



Mirroring

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Mirroring

Asynchronous mirroring

Concepts

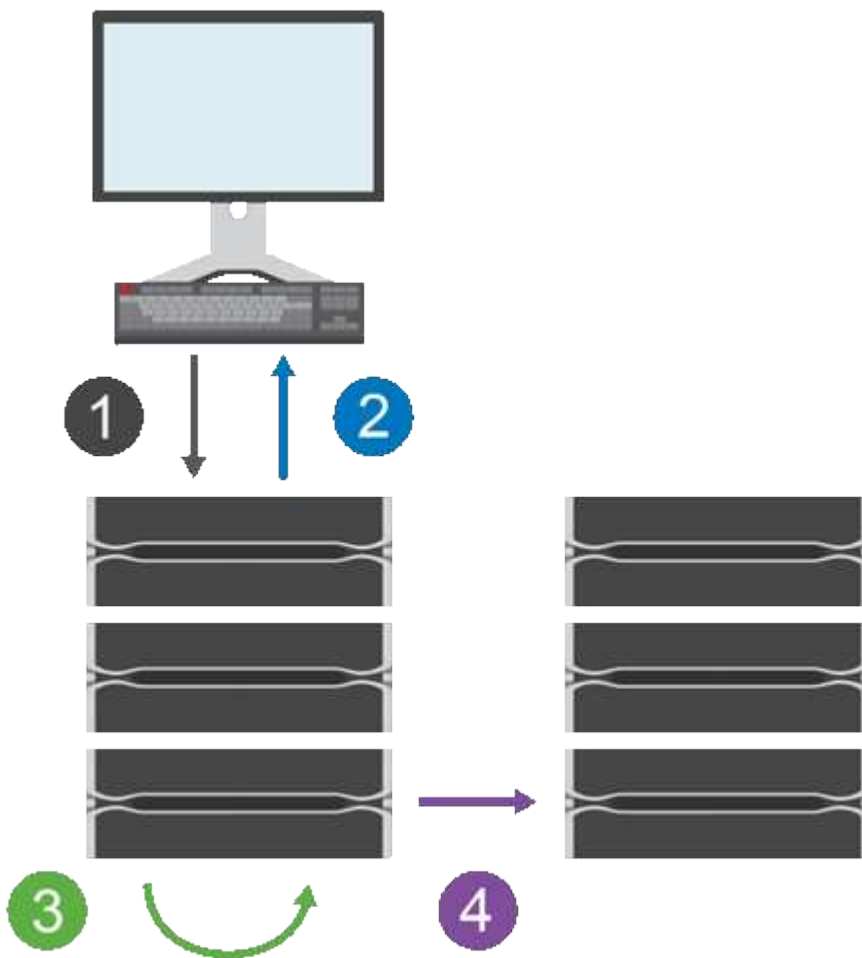
How asynchronous mirroring works

The Asynchronous Mirroring feature allows you to mirror data volumes from one storage array to another. This ensures continuous data availability and minimizes or avoids downtime that might result from data corruption or loss.

Asynchronous mirroring session

Asynchronous mirroring captures the state of the primary volume at a particular point in time and copies just the data that has changed since the last image capture. Asynchronous mirroring allows the primary site to be updated immediately and the secondary site to be updated as bandwidth allows. The information is cached and sent later, as network resources become available.

There are four primary steps in an active asynchronous mirroring session.



1. A write operation first occurs on the primary volume's storage array.

2. The status of the operation is returned to the host.
3. All changes on the primary volume are logged and tracked.
4. All changes are sent to the secondary volume's storage array as a background process.

These steps are repeated according to the defined synchronization intervals or the steps can be repeated manually if no intervals are defined.

Asynchronous mirroring transfers data to the remote site only at set intervals, so local I/O is not affected nearly as much by slow network connections. Because this transfer is not tied to the local I/O, it does not affect application performance. Therefore, asynchronous mirroring can use slower connections, such as iSCSI, and run across longer distances between the local and remote storage systems.

The primary and secondary volumes' storage arrays can run different OS versions. The minimum version supported is 7.84.



The Asynchronous Mirroring feature is not supported in a simplex configuration.

Mirror consistency groups and mirrored pairs

You create a mirror consistency group to establish the mirroring relationship between the local storage array and the remote storage array. The asynchronous mirroring relationship consists of a mirrored pair: a primary volume on one storage array and a secondary volume on another storage array.

The storage array containing the primary volume is usually located at the primary site and serves the active hosts. The storage array containing the secondary volume is usually located at a secondary site and holds a replica of the data. The secondary volume typically contains a backup copy of the data and is used for disaster recovery.

Synchronization settings

When you create a mirrored pair, you also define the synchronization priority and resynchronization policy that the mirrored pair uses to complete the resynchronization operation after a communication interruption.

When you create a mirror consistency group, you also define the synchronization priority and resynchronization policy for all mirrored pairs within the group. The mirrored pairs use the synchronization priority and resynchronization policy to complete the resynchronization operation after a communication interruption.

The primary and secondary volumes in a mirrored pair become unsynchronized when the primary volume's storage array is unable to write data to the secondary volume. This can be caused by the following issues:

- Network problems between the local and remote storage arrays.
- A failed secondary volume.
- Synchronization being manually suspended on the mirrored pair.
- Mirror group role conflict.

You can synchronize data on the remote storage array either manually or automatically.

Reserved capacity and asynchronous mirroring

Reserved capacity is used to keep track of differences between the primary and secondary volume when synchronization is not occurring. It also keeps track of synchronization statistics for each mirrored pair.

Each volume in a mirrored pair requires its own reserved capacity.

Reasons for using asynchronous mirroring

Asynchronous mirroring is ideal for satisfying the demand for non-stop operations and, in general, is far more network efficient for periodic processes, such as backup and archive. The reasons for using asynchronous mirroring include the following:

- Remote backup consolidation.
- Protect against local or wide-area disasters.
- Application development and testing on a point-in-time image of live data.

Asynchronous mirroring terminology

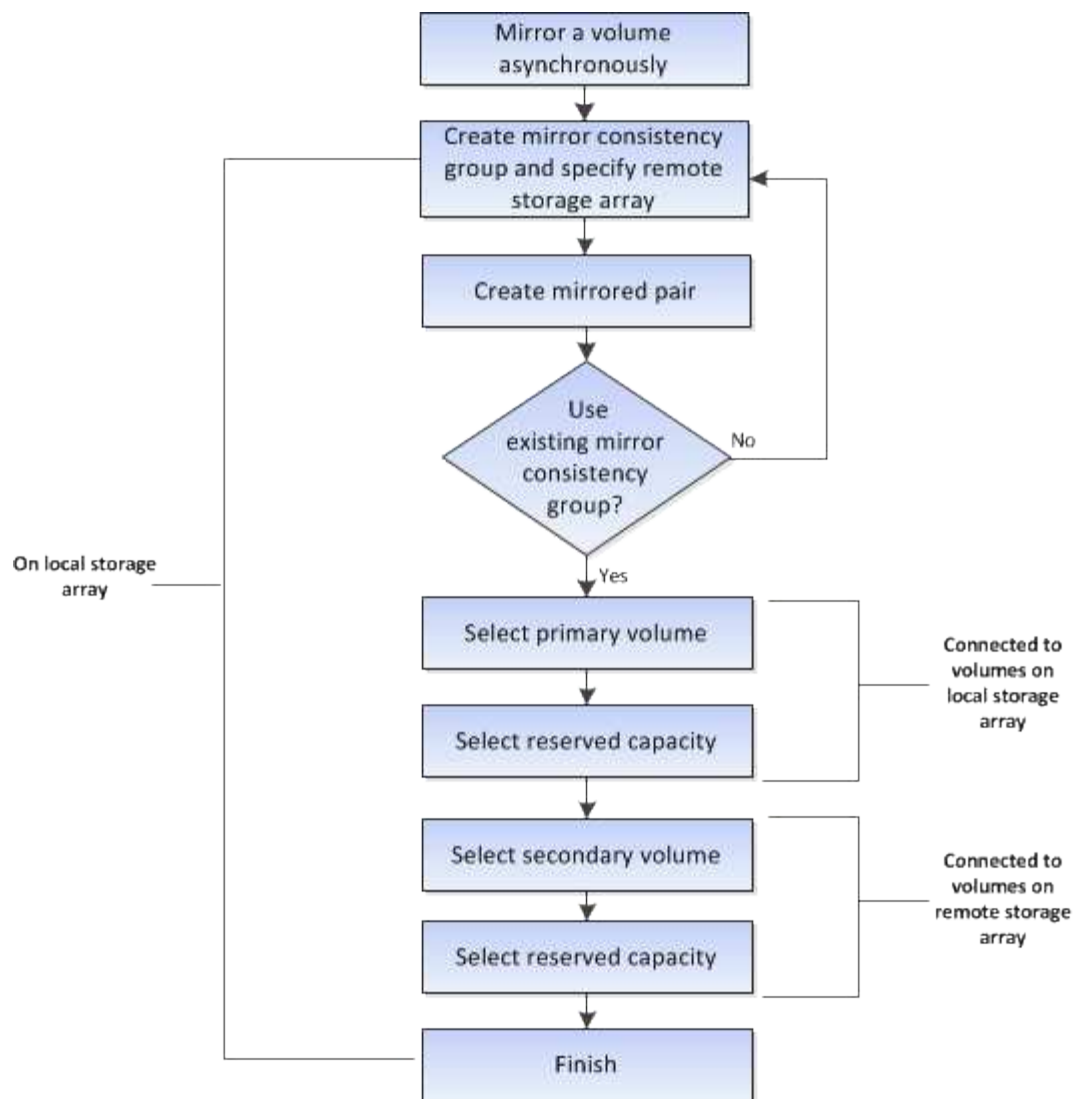
Learn how the asynchronous mirroring terms apply to your storage array.

Term	Description
Local storage array	<p>The local storage array is the storage array that you are acting upon.</p> <p>When you see Primary in the Local Role column, it indicates that the storage array contains the volume that holds the primary role in the mirror relationship. When you see Secondary in the Local Role column, it indicates that the storage array contains the volume that holds the secondary role in the mirror relationship.</p>
Mirror consistency group	<p>A mirror consistency group is a container for one or more mirrored pairs. For asynchronous mirroring operations, you must create a mirror consistency group.</p>
Mirrored pair	<p>A mirrored pair is comprised of two volumes, a primary volume and a secondary volume.</p> <p>In asynchronous mirroring, a mirrored pair always belongs to a mirror consistency group. Write operations are performed first to the primary volume and then replicated to the secondary volume. Each mirrored pair in a mirror consistency group share the same synchronization settings.</p>
Primary volume	<p>The primary volume of a mirrored pair is the source volume to be mirrored.</p>
Remote storage array	<p>The remote storage array is usually designated as the secondary site, which usually holds a replica of the data in a mirroring configuration.</p>

Term	Description
Reserved capacity	Reserved capacity is the physical allocated capacity that is used for any copy service operation and storage object. It is not directly readable by the host.
Role change	Role change is assigning the primary role to the secondary volume and vice versa.
Secondary volume	The secondary volume of a mirrored pair is usually located at a secondary site and holds a replica of the data.
Synchronization	Synchronization occurs at initial synchronization between the local storage array and the remote storage array. Synchronization also occurs when the primary and secondary volumes become unsynchronized after a communication interruption. When the communication link is working again, any unreplicated data is synchronized to the secondary volume's storage array.

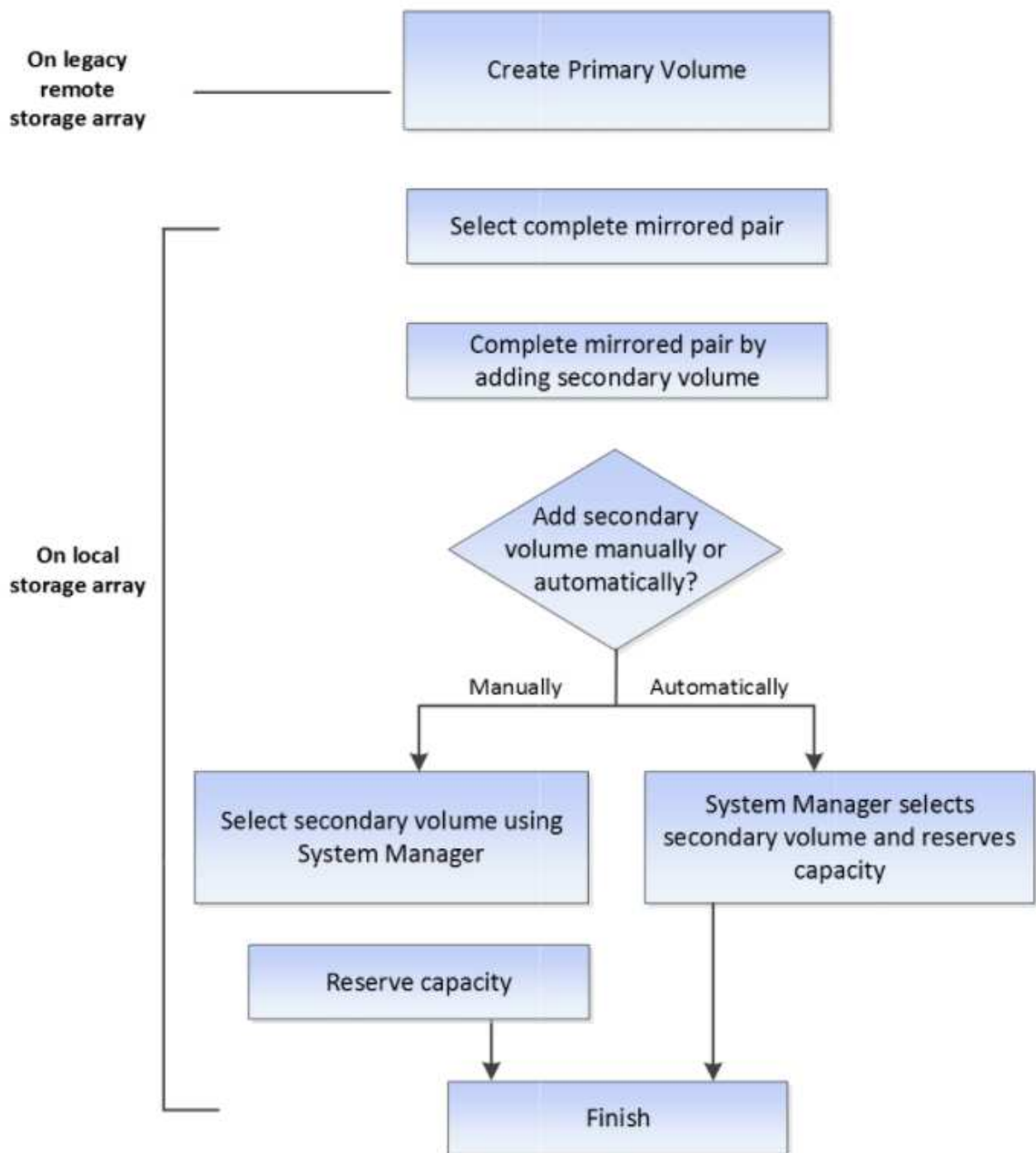
Workflow for mirroring a volume asynchronously

In System Manager, you can mirror a volume asynchronously by following these steps.



Workflow for completing a mirrored pair for primary volumes on a legacy system that is not managed with System Manager

If you created a primary volume on a legacy system that is not managed with System Manager, you can create the secondary volume with SANtricity System Manager.



Requirements for using asynchronous mirroring

If you plan to use the Asynchronous Mirroring feature, keep the following requirements in mind.

SANtricity Unified Manager

To use asynchronous mirroring, the following conditions must be set up:

- The Web Services Proxy service is running.
- SANtricity Unified Manager is running on your local host through an HTTPS connection.
- Each controller in both the primary array and secondary array must have an Ethernet management port configured and must be connected to your network.
- SANtricity Unified Manager is showing valid SSL certificates for the storage array. You can accept a self-signed certificate or install your own security certificate using Unified Manager and navigating to **Certificate > Certificate Management**.
- SANtricity System Manager is launched from a Unified Manager.
- You must have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click **Launch** to open the browser-based SANtricity System Manager.

Storage arrays

- You must have two storage arrays.
- Each controller in both the primary array and secondary array must have an Ethernet management port configured and must be connected to your network.
- Each storage array must have two controllers.
- The primary and secondary volumes' storage arrays can run different OS versions. The minimum version supported is 7.84.
- You must know the password for the local and remote storage arrays.
- You must have enough free capacity on the remote storage array to create a secondary volume equal to or greater than the primary volume that you want to mirror.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric or iSCSI interface.

Supported hardware configurations and connectivity requirements

- Asynchronous mirroring is supported only in dual-controller hardware configurations.
- Communication for the Asynchronous Mirroring feature is supported only on controllers with Fibre Channel (FC) or iSCSI host ports. The feature uses one of the host ports on each controller on both the local storage array and the remote storage array.
- If storage arrays are connected with both FC connections and iSCSI connections, one asynchronous mirror group can be mirrored over FC and another asynchronous mirror group can be mirrored over iSCSI.

Mirrored volume candidates

- RAID level, caching parameters, and segment size can be different on the primary and secondary volumes of an asynchronous mirrored pair.
- The secondary volume must be at least as large as the primary volume.
- A volume can participate in only one mirror relationship.

Reserved capacity

- A reserved capacity volume is required for a primary volume and for a secondary volume in a mirrored pair for logging write information to recover from controller resets and other temporary interruptions.
- Because both the primary volume and the secondary volume in a mirrored pair require additional reserved capacity, you must ensure that you have free capacity available on both storage arrays in the mirror

relationship.

Drive Security feature

- If you are using secure-capable drives, the primary volume and the secondary volume must have compatible security settings. This restriction is not enforced; therefore, you must verify it yourself.
- If you are using secure-capable drives, the primary volume and the secondary volume should use the same drive type. This restriction is not enforced; therefore, you must verify it yourself.
- If you are using Data Assurance (DA), the primary volume and the secondary volume must have the same DA settings.

Considerations for setting up asynchronous mirroring

To ensure a successful configuration and set up, keep in mind some key considerations as part of your planning.

Launch SANtricity Unified Manager

- Each controller in both the primary array and secondary array must have an Ethernet management port configured and must be connected to your network.
- Asynchronous mirroring is configured by opening SANtricity Unified Manager. Any mirroring relationship requires that both the local and remote storage systems are discovered by and listed in SANtricity Unified Manager.
- You must have the browser-based SANtricity Unified Manager installed, and have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.

Activating

Before using asynchronous mirroring, you must activate it on each storage array that participates in mirroring operations. Activation can be done through the CLI, REST API, or management graphical user interface (GUI).

- For systems managed by SANtricity System Manager (E2800, E5700, EF570), no separate activation step is needed; activation occurs behind the scenes while mirror groups/pairs are being set up.
- For systems managed by SANtricity Storage Manager (E2700, E5600, EF560), asynchronous mirroring is activated using the GUI on the legacy system that is not managed by SANtricity System Manager. If using iSCSI for asynchronous mirroring, the activation step is not needed.

Web services certificates and recommended browsers

• Trusted certificates

For mirroring involving systems managed by SANtricity System Manager, it is recommended to import the trusted certificates for the web services in SANtricity Unified Manager that allow the storage systems to authenticate with the web server. The steps within SANtricity Unified Manager are as follows:

- a. Generate a certificate signing request (CSR) for the machine where SANtricity Unified Manager is installed.
- b. Send the CSR to a certificate authority (CA).
- c. When the CA sends back the signed certificates, import in Unified Manager.

• Self-signed certificates

Self-signed certificates can also be used. If the administrator attempts to configure mirroring without importing signed certificates, SANtricity System Manager displays an error dialog box that allows the administrator to accept the self-signed certificate. In this case, using the latest version of Chrome or Firefox as the browser is recommended.

You can accept a self-signed certificate or install your own security certificate using Unified Manager and navigating to **Certificate > Certificate Management**.

Supported connections

Asynchronous mirroring can use either FC or iSCSI connections, or both for communication between local and remote storage systems. At the time of creating a mirror consistency group (also known as asynchronous mirror group), the administrator can select either FC or iSCSI for that group if both are connected to the remote storage array. There is no failover from one channel type to the other.

Asynchronous mirroring uses the storage array's host-side I/O ports to convey mirrored data from the primary side to the secondary side.

• Mirroring through a Fibre Channel (FC) interface

Each controller of the storage array dedicates its highest numbered FC host port to mirroring operations.

If the controller has both base FC ports and host interface card (HIC) FC ports, the highest numbered port is on an HIC. Any host logged on to the dedicated port is logged out, and no host login requests are accepted. I/O requests on this port are accepted only from controllers that are participating in mirroring operations.

The dedicated mirroring ports must be attached to an FC fabric environment that supports the directory service and name service interfaces. In particular, FC-AL and point-to-point are not supported as connectivity options between the controllers that are participating in mirror relationships.

• Mirroring through an iSCSI interface

Unlike FC, iSCSI does not require a dedicated port. When asynchronous mirroring is used in iSCSI environments, it is not necessary to dedicate any of the storage array's front-end iSCSI ports for use with asynchronous mirroring; those ports are shared for both asynchronous mirror traffic and host-to-array I/O connections.

The controller maintains a list of remote storage systems with which the iSCSI initiator attempts to establish a session. The first port that successfully establishes an iSCSI connection is used for all subsequent communication with that remote storage array. If communication fails, a new session is attempted using all available ports.

iSCSI ports are configured at the array level on a port-by-port basis. Intercontroller communication for configuration messaging and data transfer uses the global settings, including settings for:

- VLAN: Both local and remote systems must have the same VLAN setting to communicate
- iSCSI listening port
- Jumbo frames
- Ethernet priority



The iSCSI intercontroller communication must use a host connect port and not the management Ethernet port.

Asynchronous mirroring uses the storage array's host-side I/O ports to convey mirrored data from the primary side to the secondary side. Because asynchronous mirroring is intended for higher-latency, lower-cost networks, iSCSI (and thus TCP/IP-based) connections are a good fit for it. When asynchronous mirroring is used in iSCSI environments, it is not necessary to dedicate any of the array's front-end iSCSI ports for use with asynchronous mirroring; those ports are shared for both asynchronous mirror traffic and host-to-array I/O connections

Asynchronous mirror status

The mirror status defines the state of mirror consistency groups and mirrored volume pairs.

Status for mirror consistency groups

Status	Description
Synchronizing (initial sync)	<p>The progress of the initial data synchronization that has been completed between the mirrored volume pairs.</p> <p>During an initial synchronization, the volumes can transition to the following states: Degraded/Failed/Optimal/Unknown.</p>
Synchronizing (interval sync)	<p>The progress of the periodic data synchronization that has been completed between the mirrored volume pairs.</p>
System suspended	<p>Storage system-suspended synchronization of data on all mirrored pairs at the mirror consistency group level.</p> <p>At least one mirrored pair in the mirror consistency group is in a Stopped or Failed state.</p>
User suspended	<p>User-suspended synchronization of data on all mirrored pairs at the mirror consistency group level.</p> <p>This state helps to reduce any performance impact to the host application that might occur while any changed data on the local storage array is copied to the remote storage array.</p>
Paused	<p>Data synchronization process has temporarily paused due to an error accessing the remote storage array.</p>

Status	Description
Orphan	<p>An orphaned mirrored pair volume exists when a member volume in a consistency mirror group has been removed on one side of the consistency mirror group (either the primary side or secondary side) but not on the other side.</p> <p>Orphaned mirrored pair volumes are detected when inter-array communication is restored and the two sides of the mirror configuration reconcile mirror parameters.</p> <p>You can remove a mirrored pair to correct an orphaned mirrored pair state.</p>
Role change pending/in-progress	<p>A role change between the mirror consistency groups is pending or in progress.</p> <p>The role reversal change (to either a primary role or secondary role) affects all asynchronous mirrored pairs within the selected mirror consistency group.</p> <p>You can cancel a pending role change, but not an in-progress role change.</p>
Role conflict	<p>A role conflict occurred between mirror consistency groups due to a communication problem between the local storage array and the remote storage array during a role change operation.</p> <p>When the communication problem has been resolved, a Role Conflict occurs. Use the Recovery Guru to recover from this error.</p> <p>A forced promotion is not allowed when resolving a role conflict.</p>

Status for mirrored pairs

A mirrored pair's status indicates whether the data on the primary volume and on the secondary volume is synchronized.

Status	Description
Synchronizing	<p>The progress of initial or periodic data synchronization that has been completed between the mirrored pairs.</p> <p>There are two types of synchronization: initial synchronization and periodic synchronization. The initial synchronization progress is also displayed in the Long Running Operations dialog box.</p>

Status	Description
Optimal	The volumes in the mirrored pair are synchronized, which indicates that the connection between the storage arrays is operational and each volume is in the desired working condition.
Incomplete	<p>The asynchronous mirrored pair is incomplete on the remote storage array because the mirrored pair creation sequence was initiated on a storage array that is not supported with SANtricity System Manager and the mirrored pair has not been completed on the secondary.</p> <p>The mirrored pair creation process is complete when a volume is added to the mirror consistency group on the remote storage array. This volume becomes the secondary volume in the asynchronous mirrored pair.</p> <p>The mirrored pair completes automatically if the remote storage array is managed by SANtricity System Manager.</p>
Failed	The asynchronous mirroring operation is unable to operate normally due to a failure with the primary volumes, secondary volumes, or the mirror reserved capacity.
Orphan	<p>An orphaned mirrored pair volume exists when a member volume in a consistency mirror group has been removed on one side of the consistency mirror group (either the primary side or secondary side) but not on the other side.</p> <p>Orphaned mirrored pair volumes are detected when communication is restored between the two storage arrays and the two sides of the mirror configuration reconcile mirror parameters.</p> <p>You can remove a mirrored pair to correct an orphaned mirrored pair state.</p>
Stopped	The mirrored pair is in a Stopped state because the mirror consistency group is in a system-suspended state.

Volume ownership

You can change the preferred controller owner in a mirrored pair.

If the primary volume of the mirrored pair is owned by controller A, then the secondary volume will also be owned by controller A of the remote storage array. Changing the primary volume's owner will automatically

change the owner of the secondary volume to ensure that both volumes are owned by the same controller. Current ownership changes on the primary side automatically propagate to corresponding current ownership changes on the secondary side.

For example, a primary volume is owned by controller A, and then you change the controller owner to controller B. In this case, the next remote write changes the controller owner of the secondary volume from controller A to B. Because controller ownership changes on the secondary side are controlled by the primary side, they do not require any special intervention by the storage administrator.

Controller resets

A controller reset causes a volume ownership change on the primary side from the preferred controller owner to the alternate controller in the storage array.

Sometimes a remote write is interrupted by a controller reset or a storage array power cycle before it can be written to the secondary volume. The controller does not need to perform a full synchronization of the mirrored pair in this case.

When a remote write has been interrupted during a controller reset, the new controller owner on the primary side reads information stored in a log file in the reserved capacity volume of the preferred controller owner. The new controller owner then copies the affected data blocks from the primary volume to the secondary volume, eliminating the need for a full synchronization of the mirrored volumes.

Role change of a mirror consistency group

You can change the role between mirrored pairs in a mirror consistency group. You can do this by demoting the primary mirror consistency group to the secondary role, or by promoting the secondary mirror consistency group to the primary role.

Review the following information about the role change operation:

- The role change affects all mirrored pairs within the selected mirror consistency group.
- When a mirror consistency group is demoted to the secondary role, all the mirrored pairs within that mirror consistency group are also demoted to the secondary role and vice versa.
- When the primary mirror consistency group is demoted to the secondary role, hosts that have been assigned to the member volumes within that group no longer have write access to them.
- When a mirror consistency group is promoted to the primary role, any hosts that are accessing the member volumes within that group are now able to write to them.
- If the local storage array is unable to communicate with the remote storage array, you can force the role change on the local storage array.

Force role change

You can force a role change between mirror consistency groups when a communication problem between the local storage array and the remote storage array is preventing the promotion of the member volumes within the secondary mirror consistency group or the demotion of the member volumes within the primary mirror consistency group.

You can force the mirror consistency group on the secondary side to transition to the primary role. Then the recovery host is able to access the newly promoted member volumes within that mirror consistency group, and business operations can continue.

When is a forced promotion allowed and not allowed?

Forced promotion of a mirror consistency group is allowed only if all member volumes of the mirror consistency group have been synchronized and have consistent recovery points.

Forced promotion of a mirror consistency group is not allowed under the following conditions:

- Any of the member volumes of a mirror consistency group are in the process of an initial synchronization.
- Any of the member volumes of a mirror consistency group do not have a point-in-time image of the recovery point (for example, due to a full reserved capacity error).
- The mirror consistency group does not contain member volumes.
- The mirror consistency group is in the Failed, Role-Change-Pending, or Role-Change-In-Progress states, or if any of the associated member volumes or reserved capacity volumes are failed.

Mirror group role conflict

When a communication problem between the local and remote storage arrays has been resolved, a Mirror Group Role Conflict condition occurs. Use the Recovery Guru to recover from this error. A forced promotion is not allowed when resolving a dual-role conflict.

To avoid the Mirror Group Role Conflict condition and subsequent recovery steps, wait until the connection between the storage arrays is operational to force the role change.

Role change in-progress state

If two storage arrays in a mirroring configuration become disconnected, and the primary side of a mirror consistency group is force demoted to a secondary role, and the secondary side of a mirror consistency group is force promoted to a primary role, then when communication is restored, the mirror consistency groups on both storage arrays are placed in the Role-Change-In-Progress state.

The system will complete the role change process by transferring the change logs, re-synchronizing, setting the mirror consistency group state back to a normal operating state, and continuing with periodic synchronizations.

How tos

Mirror volumes asynchronously

Create asynchronous mirrored volume

You mirror a volume asynchronously to maintain data at the remote storage array to be a point-in-time consistent copy of data at the local storage array. You do this by creating a mirror consistency group to establish the mirroring relationship between the two storage arrays, and then selecting the primary volume and secondary volume that you want to use in the mirror.

Before you begin

- The following conditions must be set up:
 - The Web Services Proxy service is running.
 - SANtricity Unified Manager is running on your local host through an HTTPS connection.
 - Each controller in both the primary array and secondary array must have an Ethernet management port

configured and must be connected to your network.

- SANtricity Unified Manager is showing valid SSL certificates for the storage array. You can accept a self-signed certificate or install your own security certificate using Unified Manager and navigating to **Certificate > Certificate Management**.
- SANtricity System Manager is launched from a Unified Manager.
- You must have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.
- You must know the password for the local and remote storage arrays.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric or iSCSI interface.

About this task

The process to mirror a volume asynchronously is a multi-step procedure:

- [Step 1: Create a mirror consistency group or select an existing one](#)
- [Step 2: Select the primary volume](#)
- [Step 3: Select the secondary volume](#)

A volume can participate in only one mirror relationship.

Step 1: Create a mirror consistency group or select an existing one

You create a mirror consistency group or select an existing one to establish the mirroring relationship between the local storage array and the remote storage array.

About this task

The number of mirror consistency group relationships and mirrored pair relationships that you can create depends on the hardware in your storage array.

Steps

1. Do one of the following actions to access the asynchronous mirroring sequence:
 - Select **Storage > Asynchronous Mirroring > Create Mirrored pair**.
 - Select **Storage > Volumes > Copy Services > Mirror a volume asynchronously**.
2. Either select an existing mirror consistency group or create a new one.

To create new mirror consistency group, do the following:

- a. Enter a unique name that best describes the data on the volumes that will be mirrored between the two storage arrays (for example, R&D Data).
- b. Select the remote storage array on which you want to establish a mirror relationship with the local storage array.



If your remote storage array is password protected, the system prompts for a password.

- c. Choose whether you want to resynchronize the mirrored pairs on the remote storage array either manually or automatically.
 - **Manual** — You must explicitly update the secondary point-in-time image using the Manual

Resynchronization menu option. Select this option to manually start resynchronization for all asynchronous mirrored pairs within the asynchronous mirror group.

- **Automatic** — Using the drop-down, specify the time from the beginning of the previous update to the beginning of the next update. To change the automatic synchronization interval from the default of every 10 minutes, edit the interval value, which is defined in minutes.

d. Click Create.

System Manager creates the mirror consistency group on the local storage array first and then creates the mirror consistency group on the remote storage array.



If System Manager successfully creates the mirror consistency group on the local storage array, but fails to create it on the remote storage array, it automatically deletes the mirror consistency group from the local storage array. If an error occurs while System Manager is attempting to delete the mirror consistency group, you must manually delete it.

3. Select **Next** and go to [Step 2: Select the primary volume](#).

Step 2: Select the primary volume

You must select the primary volume that you want to use in the mirror relationship and allocate its reserved capacity. Any volumes added to the mirror consistency group on the local storage array will hold the primary role in the mirror relationship.

Steps

1. Select an existing volume that you want to use as the primary volume in the mirror, and then click **Next** to allocate the reserved capacity.
2. Allocate the reserved capacity for the primary volume you selected. Do one of the following actions:
 - **Accept the default settings** — Use this recommended option to allocate the reserved capacity for the primary volume with the default settings.
 - **Allocate your own reserved capacity settings to meet your data storage needs related to asynchronous mirroring** — Allocate the reserved capacity using the following guidelines.
 - The default setting for reserved capacity is 20% of the capacity of the base volume, and usually this capacity is sufficient.
 - The capacity needed varies, depending on the frequency and size of I/O writes to the primary volume and how long you need to keep the capacity.
 - In general, choose a larger capacity for reserved capacity if one or both of these conditions exist:
 - You intend to keep the mirrored pair for a long period of time.
 - A large percentage of data blocks will change on the primary volume due to heavy I/O activity. Use historical performance data or other operating system utilities to help you determine typical I/O activity to the primary volume.
3. Select **Next** and go to [Step 3: Select the secondary volume](#).

Step 3: Select the secondary volume

You must select the secondary volume that you want to use in the mirror relationship and allocate its reserved capacity. Any volumes added to the mirror consistency group on the

remote storage array will hold the secondary role in the mirror relationship.

About this task

When you select a secondary volume on the remote storage array, the system displays a list of all the eligible volumes for that mirrored pair. Any volumes that are not eligible to be used do not display in that list.

Steps

1. Select an existing volume that you want to use as the secondary volume in the mirrored pair, and then click **Next** to allocate the reserved capacity.
2. Allocate the reserved capacity for the secondary volume you selected. Do one of the following actions:
 - **Accept the default settings** — Use this recommended option to allocate the reserved capacity for the secondary volume with the default settings.
 - **Allocate your own reserved capacity settings to meet your data storage needs related to asynchronous mirroring** — Allocate the reserved capacity using the following guidelines.
 - The default setting for reserved capacity is 20% of the capacity of the base volume, and usually this capacity is sufficient.
 - The capacity needed varies, depending on the frequency and size of I/O writes to the primary volume and how long you need to keep the capacity.
 - In general, choose a larger capacity for reserved capacity if one or both of these conditions exist:
 - You intend to keep the mirrored pair for a long period of time.
 - A large percentage of data blocks will change on the primary volume due to heavy I/O activity. Use historical performance data or other operating system utilities to help you determine typical I/O activity to the primary volume.
3. Select **Finish** to complete the asynchronous mirroring sequence.

Results

System Manager performs the following actions:

- Begins initial synchronization between the local storage array and the remote storage array.
- If the volume being mirrored is a thin volume, only the provisioned blocks (allocated capacity rather than reported capacity) are transferred to the secondary volume during the initial synchronization. This reduces the amount of data that must be transferred to complete the initial synchronization.
- Creates the reserved capacity for the mirrored pair on the local storage array and on the remote storage array.

Complete mirrored pair for primary volumes created on legacy system

If you created a primary volume on a legacy storage array that cannot be managed by SANtricity System Manager, you can create the secondary volume on this array with SANtricity System Manager.

About this task

You can perform asynchronous mirroring between legacy arrays that use a different interface and newer arrays that can be managed by SANtricity System Manager.

- If you are mirroring between two storage arrays that use SANtricity System Manager, you can skip this task because you already completed the mirrored pair in the mirrored pair creation sequence.

- Perform this task on the remote storage array.

Steps

1. Select **Storage > Asynchronous Mirroring**.
2. Select the **Mirrored Pair** tab.

The Mirrored Pairs table appears and displays all the mirrored pairs associated with the storage array.

3. Find the mirrored pair volume with a status of Incomplete, and then click the **Complete mirrored pair** link displayed in the mirrored pair column.
4. Choose whether you want to complete the mirrored pair creation sequence automatically or manually by selecting one of the following radio buttons:
 - **Automatic** — Create new secondary volume.

Accept the default settings for the remote side of the mirrored pair by selecting an existing pool or volume group where you want to create the secondary volume. Use this recommended option to allocate the reserved capacity for the secondary volume with the default settings.

- **Manual** — Select an existing volume.

Define your own parameters for the secondary volume.

- i. Click **Next** to select the secondary volume.
- ii. Select an existing volume that you want to use as the secondary volume and then click **Next** to allocate the reserved capacity.
- iii. Allocate the reserved capacity. Do one of the following:
 - Accept the default settings.

The default setting for reserved capacity is 20% of the capacity of the base volume, and usually this capacity is sufficient.

- Allocate your own reserved capacity settings to meet your data storage needs related to asynchronous mirroring.

The capacity needed varies, depending on the frequency and size of I/O writes to the primary volume and how long you need to keep the capacity. In general, choose a larger capacity for reserved capacity if one or both of these conditions exist:

- You intend to keep the mirrored pair for a long period of time.
- A large percentage of data blocks will change on the primary volume due to heavy I/O activity. Use historical performance data or other operating system utilities to help you determine typical I/O activity to the primary volume.

5. Select **Complete**.

Results

SANtricity System Manager performs the following actions:

- Creates the secondary volume on the remote storage array and allocates reserved capacity for the remote side of the mirrored pair.
- Begins initial synchronization between the local storage array and the remote storage array.

- If the volume being mirrored is a thin volume, only the allocated blocks are transferred to the secondary volume during the initial synchronization. This transfer reduces the amount of data that must be transferred to complete the initial synchronization.
- Creates the reserved capacity for the mirrored pair on the local storage array and on the remote storage array.

Manage mirror consistency groups

Test communication for mirror consistency groups

You can test the communication link to diagnose possible communication problems between the local storage array and the remote storage array associated with a mirror consistency group.

Before you begin

The mirror consistency group that you want to test must exist on the local and remote storage arrays.

About this task

You can run four different tests:

- **Connectivity** — Verifies that the two controllers have a communication path. The connectivity test sends an inter-array message between the storage arrays, and then validates that the corresponding mirror consistency group on the remote storage array exists. It also validates that the member volumes of the mirror consistency group on the remote storage array match the member volumes of the mirror consistency group on the local storage array.
- **Latency** — Sends a SCSI Test Unit command to each mirrored volume on the remote storage array associated with the mirror consistency group to test the minimum, average, and maximum latency.
- **Bandwidth** — Sends two inter-array messages to the remote storage array to test the minimum, average, and maximum bandwidth as well as the negotiated link speed of the port on the array performing the test.
- **Port connections** — Shows the port that is being used for mirroring on the local storage array and the port that is receiving the mirrored data on the remote storage array.

Steps

1. Select **Storage > Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab, and then select the mirror consistency group that you want to test.
3. Select **Test Communication**.

The Test Communication dialog box appears.

4. Select one or more communication tests to perform between the local and remote storage arrays associated with the selected mirror consistency group, and then click **Test**.
5. Review the information displayed in the Results window.

Communication Test Status	Description
Normal with no errors	The mirror consistency group is communicating correctly.

Communication Test Status	Description
Passed status (but not normal)	Check possible network or connection problems and retry the test.
Failed status	The reason for the failure is indicated. Refer to the Recovery Guru to correct the problem.
Port connection error	The reason may be that the local storage array is not connected or the remote storage array cannot be contacted. Refer to the Recovery Guru to correct the problem.

After you finish

After the communication test completes, this dialog box shows a Normal status, a Passed status, or a Failed status.

If the communication test returns a Failed status, the test continues to run after you close this dialog box until communication between the mirror consistency groups is restored.

Suspend or resume synchronization for mirror consistency group

You can suspend or resume the synchronization of data on all mirrored pairs within a mirror consistency group, which is more efficient than suspending or resuming synchronization on individual mirrored pairs.

About this task

Suspending and resuming synchronization on groups helps to reduce any performance impact to the host application, which might occur while any changed data on the local storage array is copied to the remote storage array.

The state of the mirror consistency group and its mirrored pairs stay suspended until you use the Resume option to resume synchronization activity.

Steps

1. Select **Storage > Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirrored Consistency Group table appears and displays all the mirror consistency groups associated with the storage array.

3. Select the mirror consistency group that you want to suspend or resume, and then select either **More > Suspend** or **More > Resume**.

The system displays a confirmation.

4. Select **Yes** to confirm.

Results

System Manager performs the following actions:

- Either suspends or resumes data transfer between all mirrored pairs in a mirror consistency group without removing the mirror relationship.
- Logs any data that was written to the primary side of the mirror consistency group while the mirror group is suspended and writes the data automatically to the secondary side of the mirror consistency group when the mirror group is resumed. A full synchronization is not required.
- For a *suspended* mirror consistency groups, displays user-suspended in the Mirror Consistency Groups table.
- For a *resumed* mirror consistency group, data written to the primary volumes while the mirror consistency group was suspended is written to the secondary volumes immediately. Periodic synchronization resumes if an automatic synchronization interval has been set.

Change synchronization settings for a mirror consistency group

You can change the synchronization settings and warning thresholds that the mirror consistency group on the local storage array uses when data is initially synchronized or when data is re-synchronized during asynchronous mirroring operations.

About this task

Changing the synchronization settings affects the synchronization operations of all mirrored pairs within the mirror consistency group.

Steps

1. Select **Storage › Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirrored Consistency Group table appears and displays all the mirror consistency groups associated with the storage array.

3. Select the mirror consistency group that you want to edit, and then select **More › Edit settings**.

The system displays the Edit Settings dialog box.

4. Edit the synchronization and alert settings as appropriate, and then click **Save**.

Field details

Field	Description
Synchronize the mirrored pairs...	<p>Specify whether you want to synchronize the mirrored pairs on the remote storage array either manually or automatically.</p> <ul style="list-style-type: none">• Manually – Select this option to manually synchronize the mirrored pairs on the remote storage array.• Automatically, every – Select this option to automatically synchronize the mirrored pairs on the remote storage array by specifying the time interval from the beginning of the previous update to the beginning of the next update. The default interval is 10 minutes.
Alert me...	<p>If you set the synchronization method to occur automatically, set the following alerts:</p> <ul style="list-style-type: none">• Synchronization – Set the length of time after which System Manager sends an alert that synchronization has not completed.• Remote recovery point – Set a time limit after which System Manager sends an alert indicating that the recovery point data on the remote storage array is older than your defined time limit. Define the time limit from the end of the previous update.• Reserved capacity threshold – Define a reserved capacity amount at which System Manager sends an alert that you are nearing the reserved capacity threshold. Define the threshold by percentage of the capacity remaining.

Result

System Manager changes the synchronization settings for every mirrored pair in the mirror consistency group.

Re-synchronize mirror consistency group manually

You can manually start re-synchronization for all mirrored pairs within a mirror consistency group.

Steps

1. Select **Storage > Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirror Consistency Group table appears and displays all the mirror consistency groups associated with the storage array.

3. Select the mirror consistency group that you want to re-synchronize, and then select **More › Manually resynchronize**.

The system displays a confirmation.

4. Select **Yes** to confirm.

Results

The system performs the following actions:

- Initiates re-synchronization of data on all of the mirrored pairs within the selected mirror consistency group.
- Updates modified data from the local storage array to the remote storage array.

View unsynchronized data amount between mirror consistency groups

You can view the amount of unsynchronized data between the mirror consistency groups on the local storage array and on the remote storage array. While the mirror consistency group is in an Unsynchronized status, no mirroring activity takes place.

About this task

You can perform this task when the selected mirror consistency group contains mirrored pairs and when synchronization is not currently in-progress.

Steps

1. Select **Storage › Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirror Consistency Group table appears and displays all the mirror consistency groups associated with the storage array.

3. Click **More › View unsynchronized data amount**.

If unsynchronized data exists, the table values reflect this. The data amount column lists the unsynchronized data amount in MiB.

Update remote IP address

You can update the iSCSI IP address for your remote storage array to re-establish connection with the local storage array.

Before you begin

Both the local storage array and the remote storage array must be configured for asynchronous mirroring using an iSCSI connection.

Steps

1. Select **Storage › Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirror Consistency Group table displays all the mirror consistency groups associated with the storage array.

3. Select the mirror consistency group that you want to update, and then select **More › Update remote IP address**.

The system displays the Update Remote IP Address dialog box.

4. Select **Update** to update the iSCSI IP address for your remote storage array.

Result

The system resets the IP address of the remote storage array to re-establish connection with the local storage array.

Change mirror consistency group role to primary or secondary

You can change the role between mirror consistency groups for administrative purposes or in the event of a disaster on the local storage array.

About this task

Mirror consistency groups created on the local storage array hold the primary role. Mirror consistency groups created on the remote storage array hold the secondary role. You can either demote the local mirror consistency group to a secondary role or promote the remote mirror consistency group to a primary role.

Steps

1. Select **Storage › Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirror Consistency Group table appears and displays all the mirror consistency groups associated with the storage array.

3. Select the mirror consistency group for which you want to change the role, and then select **More › Change role to <Primary | Secondary ›**.

The system displays a confirmation.

4. Confirm that you want to change the role of the mirror consistency group, and then click **Change Role**.



The system displays the **Cannot Contact Storage Array** dialog box when a role change is requested, but the remote storage array cannot be contacted. Click Yes to force the role change.

Results

System Manager performs the following actions:

- The Mirror Consistency Group table displays the status "pending" or "in-progress" next to the mirror consistency group undergoing the role change. You can cancel a Role Change operation that is pending by clicking the Cancel link found within the table cell.
- If the associated mirror consistency group can be contacted, the roles between the mirror consistency groups change. System Manager promotes the secondary mirror consistency group to a primary role or demotes the primary mirror consistency group to a secondary role (depending on your selection). The role change affects all mirrored pairs within the selected mirror consistency group.

Delete mirror consistency group

You can delete mirror consistency groups that are no longer needed on the local storage array and on the remote storage array.

Before you begin

All mirrored pairs must be removed from the mirror consistency group.

Steps

1. Select **Storage › Asynchronous Mirroring**.
2. Select the **Mirror Consistency Groups** tab.

The Mirror Consistency Group table appears and displays all the mirror consistency groups associated with the storage array.

3. Select the mirror consistency group that you want to delete, and then select **Uncommon Tasks › Delete**.

The system displays a confirmation.

4. Select **Yes** to delete the mirror consistency group.

Results

System Manager performs the following actions:

- Deletes the mirror consistency group on the local storage array first, and then deletes the mirror consistency group on the remote storage array.
- Removes the mirror consistency group from the Mirror Consistency Group table.

After you finish

Occasionally, there may be instances where the mirror consistency group is successfully deleted from the local storage array, but a communication error prevents the mirror consistency group from being deleted from the remote storage array. In this case, you must access the remote storage array to delete the corresponding mirror consistency group.

Manage asynchronous mirrored pairs

Remove asynchronous mirror relationship

You remove a mirrored pair to remove the mirror relationship from the primary volume on the local storage array and the secondary volume on the remote storage array.

About this task

Review the following information about orphaned mirrored pairs:

- An orphaned mirrored pair exists when a member volume in a consistency mirror group has been removed on one side (either the local storage array side or the remote storage array side) but not on the other side.
- Orphaned mirrored pairs are detected when inter-array communication is restored and the two sides of the mirror configuration reconcile mirror parameters.
- You can remove a mirrored pair to correct an orphaned mirrored pair state.

Steps

1. Select **Storage > Asynchronous Mirroring**.
2. Select the **Mirrored Pair** tab.

The Mirrored Pairs table appears and displays all the mirrored pairs associated with the storage array.

3. Select the mirrored pair that you want to remove, and then click **Remove**.
4. Confirm that you want to remove the mirrored pair, and then click **Remove**.

Results

SANtricity System Manager performs the following actions:

- Removes the mirror relationship from the mirror consistency group on the local storage array and on the remote storage array, and deletes the reserved capacity.
- Returns the primary volume and the secondary volume to host-accessible, non-mirrored volumes.
- Updates the Asynchronous Mirroring tile with the removal of the asynchronous mirrored pair.

Increase reserved capacity

You can increase reserved capacity, which is the physically allocated capacity used for any copy service operation on a storage object. For snapshot operations, it is typically 40 percent of the base volume; for asynchronous mirroring operations, it is typically 20 percent of the base volume. Typically, you increase reserved capacity when you receive a warning that the storage object's reserved capacity is becoming full.

Before you begin

- The volume in the pool or volume group must have an Optimal status and must not be in any state of modification.
- Free capacity must exist in the pool or volume group that you want to use to increase capacity.

If no free capacity exists on any pool or volume group, you can add unassigned capacity in the form of unused drives to a pool or volume group.

About this task

You can increase reserved capacity only in increments of 4 GiB for the following storage objects:

- Snapshot group
- Snapshot volume
- Consistency group member volume
- Mirrored pair volume

Use a high percentage if you believe the primary volume will undergo many changes or if the lifespan of a particular copy service operation will be very long.



You cannot increase reserved capacity for a snapshot volume that is read-only. Only snapshot volumes that are read-write require reserved capacity.

Steps

1. Select **Storage > Pools & Volume Groups**.

2. Select the **Reserved Capacity** tab.
3. Select the storage object for which you want to increase reserved capacity, and then click **Increase Capacity**.

The Increase Reserved Capacity dialog box appears.

4. Use the spinner box to adjust the capacity percentage.

If free capacity does not exist on the pool or volume group that contains the storage object you selected, and the storage array has Unassigned Capacity, you can create a new pool or volume group. You can then retry this operation using the new free capacity on that pool or volume group.

5. Click **Increase**.

Results

System Manager performs the following actions:

- Increases the reserved capacity for the storage object.
- Displays the newly-added reserved capacity.

Change the reserved capacity settings for a mirrored pair volume

You can change the settings for a mirrored pair volume to adjust the percentage point at which System Manager sends an alert notification when the reserved capacity for a mirrored pair volume is nearing full.


Steps

1. Select **Storage > Pools & Volume Groups**.
2. Select the **Reserved Capacity** tab.
3. Select the mirrored pair volume that you want to edit, and then click **View/Edit Settings**.

The **Mirrored Pair Volume Reserved Capacity Settings** dialog box appears.

4. Change the reserved capacity settings for the mirrored pair volume as appropriate.

Field details

Setting	Description
Alert me when...	<p>Use the spinner box to adjust the percentage point at which System Manager sends an alert notification when the reserved capacity for a mirrored pair is nearing full.</p> <p>When the reserved capacity for the mirrored pair exceeds the specified threshold, System Manager sends an alert, allowing you time to increase reserved capacity.</p> <div><p>Changing the Alert setting for one mirrored pair changes the Alert setting for all mirrored pairs that belong to the same mirror consistency group.</p></div>

5. Click **Save** to apply your changes.

Deactivate asynchronous mirroring

You can deactivate asynchronous mirroring on the local and remote storage arrays to re-establish normal use of dedicated ports on the storage arrays.

Before you begin

- You must have deleted all mirror relationships. Verify that all mirror consistency groups and mirrored pairs have been deleted from the local and remote storage arrays.
- The local storage array and the remote storage array must be connected through a Fibre Channel fabric or iSCSI interface.

About this task

When you deactivate asynchronous mirroring, no mirror activity can occur on the local and remote storage arrays.

Steps

1. Select **Storage > Asynchronous Mirroring**.
2. Select **Uncommon Tasks > Deactivate**.

The system displays a confirmation.

3. Select **Yes** to confirm.

Results

- The controller's HBA host channels that were dedicated for asynchronous mirroring communication can now accept host read and write requests.
- None of the volumes in this storage array are able to participate in mirror relationships as either primary

volumes or secondary volumes.

FAQs

How does asynchronous mirroring differ from synchronous mirroring?

The Asynchronous Mirroring feature differs from the Synchronous Mirroring feature in one essential way: it captures the state of the source volume at a particular point in time and copies just the data that has changed since the last image capture.

With synchronous mirroring, the state of the primary volume is not captured at some point in time, but rather reflects all changes that were made on the primary volume to the secondary volume. The secondary volume is identical to the primary volume at every moment because, with this type of mirror, each time a write is done to the primary volume, a write is done to the secondary volume. The host does not receive an acknowledgment that the write was successful until the secondary volume is successfully updated with the changes that were made on the primary volume.

With asynchronous mirroring, the remote storage array is not fully synchronized with the local storage array, so if the application needs to transition to the remote storage array due to a loss of the local storage array, some transactions could be lost.

Comparison between mirroring features

Asynchronous Mirroring	Synchronous Mirroring
Replication method	
<ul style="list-style-type: none">• Point-in-Time <p>Mirroring is done on demand or automatically according to a user-defined schedule. Schedules can be defined at the granularity of minutes. The minimum time between syncs is 10 minutes.</p>	<ul style="list-style-type: none">• Continuous <p>Mirroring is automatically executed continuously, copying data from every host write.</p>
Reserved capacity	
<ul style="list-style-type: none">• Multiple <p>A reserved capacity volume is required for each mirrored pair.</p>	<ul style="list-style-type: none">• Single <p>Single reserved capacity volume is required for all mirrored volumes.</p>
Communication	
<ul style="list-style-type: none">• iSCSI and Fibre Channel <p>Supports iSCSI and Fibre Channel interfaces between storage arrays.</p>	<ul style="list-style-type: none">• Fibre Channel <p>Supports only Fibre Channel interfaces between storage arrays.</p>
Distance	
<ul style="list-style-type: none">• Unlimited <p>Support for virtually unlimited distances between the local storage array and the remote storage array, with the distance typically limited only by the capabilities of the network and the channel extension technology.</p>	<ul style="list-style-type: none">• Restricted <p>Typically must be within about 10 km (6.2 miles), of the local storage array to meet the latency and application performance requirements.</p>

Why can't I access my chosen mirroring feature?

To use either the Asynchronous Mirroring feature or the Synchronous Mirroring feature, you must have the SANtricity Unified Manager running on your local host through an HTTPS connection to discover the storage arrays that are mirroring-capable and to initiate the mirroring operation. From Unified Manager, you must select the storage array from which you want to mirror data from and then click Launch to open SANtricity System Manager.

To use the mirroring feature verify the following:

- The Web Services Proxy service is running.
- SANtricity Unified Manager is running on your local host through an HTTPS connection.
- SANtricity Unified Manager is showing valid SSL certificates for the storage array. You can accept a self-signed certificate or install your own security certificate using Unified Manager and navigating to **Certificate > Certificate Management**.
- SANtricity System Manager is launched from a Unified Manager.
- You must have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click **Launch** to open the browser-based SANtricity System Manager.

What do I need to know before creating a mirror consistency group?

You must have the browser-based SANtricity Unified Manager installed, and have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.

In addition, make sure of the following:

- You must have enough free capacity on the remote storage array to create a secondary volume equal to or greater than the primary volume that you want to mirror.
- You must have two storage arrays.
- Each storage array must have two controllers.
- You must know the password for the local and remote storage arrays.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric or iSCSI interface.

Asynchronous mirroring - What do I need to know before creating a mirrored pair?

Your storage array must contain at least one mirror consistency group.

In addition, make sure of the following:

- You must have enough free capacity on the remote storage array to create a secondary volume equal to or greater than the primary volume that you want to mirror.
- You must have two storage arrays.
- Each storage array must have two controllers.
- You must know the password for the local and remote storage arrays.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric or iSCSI interface.
- You must have the browser-based SANtricity Unified Manager installed, and have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.

What do I need to know before increasing my reserved capacity on a mirrored pair volume?

Typically, you should increase reserved capacity when you receive a warning that the

reserved capacity for a mirrored pair is becoming full. You can increase reserved capacity only in increments of 8 GiB.

For asynchronous mirroring operations, reserved capacity is typically 20 percent of the base volume. Choose a larger capacity for reserved capacity if one or both of these conditions exist:

- You intend to keep the mirrored pair for a long period of time.
- A large percentage of data blocks will change on the primary volume due to heavy I/O activity. Use historical performance data or other operating system utilities to help you determine typical I/O activity to the primary volume.

You can increase the reserved capacity for a mirrored pair by performing one of these actions:

- Adjust the capacity percentage for a mirrored pair volume by selecting **Storage > Pools and Volumes Groups** and then clicking the Reserved Capacity tab.
- Create a new volume using free capacity that is available on a pool or volume group.

If no free capacity exists on any pool or volume group, you can add unconfigured capacity in the form of unused drives to a pool or volume group.

Why can't I increase reserved capacity with my requested amount?

You can increase reserved capacity only in increments of 4 GiB.

Review the following guidelines:

- You must have sufficient free capacity in the pool or volume group so it can be expanded if necessary.

If no free capacity exists on any pool or volume group, you can add unassigned capacity in the form of unused drives to a pool or volume group.

- The volume in the pool or volume group must have an Optimal status and must not be in any state of modification.
- Free capacity must exist in the pool or volume group that you want to use to increase capacity.

For asynchronous mirroring operations reserved capacity is typically 20 percent of the base volume. Use a higher percentage if you believe the base volume will undergo many changes or if the estimated life expectancy of a storage object's copy service operation will be very long.

Why would I change this percentage?

Reserved capacity is typically 40 percent of the base volume for snapshot operations and 20 percent of the base volume for asynchronous mirroring operations. Usually this capacity is sufficient. The capacity needed varies, depending on the frequency and size of I/O writes to the base volume and how long you intend to use the storage object's copy service operation.

In general, choose a larger percentage for reserved capacity if one or both of these conditions exist:

- If the lifespan of a particular storage object's copy service operation will be very long.
- If a large percentage of data blocks will change on the base volume due to heavy I/O activity. Use historical

performance data or other operating system utilities to help you determine typical I/O activity to the base volume.

Why do I see more than one reserved capacity candidate?

You see more than one reserved capacity candidate when System Manager detects more than one volume in a pool or volume group that meets the capacity percentage amount you selected for the storage object.

You can choose to refresh the list of recommended candidates by changing the percentage of physical drive space that you want to reserve on the base volume for copy service operations. System Manager displays the best reserved capacity candidates based on your selection.

Why do I see Not Available values displayed in the table?

The table lists Not Available values when the data located on the remote storage array is not available to be displayed. To display the remote storage array data, launch SANtricity System Manager from SANtricity Unified Manager.

Why don't I see all of my pools and volume groups?

When you create a secondary volume for the asynchronous mirrored pair, the system displays a list of all the eligible pools and volume groups for that asynchronous mirrored pair. Any pool or volume group that is not eligible to be used does not display in that list.

Pools or volume groups may not be eligible for any of the following reasons.

- The security capabilities of a pool or volume group do not match.
- A pool or volume group is in a non-optimal state.
- The capacity of a pool or volume group is too small.

Asynchronous mirroring - Why don't I see all my volumes?

When you are selecting a primary volume for a mirrored pair, System Manager displays a list of all the eligible volumes for that mirrored pair. Any volumes that are not eligible to be used do not display in that list.

Volumes may not be eligible for any of the following reasons:

- The volume is a non-standard volume, such as a snapshot volume.
- The volume is not optimal.
- The volume is already participating in a mirroring relationship.

Asynchronous mirroring - Why don't I see all the volumes on the remote storage array?

When you are selecting a secondary volume on the remote storage array, System Manager displays a list of all the eligible volumes for that mirrored pair. Any volumes that are not eligible to be used, do not display in that list.

Volumes may not be eligible for any of the following reasons:

- The volume is a non-standard volume, such as a snapshot volume.
- The volume is not optimal.
- The volume is already participating in a mirroring relationship.
- The thin volume attributes between the primary volume and the secondary volume do not match.
- If you are using Data Assurance (DA), the primary volume and the secondary volume must have the same DA settings.
 - If the primary volume is DA enabled, the secondary volume must be DA enabled.
 - If the primary volume is not DA enabled, the secondary volume must not be DA enabled.

Why would I update my remote storage array's IP address?

You update your remote storage array's IP address when the IP address of an iSCSI port changes and the local storage array is unable to communicate with the remote storage array.

More about the remote IP address

When establishing an asynchronous mirroring relationship with an iSCSI connection, both the local and the remote storage arrays store a record of the IP address of the remote storage array in the asynchronous mirroring configuration. If the IP address of an iSCSI port changes, the remote storage array that is attempting to use that port encounters a communication error.

The storage array with the changed IP address sends a message to each remote storage array associated with the mirror consistency groups that are configured to mirror over an iSCSI connection. Storage arrays that receive this message automatically update their remote-target IP address.

If the storage array with the changed IP address is unable to send its inter-array message to a remote storage array, the system sends you an alert of the connectivity issue. Use the Update Remote IP Address option to re-establish connection with the local storage array.

Synchronous mirroring

Concepts

How synchronous mirroring works

Synchronous mirroring is the replication of data volumes onto separate storage arrays in real time to ensure continuous availability. The purpose is to achieve a recovery point objective (RPO) of zero lost data by having a copy of important data available if a disaster happens on one of the two storage arrays.

With synchronous mirroring, the copy is identical to production data at every moment because, with this type of mirror, each time a write is done to the primary volume, a write is done to the secondary volume. The host does not receive an acknowledgment that the write was successful until the secondary volume is successfully updated with the changes that were made on the primary volume.



The Synchronous Mirroring feature is not supported in a simplex configuration.

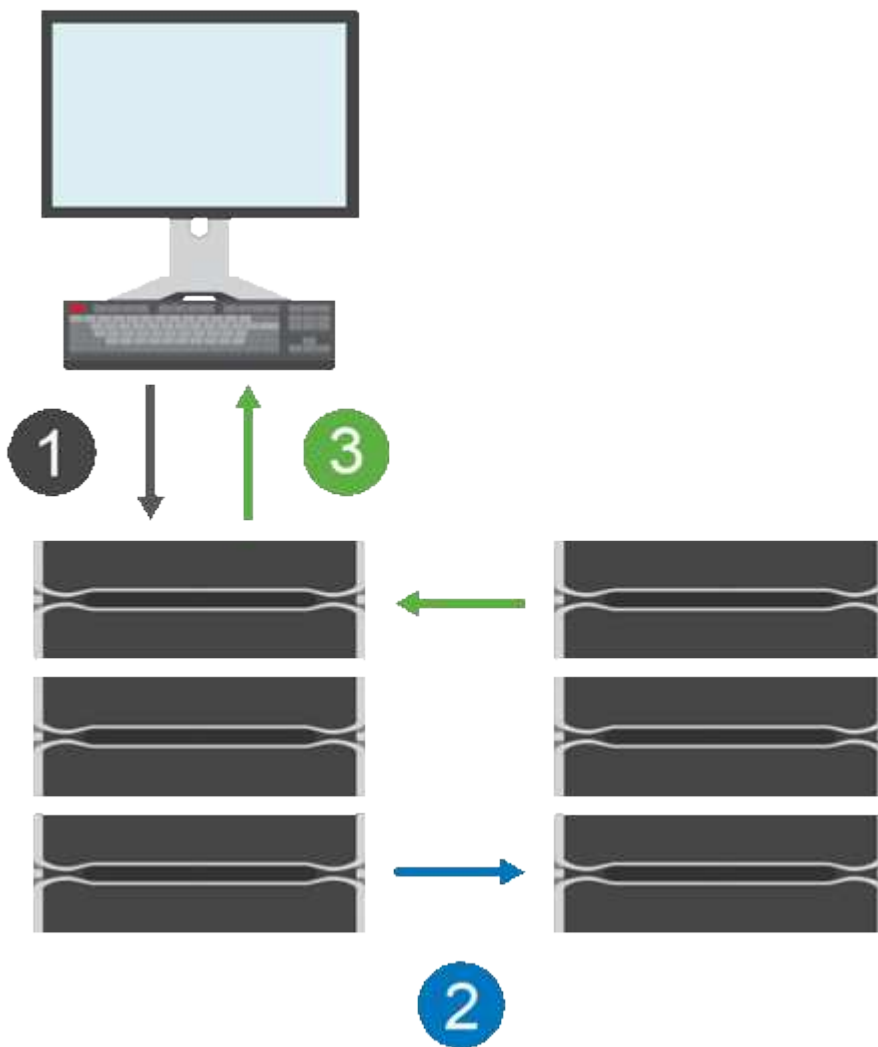
Synchronous mirroring relationship

A synchronous mirroring relationship consists of a primary volume and a secondary volume on separate storage arrays. The storage array containing the primary volume is usually located at the primary site and serves the active hosts. The storage array containing the secondary volume is usually located at a secondary site and holds a replica of the data. The secondary volume is used if the primary volume's storage array is unavailable because of, for example, a complete power outage, a fire, or a hardware failure at the primary site.

The primary and secondary volumes' storage arrays can run different OS versions. The minimum version supported is 7.84.

Synchronous mirroring session

The synchronous mirroring configuration process involves configuring volumes into pairs. After you create a mirrored pair, which consists of a primary volume on one storage array and a secondary volume on another storage array, you can start synchronous mirroring. The steps in synchronous mirroring are depicted below.



1. A write comes in from the host.
2. The write is committed to the primary volume, propagated to the remote system, and then committed to the secondary volume.

3. The primary volume's storage array sends an I/O completion message to the host system *after* both write operations have been successfully completed.

Reserved capacity is used to log information about the incoming write request from a host.

When the current controller owner of the primary volume receives a write request from a host, the controller first logs information about the write to the primary volume's reserved capacity. It then writes the data to the primary volume. Next, the controller initiates a remote write operation to copy the affected data blocks to the secondary volume at the remote storage array.

Because the host application must wait for the write to occur on the local storage array and across the network on the remote storage array, a very fast connection between the local storage array and remote storage array is required to maintain the mirror relationship without overly reducing local I/O performance.

Disaster recovery

Synchronous mirroring maintains a copy of data that is physically distant from the site where the data resides. If a disaster occurs at the primary site, such as a power outage or a flood, the data can be quickly accessed from the secondary site.

The secondary volume is unavailable to host applications while the synchronous mirroring operation is in progress, so, in the event of a disaster at the local storage array, you can fail over to the remote storage array. To fail over, promote the secondary volume to the primary role. Then the recovery host is able to access the newly promoted volume, and business operations can continue.

Synchronization settings

When you create a mirrored pair, you also define the synchronization priority and resynchronization policy that the mirrored pair uses to complete the resynchronization operation after a communication interruption.

If the communication link between the two storage arrays stops working, hosts continue to receive acknowledgements from the local storage array, preventing an access loss. When the communication link is working again, any unreplicated data can be automatically or manually resynced to the remote storage array.

Whether data is resynchronized automatically depends on the mirrored pair's resynchronization policy. An automatic resynchronization policy allows the mirrored pair to resynchronize automatically when the link is working again. A manual resynchronization policy requires you to manually resume synchronization after a communication problem. Manual resynchronization is the recommended policy.

You can edit the synchronization settings for a mirrored pair only on the storage array that contains the primary volume.

Unsyncronized data

The primary and secondary volumes become unsynchronized when the primary volume's storage array is unable to write data to the secondary volume. This can be caused by the following issues:

- Network problems between the local and remote storage arrays
- A failed secondary volume
- Synchronization being manually suspended on the mirrored pair

Orphaned mirrored pair

An orphaned mirrored pair volume exists when a member volume has been removed on one side (either the

primary side or secondary side) but not on the other side.

Orphaned mirrored pair volumes are detected when inter-array communication is restored and the two sides of the mirror configuration reconcile mirror parameters.

You can remove a mirrored pair to correct an orphaned mirrored pair state.

Synchronous mirroring terminology

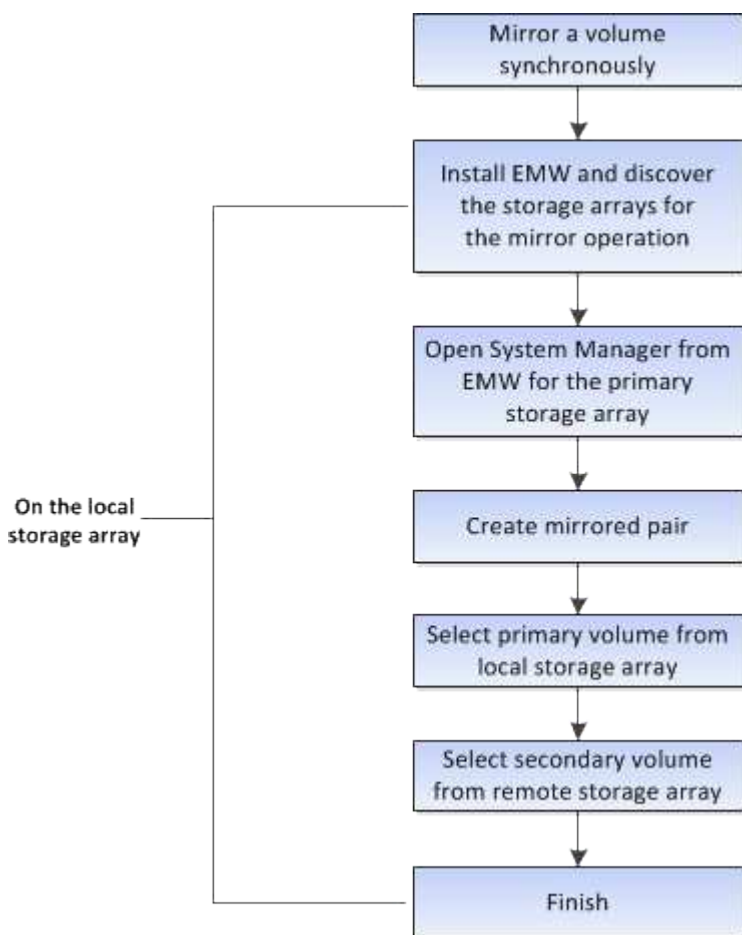
Learn how the synchronous mirroring terms apply to your storage array.

Term	Description
Local storage array	<p>The local storage array is the storage array that you are acting upon.</p> <p>When you see Primary in the Local Role column, it indicates that the storage array contains the volume that holds the primary role in the mirror relationship. When you see Secondary in the Local Role column, it indicates that the storage array contains the volume that holds the secondary role in the mirror relationship.</p>
Mirrored pair	A mirrored pair is comprised of two volumes, a primary volume and a secondary volume.
Primary volume	The primary volume of a mirrored pair is the source volume to be mirrored.
Recovery point objective (RPO)	Recovery Point Objective (RPO) represents an objective that indicates the difference considered acceptable between the primary volume and secondary volume in a mirrored pair. An RPO of zero indicates that no difference between the primary volume and secondary volume can be tolerated. An RPO greater than zero indicates that the secondary volume is less current or lags behind the primary volume.
Remote storage array	The remote storage array is usually designated as the secondary site, which usually holds a replica of the data in a mirroring configuration.
Reserved capacity	Reserved capacity is the physical allocated capacity that is used for any copy service operation and storage object. It is not directly readable by the host.
Role change	Role change is assigning the primary role to the secondary volume and vice versa.

Term	Description
Secondary volume	The secondary volume of a mirrored pair is usually located at a secondary site and holds a replica of the data.
Synchronization	Synchronization occurs at initial synchronization between the local storage array and the remote storage array. Synchronization also occurs when the primary and secondary volumes become unsynchronized after a communication interruption. When the communication link is working again, any unreplicated data is synchronized to the secondary volume's storage array.

Workflow for mirroring a volume synchronously

In SANtricity System Manager, you can mirror a volume synchronously by following these steps.



Synchronous mirroring activation

The Synchronous Mirroring feature is automatically activated when the first synchronous mirrored pair is created on a storage array.

When the Synchronous Mirroring feature is activated, System Manager performs the following actions:

- Reserves the highest-numbered port of the controller's HIC for mirror data transmission.

I/O requests received on this port are accepted only from the remote preferred controller owner of the secondary volume in the mirrored pair. (Reservations on the primary volume are allowed.)

- Creates two reserved capacity volumes, one for each controller, which are used for logging write information to recover from controller resets and other temporary interruptions.

The capacity of each volume is 128 MiB. However, if the volumes are placed in a pool, 4 GiB will be reserved for each volume.

With the Synchronous Mirroring feature, there are limits to the number of volumes that are supported on a given storage array. Before you activate Synchronous Mirroring, make sure that the number of configured volumes on your storage array is less than the supported limit. When Synchronous Mirroring is active, the two reserved capacity volumes that are created count against the volume limit.

If you need to deactivate Synchronous Mirroring at a later time, go to **Storage › Synchronous Mirroring › Uncommon Tasks › Deactivate**.

Requirements for using synchronous mirroring

If you use the Synchronous Mirroring feature, keep the following requirements in mind.

SANtricity Unified Manager

Because the Synchronous Mirroring feature requires the management of multiple storage arrays, you must have the browser-based SANtricity Unified Manager installed, and have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.

Storage arrays

- You must have two storage arrays.
- Each storage array must have two controllers.
- The primary and secondary volumes' storage arrays can run different OS versions. The minimum version supported is 7.84.
- You must know the password for the local and remote storage arrays.
- You must have enough free capacity on the remote storage array to create a secondary volume equal to or greater than the primary volume that you want to mirror.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric.

Supported hardware configuration and connections

- Synchronous mirroring is supported only in dual-controller hardware configurations.
- Communication for synchronous mirroring is supported only on controllers with Fibre Channel (FC) host ports.
- Synchronous mirroring uses the highest numbered host port on each controller on both the local storage array and the remote storage array. Controller host bus adapter (HBA) host port 4 is typically reserved for mirror data transmission.

Mirrored volume candidates

- RAID level, caching parameters, and segment size can be different on the primary and secondary volumes of a synchronous mirrored pair.
- The primary and secondary volumes in a synchronous mirrored pair must be standard volumes. They cannot be thin volumes or snapshot volumes.
- The secondary volume must be at least as large as the primary volume.
- Only the primary volume may have snapshots associated with it and/or be the source or target volume in a volume copy operation.
- A volume can participate in only one mirror relationship.

Reserved capacity

- Reserved capacity is required for a primary volume and for a secondary volume for logging write information to recover from controller resets and other temporary interruptions.
- The reserved capacity volumes are created automatically when synchronous mirroring is activated. Because both the primary volume and the secondary volume in a mirrored pair require reserved capacity, you must ensure that you have enough free capacity available on both storage arrays that are participating in the synchronous mirror relationship.

Drive Security feature

- If you are using secure-capable drives, the primary volume and the secondary volume must have compatible security settings. This restriction is not enforced; therefore, you must verify it yourself.
- If you are using secure-capable drives, the primary volume and the secondary volume should use the same drive type. This restriction is not enforced; therefore, you must verify it yourself.
 - If the primary volume uses Full Disk Encryption (FDE) drives, the secondary volume should use FDE drives.
 - If the primary volume uses Federal Information Processing Standards 140-2 (FIPS) validated drives, the secondary volume should use FIPS 140-2 validated drives.
- If you are using Data Assurance (DA), the primary volume and the secondary volume must have the same DA settings.

Synchronous mirroring status

A synchronous mirrored pair's status indicates whether the data on the primary volume and on the secondary volume is synchronized. A mirror status is independent of the component status of the volumes in the mirrored pair.

Synchronous mirrored pairs can have one of the following statuses:

- **Optimal**

Indicates that the volumes in the mirrored pair are synchronized, which means that the fabric connection between the storage arrays is operational and each volume is in the desired working condition.

- **Synchronizing**

Shows the progress of the data synchronization between the mirrored pairs. This status will also be shown during the initial synchronization.

After a communication link interruption, only the blocks of data that have changed on the primary volume during the link interruption are copied to the secondary volume.

- **Unsynchronized**

Indicates that the primary volume's storage array is unable to write incoming data to the remote array. The local host can continue to write to the primary volume, but remote writes do not take place. Different conditions can prevent the primary volume's storage array from writing incoming data to the secondary volume, such as:

- The secondary volume is not accessible.
- The remote storage array is not accessible.
- The fabric connection between the storage arrays is not accessible.
- The secondary volume cannot be updated with a new World Wide Identifier (WWID).

- **Suspended**

Indicates that the synchronous mirroring operation has been suspended by the user. When a mirrored pair is suspended, no attempt is made to contact the secondary volume. Any writes to the primary volume are persistently logged in the mirror reserved capacity volumes.

- **Failed**

Indicates that the synchronous mirroring operation is unable to operate normally due to a failure with the primary volume, secondary volume, or the mirror reserved capacity.

Volume ownership

You can change the preferred controller owner in a mirrored pair.

If the primary volume of the mirrored pair is owned by controller A, then the secondary volume will also be owned by controller A of the remote storage array. Changing the primary volume's owner will automatically change the owner of the secondary volume to ensure that both volumes are owned by the same controller. Current ownership changes on the primary side automatically propagate to corresponding current ownership changes on the secondary side.

For example, a primary volume is owned by controller A, and then you change the controller owner to controller B. In this case, the next remote write changes the controller owner of the secondary volume from controller A to B. Because controller ownership changes on the secondary side are controlled by the primary side, they do not require any special intervention by the storage administrator.

Controller resets

A controller reset causes a volume ownership change on the primary side from the preferred controller owner to the alternate controller in the storage array.

Sometimes a remote write is interrupted by a controller reset or a storage array power cycle before it can be written to the secondary volume. The controller does not need to perform a full synchronization of the mirrored pair in this case.

When a remote write has been interrupted during a controller reset, the new controller owner on the primary side reads information stored in a log file in the reserved capacity volume of the preferred controller owner. The new controller owner then copies the affected data blocks from the primary volume to the secondary volume, eliminating the need for a full synchronization of the mirrored volumes.

Role change between volumes in a mirrored pair

You can change the role between volumes in a mirrored pair. You can do this by demoting the primary volume to the secondary role or promoting the secondary volume to the primary role.

Review the following information about the role change operation:

- When a primary volume is demoted to the secondary role, the secondary volume in that mirrored pair is promoted to the primary role and vice versa.
- When the primary volume is demoted to the secondary role, hosts that have been assigned to that volume no longer have write access to it.
- When the secondary volume is promoted to the primary role, any hosts that are accessing that volume are now able to write to it.
- If the local storage array is unable to communicate with the remote storage array, you can force the role change on the local storage array.

Force role change

You can force a role change between volumes in a mirrored pair when a communication problem between the local storage array and the remote storage array is preventing the promotion of the secondary volume or the demotion of the primary volume.

You can force the volume on the secondary side to transition to the primary role. Then the recovery host can access the newly promoted volume, and business operations can continue.



When the remote storage array has recovered and any communication problems have been resolved, a Synchronous Mirroring - Primary Volume Conflict condition occurs. The recovery steps include resynchronizing the volumes. Use the Recovery Guru to recover from this error.

When is a forced promotion allowed and not allowed?

Forced promotion of a volume in a mirrored pair is not allowed under the following conditions:

- Any of the volumes in a mirrored pair are in the process of an initial synchronization.
- The mirrored pair is in the Failed, Role-Change-Pending, or Role-Change-In-Progress states or if any of the associated reserved capacity volumes are failed.

Role change in-progress state

If two storage arrays in a mirroring configuration become disconnected, and the primary volume of a mirrored pair is force demoted to a secondary role, and the secondary volume of a mirrored pair is force promoted to a primary role, then when communication is restored, the volumes on both storage arrays are placed in the Role-Change-In-Progress state.

The system will complete the role change process by transferring the change logs, re-synchronizing, setting the mirrored pair state back to a normal operating state, and continuing with synchronizations.

How tos

Create synchronous mirrored volume

You mirror a volume synchronously to replicate data in real-time between storage arrays, so your information is protected from both system and site failures. You do this by selecting the primary volume and the secondary volume that you want to use in the synchronous mirroring relationship between a local storage array and a remote storage array.

Before you begin

- Because the Synchronous Mirroring feature requires the management of multiple storage arrays, you must have the browser-based SANtricity Unified Manager installed, and have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.
- You must have two storage arrays.
- Each storage array must have two controllers.
- The primary and secondary volumes' storage arrays can run different OS versions. The minimum version supported is 7.84.
- You must know the password for the local and remote storage arrays.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric.
- You must have created both the primary and secondary volumes that you want to use in the synchronous mirror relationship.

About this task

The process to mirror a volume synchronously is a multi-step procedure:

- [Step 1: Select the primary volume](#)
- [Step 2: Select the secondary volume](#)
- [Step 3: Select synchronization settings](#)

A volume can participate in only one mirror relationship.

Step 1: Select the primary volume

You must select the primary volume that you want to use in the synchronous mirror relationship. This volume holds the primary role in the mirror relationship.

Before you begin

- You must have created the primary volume that you want to use in the synchronous mirror relationship.
- The primary volume must be a standard volume. It cannot be a thin volume or a snapshot volume.

Steps

1. Do one of the following actions to access the synchronous mirroring sequence:
 - Select **Storage > Synchronous Mirroring > Mirror volume**.
 - Select **Storage > Volumes > Copy Services > Mirror a volume synchronously**. The **Create Synchronous Mirrored Pair** dialog appears.
2. Select an existing volume that you want to use as the primary volume in the mirror.



If a volume was selected in the Volumes tile and it is eligible to be mirrored, it will be selected by default.

3. Select **Next** and go to [Step 2: Select the secondary volume](#).

Step 2: Select the secondary volume

You must select the secondary volume that you want to use in the mirror relationship. This volume will hold the secondary role in the mirror relationship.

Before you begin

- You must have created the secondary volume that you want to use in the synchronous mirror relationship.
- The secondary volume must be a standard volume. It cannot be a thin volume or a snapshot volume.
- The secondary volume must be at least as large as the primary volume.

About this task

When you select a secondary volume on the remote storage array, the system displays a list of all the eligible volumes for that mirrored pair. Any volumes that are not eligible to be used do not display in that list.

The volumes that appear in this dialog are sorted by capacity, starting with the volume nearest to the capacity of the primary volume capacity. Volumes with identical capacity are sorted alphabetically.

Steps

1. Select the remote storage array on which you want to establish a mirror relationship with the local storage array.



If your remote storage array is password protected, the system prompts for a password.

- Storage arrays are listed by their storage array name. If you have not named a storage array, it will be listed as "unnamed."
- If the storage array you want to use is not in the list, add it using the Enterprise Management Window (EMW) of SANtricity Storage Manager. Select **Edit > Add Storage Array**.

2. Select an existing volume that you want to use as the secondary volume in the mirror.



If a secondary volume is chosen with a capacity that is larger than the primary volume, the usable capacity is restricted to the size of the primary volume.

3. Click **Next** and go to [Step 3: Select synchronization settings](#).

Step 3: Select synchronization settings

You must set the priority at which the controller owner of the primary volume resynchronizes data with the secondary volume after a communication interruption. You must also select the resynchronization policy, either manual or automatic.

Steps

1. Use the slider bar to set the synchronization priority.

The synchronization priority determines how much of the system resources are used to complete initial

synchronization and the resynchronization operation after a communication interruption as compared to service I/O requests.

The priority set on this dialog applies to both the primary volume and the secondary volume. You can modify the rate on the primary volume at a later time by selecting **Storage › Synchronous Mirroring › More › Edit Settings**.

More about synchronization rates

There are five synchronization priority rates:

- Lowest
- Low
- Medium
- High
- Highest If the synchronization priority is set to the lowest rate, I/O activity is prioritized, and the resynchronization operation takes longer. If the synchronization priority is set to the highest rate, the resynchronization operation is prioritized, but I/O activity for the storage array might be affected.

2. Choose whether you want to resynchronize the mirrored pairs on the remote storage array either manually or automatically.
 - **Manual** (the recommended option) — Select this option to require synchronization to be manually resumed after communication is restored to a mirrored pair. This option provides the best opportunity for recovering data.
 - **Automatic**-- Select this option to start resynchronization automatically after communication is restored to a mirrored pair. To manually resume synchronization go to **Storage › Synchronous Mirroring**, highlight the mirrored pair in the table, and select Resume under More.
3. Click **Finish** to complete the synchronous mirroring sequence.

Results

System Manager performs the following actions:

- Activates the Synchronous Mirroring feature.
- Begins initial synchronization between the local storage array and the remote storage array.
- Sets the synchronization priority and resynchronization policy.

After you finish

Select **Home › View Operations in Progress** to view the progress of the synchronous mirroring operation. This operation can be lengthy and could affect system performance.

Manage synchronous mirrored pairs

Test communication for synchronous mirroring

You can test the communication between a local storage array and a remote storage array to diagnose possible communication problems for a mirrored pair that is participating in synchronous mirroring.

About this task

Two different tests are run:

- **Communication** — Verifies that the two storage arrays have a communication path. The communication test validates that the local storage array can communicate with the remote storage array and that the secondary volume associated with the mirrored pair exists on the remote storage array.
- **Latency** — Sends a SCSI test unit command to the secondary volume on the remote storage array associated with the mirrored pair to test the minimum, average, and maximum latency.

Steps

1. Select **Storage › Synchronous Mirroring**.
2. Select the mirrored pair that you want to test, and then select **Test Communication**.
3. Review the information displayed in the Results window, and, if necessary, follow the corrective action indicated.



If the communication test fails, the test continues to run after you close this dialog until communication between the mirrored pair is restored.

Suspend and resume synchronization for a mirrored pair

You can use the Suspend option and Resume option to control when to synchronize the data on the primary volume and the secondary volume in a mirrored pair.

About this task

If a mirrored pair is manually suspended, the mirrored pair will not synchronize until it is manually resumed.

Steps

1. Select **Storage › Synchronous Mirroring**.
2. Select the mirrored pair that you want to suspend or resume, and then select either **More › Suspend or More › Resume**.

The system displays a confirmation.

3. Select **Yes** to confirm.

Results

System Manager performs the following actions:

- Either suspends or resumes data transfer between the mirrored pair without removing the mirror relationship.
- For a *suspended* mirrored pair:
 - Displays Suspended in the Mirrored Pair table.
 - Logs any data that was written to the primary volume of the mirrored pair while synchronization is suspended.
- For a *resumed* mirrored pair, writes the data automatically to the secondary volume of the mirrored pair when synchronization is resumed. A full synchronization is not required.

Change role between volumes in a mirrored pair

You can perform a role reversal between the two volumes in a mirrored pair that are participating in synchronous mirroring. You change the role between volumes in a mirrored pair for administrative purposes or in the event of a disaster on the local storage array.

About this task

You can either demote the primary volume to the secondary role or promote the secondary volume to the primary role. Any hosts that are accessing the primary volume have read/write access to the volume. When the primary volume becomes a secondary volume, only remote writes initiated by the primary controller are written to the volume.

Steps

1. Select **Storage › Synchronous Mirroring**.
2. Select the mirrored pair that contains the volumes for which you want to change the role, and then select **More › Change role**.

The system displays a confirmation.

3. Confirm that you want to change the role of the volumes, and then select **Change Role**.



If the local storage array cannot communicate with the remote storage array, the system displays the **Cannot Contact Storage Array** dialog box when a role change is requested, but the remote storage array cannot be contacted. Click Yes to force the role change.

Result

System Manager performs the following action:

- If the associated volume in the mirrored pair can be contacted, the roles between the volumes change. System Manager promotes the secondary volume in the mirrored pair to the primary role or demotes the primary volume in the mirrored pair to the secondary role (depending on your selection).

Change synchronization settings for a mirrored pair

You can change the synchronization priority and resynchronization policy that the mirrored pair uses to complete the resynchronization operation after a communication interruption.

About this task

You can edit the synchronization settings for a mirrored pair only on the storage array that contains the primary volume.

Steps

1. Select **Storage › Synchronous Mirroring**.
2. Select the mirrored pair that you want to edit, and then select **More › Edit settings**.

The system displays the View/Edit Settings dialog box.

3. Use the slider bar to edit the synchronization priority.

The synchronization priority determines how much of the system resources are used to complete the resynchronization operation after a communication interruption as compared to service I/O requests.

More about synchronization rates

There are five synchronization priority rates:

- Lowest
- Low
- Medium
- High
- Highest If the synchronization priority is set to the lowest rate, I/O activity is prioritized, and the resynchronization operation takes longer. If the synchronization priority is set to the highest rate, the resynchronization operation is prioritized, but I/O activity for the storage array might be affected.

4. Edit the resynchronization policy as appropriate.

You can resynchronize the mirrored pairs on the remote storage array either manually or automatically.

- **Manual** (the recommended option) — Select this option to require synchronization to be manually resumed after communication is restored to a mirrored pair. This option provides the best opportunity for recovering data.
- **Automatic** — Select this option to start resynchronization automatically after communication is restored to a mirrored pair.

5. Select **Save**.

Remove synchronous mirror relationship

You remove a mirrored pair to remove the mirror relationship from the primary volume on the local storage array and the secondary volume on the remote storage array.

About this task

You can also remove a mirrored pair to correct an orphaned mirrored pair state. Review the following information about orphaned mirrored pairs:

- An orphaned mirrored pair exists when a member volume has been removed on one side (local/remote) but not on the other side.
- Orphaned mirrored pairs are detected when inter-array communication is restored.

Steps

1. Select **Storage › Synchronous Mirroring**.
2. Select the mirrored pair that you want to remove, and then select the **Uncommon Tasks › Remove**.

The Remove Mirror Relationship dialog box appears.

3. Confirm that you want to remove the mirrored pair, and then click **Remove**.

Results

System Manager performs the following actions:

- Removes the mirror relationship from the mirrored pair on the local storage array and on the remote storage array.
- Returns the primary volume and the secondary volume to host-accessible, non-mirrored volumes.
- Updates the Synchronous Mirroring tile with the removal of the synchronous mirrored pair.

Deactivate synchronous mirroring

You can deactivate the Synchronous Mirroring feature on a storage array to re-establish normal use of host bus adapter (HBA) host port 4, which was reserved for mirror data transmission.

Before you begin

You must have deleted all synchronous mirror relationships. Verify that all mirrored pairs have been deleted from the storage array.

Steps

1. Select **Storage > Synchronous Mirroring**.
2. Select **Uncommon Tasks > Deactivate**.

The system displays a confirmation.

3. Select **Yes** to confirm.

Results

- The controller's HBA host port 4, which was dedicated for synchronous mirroring communication, can now accept host read and write requests.
- The reserved capacity volumes on the storage array are deleted.

FAQs

Synchronous mirroring - Why don't I see all my volumes?

When you are selecting a primary volume for a mirrored pair, System Manager displays a list of all the eligible volumes for that mirrored pair. Any volumes that are not eligible to be used do not display in that list.

Volumes might not be eligible for any of the following reasons:

- The volume is a non-standard volume, such as a snapshot volume or thin volume.
- The volume is not optimal.
- The volume is already participating in a mirroring relationship.

Synchronous mirroring - Why don't I see all the volumes on the remote storage array?

When you are selecting a secondary volume on the remote storage array, System Manager displays a list of all the eligible volumes for that mirrored pair. Any volumes that are not eligible to be used, do not display in that list.

Volumes may not be eligible for any of the following reasons:

- The volume is a non-standard volume, such as a snapshot volume or thin volume.
- The volume is not optimal.
- The volume is already participating in a mirroring relationship.
- If you are using Data Assurance (DA), the primary volume and the secondary volume must have the same DA settings.
 - If the primary volume is DA enabled, the secondary volume must be DA enabled.
 - If the primary volume is not DA enabled, the secondary volume must not be DA enabled.

Synchronous mirroring - What do I need to know before creating a mirrored pair?

Before creating a mirrored pair, make sure your environment meets the following guidelines.

- You must have enough free capacity on the remote storage array to create a secondary volume equal to or greater than the primary volume that you want to mirror.
- You must have two storage arrays.
- Each storage array must have two controllers.
- You must know the password for the local and remote storage arrays.
- Your local and remote storage arrays must be connected through a Fibre Channel fabric.
- You must have discovered the two storage arrays you want to mirror data between. Then, from Unified Manager, you select the primary volume's storage array and click Launch to open the browser-based SANtricity System Manager.

What impact does synchronization priority have on synchronization rates?

The synchronization priority defines how much processing time is allocated for synchronization activities relative to system performance.

The controller owner of the primary volume performs this operation in the background. At the same time, the controller owner processes local I/O writes to the primary volume and associated remote writes to the secondary volume. Because the resynchronization diverts controller processing resources from I/O activity, resynchronization can have a performance impact to the host application.

Keep these guidelines in mind to help you determine how long a synchronization priority might take and how the synchronization priorities can affect system performance.

About synchronization priority rates

These priority rates are available:

- Lowest
- Low
- Medium
- High
- Highest

The lowest priority rate supports system performance, but the resynchronization takes longer. The highest priority rate supports resynchronization, but system performance might be compromised.

These guidelines roughly approximate the differences between the priorities.

Priority rate for full synchronization	Time elapsed compared to highest synchronization rate
Lowest	Approximately eight times as long as at the highest priority rate.
Low	Approximately six times as long as at the highest priority rate.
Medium	Approximately three-and-a-half times as long as at the highest priority rate.
High	Approximately twice as long as at the highest priority rate.

Volume size and host I/O rate loads affect the synchronization time comparisons.

Why is it recommended to use a manual synchronization policy?

Manual resynchronization is recommended because it lets you manage the resynchronization process in a way that provides the best opportunity for recovering data.

If you use an Automatic resynchronization policy and intermittent communication problems occur during resynchronization, data on the secondary volume could be temporarily corrupted. When resynchronization is complete, the data is corrected.

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