multiple nodes from using a single resource or from answering client requests. Fire drill service groups do not interact with outside clients or with other instances of resources, so they can safely come online even when the application service group is online.

Typically, you would enable the FireDrill attribute for the resource type used the configure the agent. For example, in a service group monitoring Oracle, enable the FireDrill attribute for the Oracle resource type.

To enable the FireDrill attribute

1. In Cluster Explorer, click the **Types** tab in the left pane, right-click the type to be edited, and then click **View** > **Properties View**.
2. Click **Show All Attributes**.
3. Double click **FireDrill**.
4. In the Edit Attribute dialog box, enable **FireDrill** as required and then click **OK**.

Repeat the process of enabling the FireDrill attribute for all required resource types.

Verifying a successful fire drill

Run the fire drill routine periodically to verify the application service group can fail over to the remote node.

To verify a successful fire drill

1. Bring the fire drill service group online on a node that does not have the application running. Verify that the fire drill service group comes online.

   This action validates your disaster recovery configuration. The production service group can fail over to the secondary site in the event of an actual failure (disaster) at the primary site.
2. If the fire drill service group does not come online, review the VCS engine log for more information.
3. Take the fire drill offline after its functioning has been validated.

   Failing to take the fire drill offline could cause failures in your environment. For example, if the application service group fails over to the node hosting the fire drill service group, there would be resource conflicts, resulting in both service groups faulting.

Sample main.cf file including the fire drill service group

The sample configuration of a fire drill service group is almost identical to that of an application service group that has a hardware replication resource. The difference is that, in a fire drill service group, the MirrorViewSnap resource replaces the MirrorView resource as shown in the sample main.cf file. The fire drill groups for running the fire drill on both a secondary site (normal fire drill) and locally (to generate last-known good copy) are denoted by the following declarations:

```
group test_fd
group test_fd_local
```

The following is the sample file. Comments depicting the resource dependency trees have been omitted for brevity:

```
include "types.cf"
include "ClusterConnectorConfigType.cf"
include "DNStypes.cf"
include "MirrorViewTypes.cf"
include "VMIPtypes.cf"

cluster hapri (
    UserNames = { admin = HopHojOlpKppNxpJom,
        root_AT_lab310_DOT_veritas_DOT_com_AT_unixpwd =
        tPx6obnB,
        myvmuser = myvmpassword,
        newvmuser = password }
         ClusterAddress = "192.128.12.87"
         Administrators = { admin,
        root_AT_lab310_DOT_veritas_DOT_com_AT_unixpwd
        }
    )

remotecluster hadr (
    ClusterAddress = "192.128.150.60"
    )

heartbeat Icmp (
    ClusterList = { hadr }
    AYATimeout = 30
    Arguments @hadr = { "192.128.150.60" }
    )

system labpc281 (
)

system labpc282 (
)

group Apache_SG (
SystemList = { labpc282 = 0, labpc281 = 1 }
ClusterList = { hadr = 0, hapri = 1 }
AutoStartList = { labpc281, labpc282 }
TriggerResStateChange = 1
)

DNS dns_apache (
    Critical = 0
    Domain = "example.com"
    Alias = apache_1
    Hostname = apachehost
    IPAddress = "192.128.1.255"
    TSIGKeyFile = "/var/tsig/Ktsig-key.+157+63053.private"
    )

ESXVirtualMachine vm_apache (
    CfgFile =
    "/vmfs/volumes/455bcae1-8f9c581d-5e47-000e0cb60b24/vm_
    labpc281v1_apache_sle/vm_labpc281v1_apache_sle.vmx"
    VCserver = "vcslabpc2.engba.veritas.com"
    username = administrator
    password = password
    sslcert = "/var/ssl/vmware.keystore"
    esxhostdomain = "veritas.com"
    )

GuestOSApp apache_res (
    VMwareResName = vm_apache
    )

MirrorView mirrorview_apache (
    LocalArraySPNames = { "cx600c1.veritas.com",
    "cx600c2.veritas.com" }
    RemoteArraySPNames = { "cx700spj1.veritas.com",
    "cx700spj2.veritas.com" }
    Mode = sync
    MirNames = { aaVMWare-s1, aaVMWare-s5 }
    )

VMFSVolume vmfsvol_apache (
    Volume = {
    "/vmfs/volumes/455bcae1-8f9c581d-5e47-000e0cb60b24/" }
    )

VMIP vmip_apache (
    Critical = 0
    VMwareResName = vm_apache
    IPAddress = "192.128.12.88"
    MACAddress = "00:50:56:A6:3A:15"
    NetMask = "255.255.240.0"
    Gateway = "192.128.1.1"
    DNS = { "192.128.150.67", "192.128.9.163", "192.128.9.163" }
    )
    VSwitch vmnetwork_apache (
        VirtualSwitch = vSwitch0
        )

    apache_res requires vm_apache
    vm_apache requires vmfsvol_apache
    vm_apache requires vmnetwork_apache
    vmfsvol_apache requires mirrorview_apache

group ClusterService (
    SystemList = { labpc281 = 1, labpc282 = 2 }
    AutoStartList = { labpc281, labpc282 }
    Tag = CSG
    )

    Application wac (
        StartProgram = "/opt/VRTSvcs/bin/wacstart"
        StopProgram = "/opt/VRTSvcs/bin/wacstop"
        MonitorProcesses = { "/opt/VRTSvcs/bin/wac" }
        )

    IP gcoip (
        Device = vswif0
        Address = "192.128.12.91"
        NetMask = "255.255.240.0"
        )

    VSwitch csgnic (
        VirtualSwitch = vSwitch0
        )

    gcoip requires csgnic
    wac requires gcoip

group MSSQL_IIS_SG (
    SystemList = { labpc282 = 0, labpc281 = 1 }
    ClusterList = { hapri = 1, hadr = 0 }
    AutoStartList = { labpc281, labpc282 }
    ClusterFailOverPolicy = Auto
    TriggerResStateChange = 1
    )

    ESXVirtualMachine vm_mssql_iis (
        CfgFile =
        "/vmfs/volumes/455f6f8b-d632ecb3-110b-000e0cb60b24/labpc281v
        3_w2k/labpc281v3_w2k.vmx"
        )

    GuestOSApp IIS_Res (
        VMwareResName = vm_mssql_iis
        )

    GuestOSApp MSSQLSERVER_GenericService (
        VMwareResName = vm_mssql_iis
        )
    GuestOSApp MSSQLSERVER_SQLAgService2005 (
        VMwareResName = vm_mssql_iis
        )

    GuestOSApp MSSQLSERVER_SQLOlapService2005 (
        Critical = 0
        VMwareResName = vm_mssql_iis
        )

    GuestOSApp MSSQLSERVER_SQLServer2005 (
        VMwareResName = vm_mssql_iis
        )

    MirrorView mirrorware-mssql (
        LocalArraySPNames = { "cx600c1.veritas.com",
        "cx600c2.veritas.com" }
        RemoteArraySPNames = { "cx700spj1.veritas.com",
        "cx700spj2.verit
        as.com" }
        Mode = sync
        MirNames = { aaVMWare-s3 }
        )

    VMFSVolume vmfsvol_mssql_iis (
        Volume = {
        "/vmfs/volumes/455f6f8b-d632ecb3-110b-000e0cb60b24/" }
        )

    VSwitch vmnetwork_mssql_iis (
        VirtualSwitch = vSwitch0
        )

    IIS_Res requires vm_mssql_iis
    MSSQLSERVER_GenericService requires vm_mssql_iis
    MSSQLSERVER_SQLAgService2005 requires vm_mssql_iis
    MSSQLSERVER_SQLOlapService2005 requires vm_mssql_iis
    MSSQLSERVER_SQLServer2005 requires vm_mssql_iis
    vm_mssql_iis requires vmfsvol_mssql_iis
    vm_mssql_iis requires vmnetwork_mssql_iis
    vmfsvol_mssql_iis requires mirrorware-mssql

group Oracle_SG (
    SystemList = { labpc282 = 0, labpc281 = 1 }
    ClusterList = { hapri = 1, hadr = 0 }
    AutoStartList = { labpc281, labpc282 }
    TriggerResStateChange = 1
    )

    DNS dns_oracle (
        Critical = 0
        Domain = "example.com"
        Alias = oracle_hosta
        Hostname = oraclehost
        IPAddress = "192.168.1.155"
        TSIGKeyFile = "/var/tsig/Ktsig-key.+157+63053.private"
        )

    ESXVirtualMachine vm_oracle (
        CfgFile =
        "/vmfs/volumes/45306cf4-a8c7baf3-954d-000e0cb60b24/labpc282v
        1_rh4_orcl/labpc282v1_rh4_orcl.vmx"
        )

    GuestOSApp oracle_res (
        VMwareResName = vm_oracle
        )

    MirrorView mirrorview_oracle (
        LocalArraySPNames = { "cx600c1.veritas.com",
        "cx600c2.veritas.com" }
        RemoteArraySPNames = { "cx700spj1.veritas.com",
        "cx700spj2.veritas.com" }
        Mode = sync
        MirNames = { aaVMWare-s, aaVMWare-s6, aaVMWare-s2 }
        )

    VMFSVolume vmfsvol_oracle (
        Volume = {
        "/vmfs/volumes/45306cf4-a8c7baf3-954d-000e0cb60b24/" }
        )

    VMIP vmip_oracle (
        Critical = 0
        VMwareResName = vm_oracle
        IPAddress = "192.128.12.92"
        MACAddress = "00:50:56:A6:0A:42"
        NetMask = "255.255.240.0"
        Gateway = "192.128.1.1"
        DNS = { "192.128.9.164", "192.128.9.163" }
        )

    VSwitch vmnetwork_oracle (
        VirtualSwitch = vSwitch0
        )

    dns_oracle requires vmip_oracle
    oracle_res requires vm_oracle
    vm_oracle requires vmfsvol_oracle
    vm_oracle requires vmnetwork_oracle
    vmfsvol_oracle requires mirrorview_oracle
    vmip_oracle requires vm_oracle

group test_SG (
    SystemList = { labpc281 = 0, labpc282 = 1 }
    ClusterList = { hadr = 0, hapri = 1 }
    AutoStartList = { labpc281 }
    )

    ESXVirtualMachine vm_mirrorview (
        Critical = 0
        CfgFile =
        "/vmfs/volumes/45634bb9-4d9928ec-6152-000e0cb60b24/vm_281_sl
        e/vm_281_sle.vmx"
        )

    MirrorView test_mirrorview (
        Critical = 0
        LocalArraySPNames = { "cx600c1.veritas.com",
        "cx600c2.veritas.com" }
        RemoteArraySPNames = { "cx700spj1.veritas.com",
        "cx700spj2.veritas.com" }
        Mode = sync
        MirNames = { aaVMWare-s7 }
        )

        vm_mirrorview requires test_mirrorview

group test_fd (
    SystemList = { labpc281 = 0 }
    )

    ESXVirtualMachine mirrorview_vm1 (
        Enabled = 0
        CfgFile =
        "/vmfs/volumes/45751403-65008bd0-92af-000e0cb60b24/vm_mirror
        view/vm_mirrorview.vmx"
        )

    MirrorViewSnap MirrorViewSnp_fd (
        Critical = 0
        StorageGrpName = aaVMWare
        TargetResName = test_mirrorview
        LocalArraySPNames = { "cx600c1.veritas.com",
        "cx600c2.veritas.com" }
        )

group test_growfs_SG (
    SystemList = { labpc281 = 0 }
    )

    ESXVirtualMachine growfs_vm (
        Critical = 0
        CfgFile =
        "/vmfs/volumes/45255fc4-c0d8605a-698e-000e0cb60b24/vm_thropc
        281_rh4/vm_thropc281_rh4.vmx"
        VCserver = "vcslabpc2.engba.veritas.com"
        username = administrator
        password = password
        sslcert = "/var/ssl/vmware.keystore"
        esxhostdomain = "veritas.com"
        )

group test_local_fd (
    SystemList = { labpc281 = 0 }
    AutoStartList = { labpc281 }
```

```
        )

        ESXVirtualMachine MirrorViewSnp_vm (
            Critical = 0
            )

        MirrorViewSnap MirrorViewSnp_local (
            Critical = 0
            StorageGrpName = aaVMWare
            TargetResName = vm_mirrorview
            LocalArraySPNames = { "cx600c1.veritas.com",
            "cx600c2.veritas.com" }
            )

        MirrorViewSnp_vm requires MirrorViewSnp_local

    group test_vm1 (
        SystemList = { labpc281 = 0, labpc282 = 1 }
        )

        ESXVirtualMachine esxVM_test_vm1 (
            CfgFile =
            "/vmfs/volumes/456faef2-496a64fe-d007-000e0cb60b24/test_vm/t
            est_vm.vmx"
            )

        VMFSVolume vmFSVol_test_vm1 (
            Volume = {
            /vmfs/volumes/456faef2-496a64fe-d007-000e0cb60b24" }
            )

        VSwitch vSwitch_test_vm1 (
            VirtualSwitch = vSwitch0
            )

        esxVM_test_vm1 requires vSwitch_test_vm1
        esxVM_test_vm1 requires vmFSVol_test_vm1
```

Running a fire drill on VMWare

This section contains procedures that are required to run a local fire drill for a VMWare guest that is configured as a resource under VCS control:

- Take and scan a new snapshot
- Identify and configure the new data stores
- Configure the new VM
- Run the fire drill

Take and scan a new snapshot

You must take a new snapshot and then scan it to update the data stores.

To take and scan a new snapshot

1 Online the MirrorviewSnap agent.
  This action destroys the old snapshot and takes a new one.

2 From the VI client on the ESX server and after the MirrorViewSnap resource is online, rescan the storage adapters. Ensure that you scan for both new storage devices and new vmfs volumes.

3 Run the following command to make a copy of the configuration file.
  Enter the command on one line.
  ```
  cp /vmfs/volumes/UID/snapshot_vm_name/vmx_file_name
  /vmfs/volumes/<UID>/snapshot_vm_name/vmx_file_name.orig
  ```

Identify and configure the new data stores

Next, you must identify the copies of the original data stores and configure them so that they can be used in a fire drill.

To identify and configure the new data stores

1 Run the following command to identify the newly discovered data stores that are copies of the originals:
  ```
  vdf /vmfs/volumes
  ```
  The command output specifies new data stores that correspond to each of the following:
  - Data store containing an operating system image
  - Data store containing application data
  - Data store that is used for swap space

2 Run the following command to register the newly-detected VM, which is a copy of the original VM.
  The new VM is the data store that contains the operating system image.
  Enter the command on one line.
  ```
  vmware-cmd -s register /vmfs/volumes/UID/snapshot vm name/
  vmx file name
  ```

3 Run the following command to ensure that the VM is registered:
  ```
  vmware-cmd -l
  ```

4 Run the following command to obtain the name of the parent VM of the MirrorViewSnap resource. The resource type of the parent is ESXVirtualMachine.
  ```
  hares -dep
  ```

5 Run the following three commands to set the CfgFile attribute of the parent VM to the one of the newly-discovered (snapshot) VMs:

```
haconf -makerw
```

This command makes the configuration file read-write.

```
hares -modify Parent_VM_resource_Name CfgFile
cfg_file_of_the_newly_discovered_VM
```

This command (entered on one line) changes the resource value.

```
haconf -dump -makero
```

This command makes the configuration file read-only.

6 Run the following command to change the DisplayName of the newly-discovered VM.

Enter the command on one line.

```
vmware-cmd /vmfs/volumes/UID/snapshot_vm_name/
vmx_file_name setconfig displayName new_display_name
```

If you have the VI client running, you can check to see if the new display name appears in the list of VMs.

7 Run the following three commands to change the signatures of the SCSI disks in the configuration file of the newly-discovered VM to reflect the new VM.

Enter each command on one line.

```
vmware-cmd /vmfs/volumes/UID/snapshot_vm_name/
vmx_file_name getconfig scsi0:0.present
```

The return value of this command should be true. Next, enter:

```
vmware-cmd /vmfs/volumes/UID/snapshot_vm_name/
vmx_file_name getconfig scsi0:0.filename
```

Next, enter:

```
getconfig(scsi<m>:<n>.filename) = [label_of_the_original_VM]
/original_VM_name/disk_name_in_original_config_file.vmdk
```

Next, enter:

```
vmware-cmd /vmfs/volumes/UID/snapshot_vm_name/
vmx_file_name setconfig scsi<m>:<n>.filename
[label_of_the_new_VM] /original_VM_name/
disk_name_in_original_config_file.vmdk
```

8 Run the following two commands to confirm the changes.

Enter each command on one line.

```
vmware-cmd /vmfs/volumes/<UID>/<snapshot vm name>/
<vmx file name> getconfig scsi0:0.filename
```

Next, enter:

```
getconfig(scsi<m>:<n>.filename) = [label_of_the_new_VM]
/original_VM_name/disk_name_in_original_config_file.vmdk
```

9 Change the MAC address of the adaptors in the configuration file of the newly-discovered VM.

Edit the .vmx file to change the MAC addresses. Ensure that you assign a unique MAC address to all available adaptors.

Configure the new VM

Next, you must configure the new VM to prepare it for a fire drill.

To configure the new VM to run a fire drill

1. Change the network interfaces for the new VM so that it is not connected to any public switches.
2. Change the ethernet<n>.networkName attribute for each interface.
   You must edit the .vmx file to make this change.
3. Reboot the new VM. This VM now comes up without any connections to any public network.
4. If required, stop any applications that start as a part of the VM startup.
   Symantec recommends that you change the services to be started manually instead of starting them automatically. You can change the service startup settings using the Cluster Management Console running in single-cluster mode. You should also make these changes for any linux guests.
5. Assign a new, unique IP address and host name to the new VM.
6. Shut down the new VM.
   Do not reboot the VM at this time.
7. If you want to connect the new VM to the internet, connect the VM to at least one public switch while it is shut down.

Run the fire drill

You are now ready to run the fire drill.

To run the fire drill

1. Power-on the new VM.
2. After the VM is running, manually start the applications that are under VCS control in the original VM.
   These applications come up using snapshot data.
3. Ensure the validity of your application by using it to perform tasks that are appropriate for the application.
   Being able to use the application normally indicates a successful fire drill and ensures that your replication data is valid. The snapshot is stored in the current state until you run the next fire drill.

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