



# **Asynchronous mirroring**

## **SANtricity 11.6**

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# Asynchronous mirroring

## Concepts

### How asynchronous mirroring works

Asynchronous mirroring copies data volumes on demand or on a schedule, which minimizes or avoids downtime that might result from data corruption or loss.



Mirroring is not available on the EF600 storage array.

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. The primary site can be updated immediately and the secondary site can be updated as bandwidth allows. The information is cached and sent later, as network resources become available.

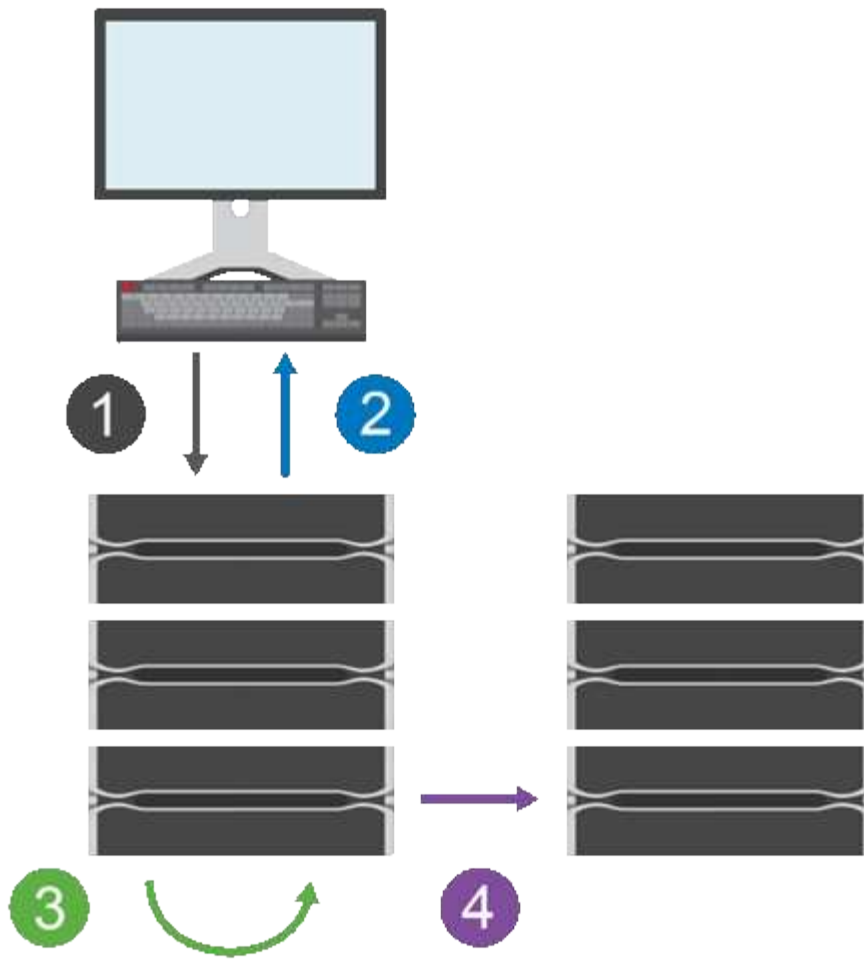
This type of mirroring is ideal for satisfying the demand for non-stop operations and, in general, is far more network efficient for periodic processes, such as backup and archive. The reasons for using asynchronous mirroring include the following:

- 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 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 storage arrays must have a minimum firmware version of 7.84. (They can each run different OS versions.)

### **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 can become unsynchronized when the primary volume's storage array is unable to write data to the secondary volume. This condition 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.

## Configuration and management

To enable and configure mirroring between two arrays, you must use the Unified Manager interface. Once mirroring is enabled, you can manage mirrored pairs and synchronization settings in System Manager.

## 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 <b>Primary</b> 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 <b>Secondary</b> 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>

Term	Description
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	The primary volume of a mirrored pair is the source volume to be mirrored.
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.
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

You configure asynchronous mirroring using the following workflow.



This feature is not available on the EF600 storage system.

1. Perform the initial configuration in Unified Manager:
  - a. Select the local storage array as the source for the data transfer.
  - b. Create or select an existing mirror consistency group, which is a container for the primary volume on the local array and the secondary volume on the remote array. The primary and secondary volumes are referred to as the "mirrored pair." If you are creating the mirror consistency group for the first time, you specify whether you want to perform manual or scheduled synchronizations.
  - c. Select a primary volume from the local storage array, and then determine its reserved capacity. Reserved capacity is the physical allocated capacity to be used for the copy operation.
  - d. Select a remote storage array as the destination of the transfer, a secondary volume, and then determine its reserved capacity.
  - e. Begin the initial data transfer from the primary volume to the secondary volume. Depending on the volume size, this initial transfer could take several hours.

2. Check the progress of the initial synchronization:
  - a. In Unified Manager, launch System Manager for the local array.
  - b. In System Manager, view the status of the mirroring operation. When mirroring is complete, the status of the mirrored pair is "Optimal."
3. **Optional:** You can reschedule or manually perform subsequent data transfers in System Manager. Only new and changed blocks are transferred from the primary volume to the secondary volume.



Because asynchronous replication is periodic, the system can consolidate the changed blocks and conserve network bandwidth. There is minimal impact on write throughput and write latency.

## Requirements for using asynchronous mirroring

If you plan to use asynchronous mirroring, keep the following requirements in mind.

### SANtricity Unified Manager

To enable and configure mirroring between two arrays, you must use the Unified Manager interface. Unified Manager is installed on a host system along with the Web Services Proxy.

- The Web Services Proxy service must be running.
- Unified Manager must be running on your local host through an HTTPS connection.
- Unified Manager must be 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**.

### Storage arrays



Mirroring is not available on the EF600 storage array.

- You must have two storage arrays.
- Each storage array must have two controllers.
- The two storage arrays must be discovered in 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.
- The storage arrays have a minimum firmware version of 7.84. (They can each run different OS versions.)
- 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 are connected through a Fibre Channel fabric or iSCSI interface.

### 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, 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

### **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.

## Asynchronous mirror status

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



This feature is not available on the EF600 storage system.

## 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>

Status	Description
Paused	Data synchronization process has temporarily paused due to an error accessing the remote storage array.
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>
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.

Status	Description
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.



This feature is not available on the EF600 storage system.

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.



This feature is not available on the EF600 storage system.

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

### 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.
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"><li>• <b>Manually</b> – Select this option to manually synchronize the mirrored pairs on the remote storage array.</li><li>• <b>Automatically, every</b> – 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.</li></ul>
Alert me...	<p>If you set the synchronization method to occur automatically, set the following alerts:</p> <ul style="list-style-type: none"><li>• <b>Synchronization</b> – Set the length of time after which System Manager sends an alert that synchronization has not completed.</li><li>• <b>Remote recovery point</b> – 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.</li><li>• <b>Reserved capacity threshold</b> – 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.</li></ul>

## Results

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 › Synchronous 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.

## Results

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 8 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...	<div><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> Changing the Alert setting for one mirrored pair changes the Alert setting for all mirrored pairs that belong to the same mirror consistency group.</div></div>

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

## 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.

## 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
<b>Replication method</b>	
<ul style="list-style-type: none"><li>• <b>Point-in-Time</b></li></ul> <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"><li>• <b>Continuous</b></li></ul> <p>Mirroring is automatically executed continuously, copying data from every host write.</p>
<b>Reserved capacity</b>	
<ul style="list-style-type: none"><li>• <b>Multiple</b></li></ul> <p>A reserved capacity volume is required for each mirrored pair.</p>	<ul style="list-style-type: none"><li>• <b>Single</b></li></ul> <p>Single reserved capacity volume is required for all mirrored volumes.</p>
<b>Communication</b>	
<ul style="list-style-type: none"><li>• <b>iSCSI and Fibre Channel</b></li></ul> <p>Supports iSCSI and Fibre Channel interfaces between storage arrays.</p>	<ul style="list-style-type: none"><li>• <b>Fibre Channel</b></li></ul> <p>Supports only Fibre Channel interfaces between storage arrays.</p>
<b>Distance</b>	
<ul style="list-style-type: none"><li>• <b>Unlimited</b></li></ul> <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"><li>• <b>Restricted</b></li></ul> <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?

Mirroring is configured in the Unified Manager interface.

To enable and configure mirroring between two arrays, verify the following:

- The Web Services Proxy service must be running. (Unified Manager is installed on a host system along with the Web Services Proxy.)
- Unified Manager must be running on your local host through an HTTPS connection.

- The two storage arrays you want to use for mirroring must be discovered in Unified Manager.
- Unified Manager must have valid SSL certificates for the storage arrays. You can accept a self-signed certificate or install CA-signed certificates from Unified Manager.

For more information about requirements, see the online help for Unified Manager.



Mirroring is not available on the EF600 storage array.

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

Follow these guidelines before you create a mirror consistency group.

You create a consistency group in Unified Manager in the Create Mirrored Pairs wizard.

Meet the following requirements for Unified Manager:

- The Web Services Proxy service must be running.
- Unified Manager must be running on your local host through an HTTPS connection.
- Unified Manager must be 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**.

Also be sure to meet the following requirements for storage arrays:

- The two storage arrays must be discovered in Unified Manager.
- Each storage array must have two controllers.
- Each controller in both the primary array and secondary array must have an Ethernet management port configured and must be connected to your network.
- The storage arrays have a minimum firmware version of 7.84. (They can each run different OS versions.)
- You must know the password for the local and remote storage arrays.
- Your local and remote storage arrays are connected through a Fibre Channel fabric or iSCSI interface.



This feature is not available on the EF600 storage system.

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

You configure mirrored pairs in the Unified Manager interface, and then manage the pairs in System Manager.

Before creating a mirrored pair, follow these guidelines.

- You must have two storage arrays.
- Each storage array must have two controllers.
- Each controller in both the primary array and secondary array must have an Ethernet management port configured and must be connected to your network.
- Your local and remote storage arrays are connected through a Fibre Channel fabric or iSCSI interface.
- The storage arrays have a minimum firmware version of 7.84. (They can each run different OS versions.)

- 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.
- You have installed the Web Services Proxy and Unified Manager. Mirrored pairs are configured in the Unified Manager interface.
- The two storage arrays are discovered in Unified Manager.
- Your storage array must contain at least one mirror consistency group. You create a consistency group in Unified Manager in the Create Mirrored Pairs wizard.

## 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 Volume 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?**

If there is more than one volume in a pool or volume group that meets the capacity percentage amount you selected for the storage object, you will see multiple candidates.

You can 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. The best candidates are displayed 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 System Manager from 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, a list shows all the eligible volumes.

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 not optimal.
- The volume is already participating in a mirroring relationship.
- For thin volumes, auto-expansion must be enabled.

## 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, a list shows 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 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.

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