NetApp

Mirroring

SANtricity 11.6

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Mirroring overview

Unified Manager includes configuration options for the SANtricity mirroring features, which enable administrators to replicate data between two storage arrays for data protection.

ⓘ | This feature is not available on the EF600 or EF300 storage system.

Types of mirroring

SANtricity applications include two types of mirroring — asynchronous and synchronous.

Asynchronous mirroring copies data volumes on demand or on a schedule, which minimizes or avoids downtime that might result from data corruption or loss. 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 periodic processes such as backup and archive.

Synchronous mirroring replicates data volumes 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. The copy is identical to production data at every moment because 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 updated with the changes that were made on the primary volume. This type of mirroring is ideal for business continuity purposes such as disaster recovery.

Differences between mirroring types

The following table describes the main differences between the two types of mirroring.

Attribute	Asynchronous	Synchronous
Replication method	Point-in-time — Mirroring is done on demand or automatically according to a user-defined schedule.	Continuous — Mirroring is automatically executed continuously, copying data from every host write.
Distance	Supports long distances between arrays. Typically, the distance is limited only by the capabilities of the network and the channel extension technology.	Restricted to shorter distances between arrays. Typically, the distance must be within about 10 km (6.2 miles) of the local storage array to meet the latency and application performance requirements.

Attribute	Asynchronous	Synchronous
Communication method	A standard IP or Fibre Channel network.	Fibre Channel network only.
Volume types	Standard or thin.	Standard only.

> ⓘ For more information on how mirroring works in SANtricity applications, refer to the online help for System Manager.

Mirroring configuration workflow

You configure asynchronous or synchronous mirroring in Unified Manager, and then use System Manager to manage synchronizations.

Asynchronous mirroring workflow

Asynchronous mirroring involves the following workflow:

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.

Synchronous mirroring workflow

Synchronous mirroring involves the following workflow:

1. Perform the initial configuration in Unified Manager:
   a. Select a local storage array as the source for the data transfer.
   b. Select a primary volume from the local storage array.
   c. Select a remote storage array as the destination for the data transfer, and then select a secondary volume.
   d. Select synchronization and resynchronization priorities.
   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." The two arrays attempt to stay synchronized through normal operations. Only new and changed blocks are transferred from the primary volume to the secondary volume.
3. **Optional:** You can change synchronization settings in System Manager.

> ⓘ Because synchronous replication is continuous, the replication link between the two sites must provide sufficient bandwidth capabilities.

Mirroring terminology

Learn how the mirroring terms apply to your storage array.

Term	Description
Local storage array	The local storage array is the storage array that you are acting upon.
Mirror consistency group	A mirror consistency group is a container for one or more mirrored pairs. For asynchronous mirroring operations, you must create a mirror consistency group. All mirrored pairs in a group are resynchronized simultaneously, thus preserving a consistent recovery point. Synchronous mirroring does not use mirror consistency groups.
Mirrored pair	A mirrored pair is comprised of two volumes, a primary volume and a secondary volume. 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.

Term	Description
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. These volumes are required so that the controller can persistently save information needed to maintain mirroring in an operational state. They contain information such as delta logs and copy-on-write data.
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.

Requirements for using mirroring

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

SANtricity 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**.

Storage arrays

> (i) 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.

- Asynchronous mirroring is supported on controllers with Fibre Channel (FC) or iSCSI host ports, while synchronous mirroring is supported only on controllers with FC host ports.

Connectivity requirements

Mirroring through an FC interface (asynchronous or synchronous) requires the following:

- 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 a 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 (asynchronous only) requires the following:

- 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

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

Mirrored volume candidates

- RAID level, caching parameters, and segment size can be different on the primary and secondary volumes of a mirrored pair.

- The secondary volume must be at least as large as the primary volume.

- A volume can participate in only one mirror relationship.

- For a synchronous mirrored pair, the primary and secondary volumes must be standard volumes. They cannot be thin volumes or snapshot volumes.

- For synchronous mirroring, there are limits to the number of volumes that are supported on a given storage array. 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.

Reserved capacity

Asynchronous mirroring:

- 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.

Synchronous mirroring:

- 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 you are using Data Assurance (DA), the primary volume and the secondary volume must have the same DA settings.

How tos

Create asynchronous mirrored pair

To configure asynchronous mirroring, you create a mirrored pair that includes a primary volume on the local array and a secondary volume on the remote array.

ⓘ This feature is not available on the EF600 or EF300 storage system.

Before you begin

Before you create a mirrored pair, 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:

- 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.

- You have created both the primary and secondary volumes that you want to use in the asynchronous mirror relationship.

About this task

The process to create an asynchronous mirrored pair is a multi-step procedure.

Step 1: Create or select a mirror consistency group

You can create a new mirror consistency group or select an existing one.

Before you begin

- To create a new mirror consistency group, the local and remote storage arrays must be discovered in Unified Manager.

About this task

A mirror consistency group is a container for the primary and secondary volumes (the mirrored pair), and specifies the desired resynchronization method (manual or automatic) for all pairs in the group.

Steps

1. From the **Manage** page, select the local storage array that you want to use for the source.

2. Select **Actions › Create Asynchronous Mirrored Pair**.

   The **Create Asynchronous Mirrored Pair** wizard opens.

3. Select either an existing mirror consistency group or create a new one.

   To select an existing group, make sure **An existing mirror consistency group** is selected, and then select the group from the table. A consistency group can include multiple mirrored pairs.

   To create a new group, do the following:

   a. Select **A new mirror consistency group**, and then click **Next**.

b. Enter a unique name that best describes the data on the volumes that will be mirrored between the two storage arrays. A name can only consist of letters, numbers, and the special characters underscore (_), dash (-), and the hash sign (#). A name may not exceed 30 characters and may not contain spaces.

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

> (i)   If your remote storage array is password protected, the system prompts for a password.

d. Choose whether you want to synchronize the mirrored pairs manually or automatically:

- **Manual** — Select this option to manually start synchronization for all mirrored pairs within this group. Note that when you want to perform a resynchronization later, you must launch System Manager for the primary storage array, and then go to **Storage › Asynchronous Mirroring**, select the group from the **Mirror Consistency Groups** tab, and then select **More › Manually resynchronize**.

- **Automatic** — Select the desired interval in **Minutes**, **Hours**, or **Days**, from the beginning of the previous update to the beginning of the next update. For example, if the synchronization interval is set at 30 minutes, and the synchronization process starts at 4:00 p.m., the next process starts at 4:30 p.m.

e. Select the desired alert settings:

- For manual synchronizations, specify the threshold (defined by the percentage of the capacity remaining) for when you receive alerts.

- For automatic synchronizations, you can set three methods of alerting: when the synchronization has not completed in a specific length of time, when the recovery point data on the remote array is older than a specific time limit, and when the reserved capacity is nearing a specific threshold (defined by the percentage of the capacity remaining).

4. Select **Next** and go to .

If you defined a new mirror consistency group, Unified Manager creates the mirror consistency group on the local storage array first and then creates the mirror consistency group on the remote storage array. You can view and manage the mirror consistency group by launching System Manager for each array.

> (i)   If Unified 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 Unified Manager is attempting to delete the mirror consistency group, you must manually delete it.

Step 2: Select the primary volume

Select the primary volume that you want to use in the mirror relationship and allocate its reserved capacity.

Before you begin

- You must have created the primary volume on the local storage array that you want to use in the asynchronous mirror relationship.

About this task

When you select a primary volume on the local 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.

Any volumes you add to the mirror consistency group on the local storage array will hold the primary role in the

mirror relationship.

Steps

1. From the list of eligible volumes, select a volume that you want to use as the primary volume, and then click **Next** to allocate the reserved capacity.

2. From the list of eligible candidates, select reserved capacity for the primary volume.

   Keep the following guidelines in mind:

   ◦ The default setting for reserved capacity is 20% of the capacity of the base volume, and usually this capacity is sufficient. If you change the percentage, click **Refresh Candidates**.

   ◦ 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

Select the secondary volume that you want to use in the mirror relationship and allocate its reserved capacity.

Before you begin

• You must have created the secondary volume on the remote storage array that you want to use in the asynchronous mirror relationship.

• 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.

Any volumes you add to the mirror consistency group on the remote storage array will hold the secondary role in the mirror relationship.

Steps

1. From the list of eligible volumes, select a volume that you want to use as the secondary volume in the mirrored pair, and then click **Next** to allocate the reserved capacity.

2. From the list of eligible candidates, select reserved capacity for the secondary volume.

   Keep the following guidelines in mind:

   ◦ The default setting for reserved capacity is 20% of the capacity of the base volume, and usually this capacity is sufficient. If you change the percentage, click **Refresh Candidates**.

   ◦ 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

Unified 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.

Create synchronous mirrored pair

To configure synchronous mirroring, you create a mirrored pair that includes a primary volume on the local array and a secondary volume on the remote array.

(i)   This feature is not available on the EF600 or EF300 storage system.

Before you begin

Before you create a mirrored pair, 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 you plan to use for mirroring are 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.
- You have created both the primary and secondary volumes that you want to use in the synchronous mirror relationship.

About this task

The process to create synchronous mirrored pairs is a multi-step procedure.

Step 1: Select the primary volume

Select the primary volume that you want to use in the synchronous 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.

About this task

When you select a primary volume on the local 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 volume you select holds the primary role in the mirror relationship.

Steps

1. From the **Manage** page, select the local storage array that you want to use for the source.
2. Select **Actions › Create Synchronous Mirrored Pair**.

   The **Create Synchronous Mirrored Pair** wizard opens.

3. From the list of eligible volumes, select a volume that you want to use as the primary volume in the mirror.
4. Select **Next** and go to .

Step 2: Select the secondary volume

Select the secondary volume that you want to use 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 should 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 volume you select will hold the secondary role in the mirror relationship.

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, make sure it has been discovered in Unified Manager.

2. From the list of eligible volumes, select a volume that you want to use as the secondary volume in the mirror.

> ℹ️ 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

Select the settings that determine how data is synchronized after a communication interruption.

About this task

You can 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 going to System Manager and selecting **Storage › Synchronous Mirroring › More › Edit Settings**.

   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 System Manager and select **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

Once mirroring is activated, the system performs the following actions:

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

- 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.

After you finish

Go to System Manager and 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.

FAQs

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

Follow these guidelines before you create a mirror consistency group.

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 or EF300 storage system.

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

Before creating a mirrored pair, follow these guidelines.

- 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.

- Asynchronous mirroring is supported on controllers with Fibre Channel (FC) or iSCSI host ports, while synchronous mirroring is supported only on controllers with FC host ports.

> ⓘ This feature is not available on the EF600 or EF300 storage system.

Why would I change this percentage?

Reserved capacity is typically 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, then 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 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 might not be eligible for any of the following reasons:

- The volume is not optimal.

- The volume is already participating in a mirroring relationship.

- For synchronous mirroring, the primary and secondary volumes in a mirrored pair must be standard volumes. They cannot be thin volumes or snapshot volumes.

- For asynchronous mirroring, thin volumes must have auto-expansion enabled.

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 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.
- For asynchronous mirroring, 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.

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.

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.