



# **Manage storage**

## **ONTAP 9**

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# Manage storage

## Capacity measurements in System Manager

System capacity can be measured as physical space or logical space. Recent versions of System Manager use measurements of both physical and logical capacity.

The differences between the two measurements are explained in the following descriptions:

- **Physical capacity:** Physical space refers to the physical blocks of storage used in the volume. The value for physical used capacity is typically smaller than the value for logical used capacity due to the reduction of data from storage efficiency features (such as deduplication and compression).
- **Logical capacity:** Logical space refers to the usable space (the logical blocks) in a volume. Logical space refers to how theoretical space can be used, without accounting for results of deduplication or compression. The value for logical space used is derived from the amount of physical space used plus the savings from storage efficiency features (such as deduplication and compression) that have been configured. This measurement often appears larger than the physical used capacity because it includes Snapshot copies, clones, and other components, and it does not reflect the data compression and other reductions in the physical space. Thus, the total logical capacity could be higher than the provisioned space.



In System Manager, capacity representations do not account for root storage tier (aggregate) capacities.

### Measurements of used capacity

Measurements of used capacity are displayed differently depending on the version of System Manager you are using, as explained in the following table:

Version of System Manager	Term used for capacity	Type of capacity referred to
9.5 and 9.6 (Classic view)	Used	Physical space used
9.7 and 9.8	Used	Logical space used (if storage efficiency settings have been enabled)
9.9.1	Logical Used	Logical space used (if storage efficiency settings have been enabled)

### Measurement terms

- **Physical used:** Displays the amount of capacity used in the physical blocks of a volume.
- **Physical used %:** Displays the percentage of capacity used in the physical blocks of a volume compared to the provisioned size.
- **Logical used:** Displays the amount of used space without considering the space saved by storage efficiency features.
- **Logical used %:** Displays the percentage of the current logical used capacity compared to the provisioned

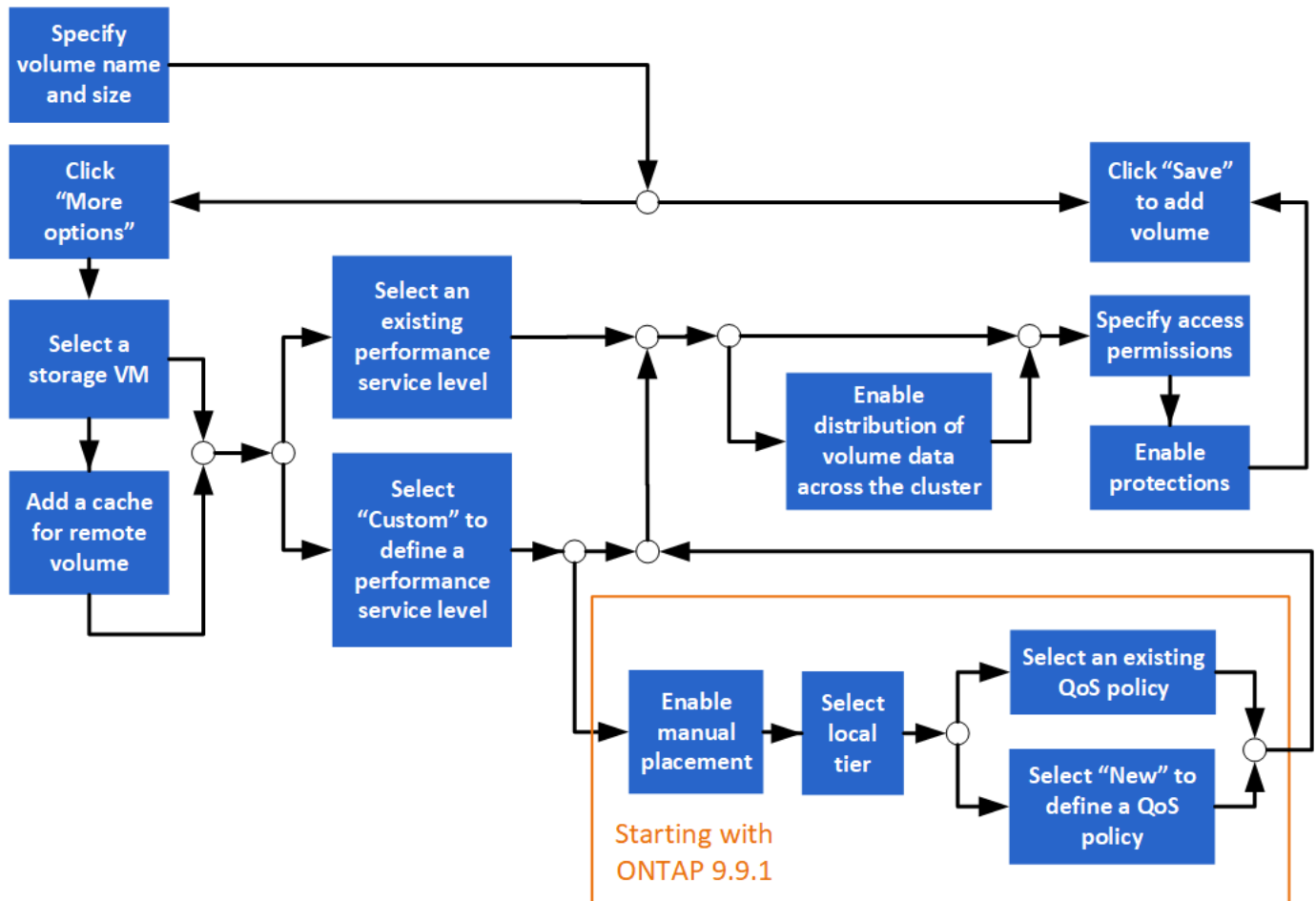
size, excluding the Snapshot reserve of the volume. This value can be greater than 100%, because it includes efficiency savings in the volume.

#### Additional references:

"Logical space reporting and enforcement for volumes" topic in the [ONTAP 9 Logical Storage Management Guide](#)

## Add a volume

You can create an NFS volume and add it to an existing storage VM that is configured for NFS or SMB/CIFS service.



#### Before you Start

A storage VM that is configured for NFS or SMB/CIFS service should exist in the cluster.

#### Steps

1. Go to **Storage > Volumes**.
2. Click **+ Add**.
3. Specify a name and size for the volume.
4. Perform one of the following steps:

Click this button...	To perform this action...
<b>Save</b>	The volume is created and added using the system defaults. No additional steps are required.
<b>More Options</b>	Proceed to <a href="#">Step 5</a> to define the specifications for the volume.

5. The volume name and size are shown if you previously specified them. Otherwise, enter the name and size.
6. Select a storage VM from the pull-down list.

Only storage VMs configured with the NFS protocol are listed. If only one storage VM configured with the NFS protocol is available, the **Storage VM** field is not shown.

7. To add a cache for the remote volume, select **Add a cache for remote volume** and specify the following values:
  - Select a cluster.
  - Select a storage VM.
  - Select the volume that you want to be a cache volume.
8. In the **Storage and Optimization** section, specify the following values:
  - a. The capacity of the volume is already shown, but you can modify it.
  - b. In the **Performance Service Level** field, select a service level:

When you select this service level...	This occurs...
<p>An existing service level, such as "Extreme", "Performance", or "Value".</p> <p>Only the service levels that are valid for the system platform (AFF, FAS, or others) are displayed.</p>	A local tier or tiers are automatically chosen. Proceed to <a href="#">Step 9</a> .
Custom	Proceed to <a href="#">Step 8c</a> to define a new service level.

- c. Starting with ONTAP 9.9.1, you can use System Manager to manually select the local tier on which you want to place the volume you are creating (if you have selected the "Custom" service level).



This option is not available if you select **Add as a cache for a remote volume** or **Distribute volume data across the cluster** (see below).

When you make this choice...	You perform these steps...
<b>Manual placement</b>	Manual placement is enabled. The <b>Distribute volume data across the cluster</b> selection is disabled (see below). Proceed to <a href="#">Step 8d</a> to complete the process.
No selection	Manual placement is not enabled. The local tier is automatically selected. Proceed to <a href="#">Step 9</a> .

- d. Select a local tier from the pull-down menu.

- e. Select a QoS policy.

Select "Existing" to choose from a list of existing policies, or select "New" to enter the specifications of a new policy.

9. In the **Optimization options** section, determine if you want to distribute the volume data across the cluster:

When you make this choice...	This occurs...
<b>Distribute volume data across the cluster</b>	The volume you are adding becomes a FlexGroup volume. This option is not available if you previously selected <b>Manual placement</b> .
No selection	The volume you are adding becomes a FlexVol volume by default.

10. In the **Access Permissions** section, specify the access permissions for the protocols for which the volume is configured.
11. In the **Protection** section, specify the protections for the volume. If you select **Enable SnapMirror (Local or Remote)**, then specify the protection policy and settings for the destination cluster from the pull-down lists.
12. Click **Save**.

The volume is created and added to the cluster and storage VM.



You can also save the specifications of this volume to an Ansible Playbook. For more details, go to [Use Ansible Playbooks to add or edit volumes or LUNs](#).

## Add LUNs

You can create LUNs and add them to an existing storage VM that is configured with the SAN protocol.

[workflow diagram of add LUNs task]

### Before you Start

A storage VM that is configured for SAN service should exist in the cluster.

### Steps

1. Go to **Storage > LUNs**.
2. Click **+ Add**.
3. Specify a prefix that will be used at the start of each LUN name. (If you are creating only one LUN, enter the LUN name.)
4. Select a storage VM from the pull-down list.

Only storage VMs that are configured for the SAN protocol are listed. If only one storage VM that is configured for the SAN protocol is available, then the **Storage VM** field is not displayed.

5. Indicate how many LUNs you want to create and the size of each LUN.

6. Select the host operating system and LUN format from the pull-down lists.
7. Enter the host initiators, and separate them with commas.
8. Perform one of the following actions:

Click this button...	To perform this action...
<b>Save</b>	The LUNs are created with the specifications you entered. System defaults are used for other specifications. No additional steps are required.
<b>More Options</b>	Proceed to <a href="#">Step 9</a> to define additional specifications for the LUNs.

9. The LUN prefix is already shown if you previously entered it, but you can modify it. Otherwise, enter the prefix.
10. Select a storage VM from the pull-down list.

Only storage VMs that are configured for the SAN protocol are listed. If only one storage VM that is configured for the SAN protocol is available, then the **Storage VM** field is not displayed.

11. Determine how you want the LUNs to be grouped:

When you make this choice...	This occurs...
<b>Group with related LUNs</b>	The LUNs will be grouped together with related LUNs on an existing volume on the storage VM.
No selection	The LUNs will be grouped together on a volume called "container".

12. In the **Storage and Optimization** section, specify the following values:
  - a. The number and capacity of the LUNs are already shown if you previously entered them, but you can modify them. Otherwise, enter the values.
  - b. In the **Performance Service Level** field, select a service level:

When you select this service level...	This occurs...
An existing service level, such as "Extreme", "Performance", or "Value".  Only the service levels that are valid for the system platform (AFF, FAS, or others) are displayed.	A local tier is automatically chosen. Proceed to <a href="#">Step 13</a> .
Custom	Proceed to <a href="#">Step 12c</a> to define a new service level.

- c. Starting with ONTAP 9.9.1, you can use System Manager to manually select the local tier on which you want to place the LUNs you are creating (if you have selected the "Custom" service level).

When you make this choice...	You perform these steps...
<b>Manual placement</b>	Manual placement is enabled. Proceed to <a href="#">Step 12d</a> to complete the process.

When you make this choice...	You perform these steps...
No selection	Manual selection is not enabled. The local tier is automatically selected. Proceed to <a href="#">Step 13</a> .

- d. Select a local tier from the pull-down menu.
- e. Select a QoS policy.

Select "Existing" to choose from a list of existing policies, or select "New" to enter the specifications of a new policy.

13. In the **Host Information** section, the host operating system and LUN format are already shown, but you can modify them.
14. Under **Host Mapping**, select the type of initiators for the LUNs:
  - **Existing initiator group:** Select an initiator group for the list that displays.
  - **New initiator group using existing initiator groups:** Specify the name of the new group, and select the group or groups that you want to use to create the new group.
  - **Host initiators:** Specify a name from the new initiator group, and click **+Add Initiator** to add initiators to the group.
15. In the **Protection** section, specify the protections for the LUNs.

If you select **Enable SnapMirror (Local or Remote)**, then specify the protection policy and settings for the destination cluster from the pull-down lists.

16. Click **Save**.

The LUNs are created and added to the cluster and storage VM.



You can also save the specifications of these LUNs to an Ansible Playbook. For more details, go to [Use Ansible Playbooks to add or edit volumes or LUNs](#).

## Expand storage

You can increase the size of your volume or LUN so that more space is available to your host. The size of a LUN cannot exceed the size of the containing volume.

- [Increase the size of a volume](#)
- [Increase the size of a LUN](#)

Also, you can add a LUN to an existing volume. The processes are different for using System Manager with ONTAP 9.7 or 9.8


- [Add a LUN to an existing volume \(ONTAP 9.7\)](#)
- [Add a LUN to an existing volume \(ONTAP 9.8\)](#)

Also, starting with ONTAP 9.8, you can use System Manager to add a LUN to an existing volume.




## Increase the size of a volume

### Steps

1. Click **Storage > Volumes**.
2. Hover over the name of the volume you want to increase in size.
3. Click .
4. Select **Edit**.
5. Increase the capacity value.

## Increase the size of a LUN

### Steps

1. Click **Storage > LUNs**.
2. Hover over the name of the LUN you want to increase in size.
3. Click .
4. Select **Edit**.
5. Increase the capacity value.

## Add a LUN to an existing volume (ONTAP 9.7)

To use System Manager with ONTAP 9.7 to add a LUN to an existing volume, you should switch to the Classical View first.

### Steps

1. Log in to System Manager in ONTAP 9.7.
2. Click **Classical View**.
3. Select **Storage > LUNs > Create**
4. Specify the details to create the LUN.
5. Specify to which existing volume or qtree the LUN should be added.

## Add a LUN to an existing volume (ONTAP 9.8)

Starting with ONTAP 9.8, you can use System Manager to add a LUN to an existing volume that already has a least one LUN.

### Steps

1. Click **Storage > LUNs**.
2. Click **Add+**.
3. Complete the fields in the **Add LUNs** window.
4. Select **More Options**.
5. Select the checkbox labeled **Group with related LUNs**.
6. In the drop-down field, select a LUN that exists on the volume to which you want to add another LUN.
7. Complete the rest of the fields. For **Host Mapping**, click one of the radio buttons:
  - **Existing initiator group** lets you select an existing group from a list.

- **New initiator group** lets you enter a new group in the field.

## Add disks to a local tier (Add capacity to aggregate)

You can increase the size of an existing aggregate (local tier) by adding capacity disks.

### Steps

1. Click **(Return to classic version)**.
2. Click **Hardware and Diagnostics > Aggregates**.
3. Select the aggregate to which you want to add capacity disks, and then click **Actions > Add Capacity**.

You should add disks that are of the same size as the other disks in the aggregate.

4. Click **Switch to the new experience**.
5. Click **Storage > Tiers** to verify the size of the new aggregate.

## Add nodes to cluster

You can increase the size and capabilities of your cluster by adding new nodes.

### Before you Start

You should have already cabled the new nodes to the cluster.

There are separate processes for working with System Manager in ONTAP 9.7 or ONTAP 9.8.

- [Adding nodes to a cluster with System Manager 9.7](#)
- [Adding nodes to a cluster with System Manager 9.8](#)

### Adding nodes to a cluster with System Manager 9.7

#### Steps

1. Click **(Return to classic version)**.
2. Click **Configurations > Cluster Expansion**.

System Manager automatically discovers the new nodes.

3. Click **Switch to the new experience**.
4. Click **Cluster > Overview** to view the new nodes.

### Adding nodes to a cluster with System Manager 9.8

#### Steps

1. Select **Cluster > Overview**.

The new controllers are shown as nodes connected to the cluster network but are not in the cluster.

2. Click **Add**.
  - The nodes are added into the cluster.
  - Storage is allocated implicitly.


# Manage storage efficiency policies

Starting with ONTAP 9.8, you can use System Manager to enable, disable, add, edit, or delete efficiency policies for storage VMs on FAS systems.





This function is not available on AFF systems.

## Steps

1. Select **Storage > Storage VMs**
2. Select the storage VM for which you want to manage efficiency policies.
3. On the **Settings** tab, select  in the **Efficiency Policy** section. The efficiency policies for that storage VM are displayed.

You can perform the following tasks:

- **Enable or disable** an efficiency policy by clicking the toggle button in the Status column.
- **Add** an efficiency policy by clicking on **Add+**.
- **Edit** an efficiency policy by clicking on  to the right of the policy name and selecting **Edit**.
- **Delete** an efficiency policy by clicking on  to the right of the policy name and selecting **Delete**.

# Recover deleted volumes

If you have accidentally deleted one or more FlexVol volumes, you can recover these volumes. Starting in System Manager 9.8, you can also recover FlexGroup volumes. You can also delete the volumes permanently by purging the volumes.

The volume retention time can be set on a storage VM level. By default, the volume retention time is set to 12 hours.

## Selecting deleted volumes

### Steps

1. Click **Storage > Volumes**.
2. Click **More > Show Deleted Volumes**.
3. Select the volumes and click the desired action to recover or permanently delete the volumes.

## Resetting the volume configurations

Deleting a volume deletes the associated configurations of the volume. Recovering a volume does not reset all the configurations. Perform the following tasks manually after recovering a volume to bring the volume back to its original state:

### Steps

1. Rename the volume.
2. Set up a junction path (NAS).
3. Create mappings for LUNs in the volume (SAN).

4. Associate a Snapshot policy and export policy with the volume.
5. Add new quota policy rules for the volume.
6. Add a QOS policy for the volume.

## Save storage space using compression, compaction, and deduplication

For volumes on non-AFF clusters, you can run deduplication, data compression, and data compaction together or independently to achieve optimal space savings.

- Deduplication eliminates duplicate data blocks.
- Data compression compresses the data blocks to reduce the amount of physical storage that is required.
- Data compaction stores more data in less space to increase storage efficiency.



These tasks are supported for volumes on non-AFF clusters. Beginning with ONTAP 9.2, all inline storage efficiency features, such as inline deduplication and inline compression, are enabled by default on AFF volumes.

### Steps

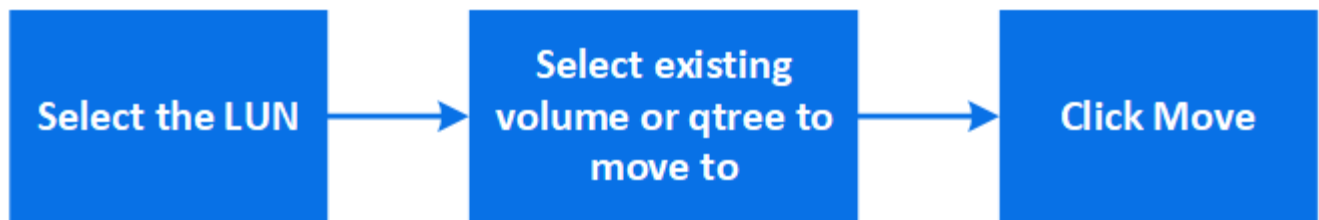
1. Click **Storage > Volumes**.
2. Next to the name of the volume for which you want to save storage, click .
3. Click **Edit** and scroll to **Storage Efficiency**.
4. *Optional:* If you want to enable background deduplication, ensure the checkbox is checked.
5. *Optional:* If you want to enable background compression, specify the storage efficiency policy and ensure the checkbox is checked.
6. *Optional:* If you want to enable inline compression, ensure the checkbox is checked.

## Balance loads by moving LUNs

You can move a LUN to another volume within the storage VM to balance the load, or you can move it to a volume with a higher performance service level to improve performance.

### Move restrictions

- A LUN cannot be moved to a qtree within the same volume.
- A LUN created from a file using the CLI cannot be moved with System Manager.
- LUNs that are online and serving data cannot be moved.
- LUNs cannot be moved if the allocated space in the destination volume cannot contain the LUN (even if autogrow is enabled on the volume).
- LUNs on SnapLock volumes cannot be moved with System Manager.



#### Steps

1. Click **Storage > LUNs**.
2. Select the LUN that you want to move and click **Move**.
3. Select an existing volume to which you want to move the LUN. If the volume contains qtrees, select the qtree.



While the Move operation is in progress, the LUN is displayed on both the origin and destination volume.

## Balance loads by moving volumes to another tier

Starting with ONTAP 9.8, you can use System Manager to move a volume to another tier to balance the load.

Starting with ONTAP 9.9.1, you can also move volumes based on analysis of active and inactive data storage. For more information, see [File System Analytics overview](#).

#### Steps

1. Click **Storage > Volumes**.
2. Select the volume or volumes that you want to move, and then click **Move**.
3. Select an existing tier (aggregate) to which you want to move the volume or volumes.

## Use Ansible Playbooks to add or edit volumes or LUNs

Starting with ONTAP 9.9.1, you can use Ansible Playbooks with System Manager when you want to add or edit volumes or LUNs.

This feature lets you use the same configuration multiple times or use the same configuration with slight changes when you add or edit volumes or LUNs.

### Enable or disable Ansible Playbooks

You can enable or disable the use of Ansible Playbooks with System Manager.

#### Steps

1. In System Manager, go to the UI settings in the cluster settings page:

**Cluster > Settings**

2. Under **UI Settings**, change the slider switch to "Enabled" or "Disabled".

## Save a volume configuration to an Ansible Playbook

When you create or modify the configuration of a volume, you can save the configuration as Ansible Playbook files.

### Steps

1. Add or Edit the volume:

**Volume > Add** (or **Volume > Edit**)

2. Specify or edit the configuration values of the volume.
3. Select **Save to Ansible Playbook** to save the configuration to Ansible Playbook files.

A zip file is downloaded that contains the following files:

- **variable.yaml**: The values you entered or modified to add or edit the volume.
- **volumeAdd.yaml** (or **volumeEdit.yaml**): The test cases that are required to create or modify the values when reading the inputs from the **variable.yaml** file.

## Save a LUN configuration to an Ansible Playbook

When you create or modify the configuration of a LUN, you can save the configuration as Ansible Playbook files.

### Steps

1. Add or Edit the LUN:

**LUN > Add** (or **LUN > Edit**)

2. Specify or edit the configuration values of the LUN.
3. Select **Save to Ansible Playbook** to save the configuration to Ansible Playbook files:


A zip file is downloaded that contains the following files:

- **variable.yaml**: The values you entered or modified to add or edit the LUN.
- **lunAdd.yaml** (or **lunEdit.yaml**): The test cases that are required to create or modify the values when reading the inputs from the **variable.yaml** file.

## Download Ansible Playbook files from global search results

You can download Ansible Playbook files when you do a global search.

### Steps

1. In the search field, enter “volume” or “LUN” or “Playbook”.
2. Find the search result, either “Volume Management (Ansible Playbook)” or “LUN Management (Ansible Playbook)”.
3. Click on  to download the Ansible Playbook files.

# Work with Ansible Playbook files

Ansible Playbook files can be modified and run to specify configurations for volumes and LUNs.

## About this task

You use two files to perform an operation (either an “add” or an “edit”):

If you want to...	Use this variable file...	And use this run file...
Add a volume	volumeAdd-variable.yaml	valueAdd.yaml
Edit a volume	volumeEdit-variable.yaml	volumeEdit.yaml
Add a LUN	lunAdd-variable.yaml	lunAdd.yaml
Edit a LUN	lunEdit-variable.yaml	lunEdit.yaml

## Steps

1. Modify the variables file.

The file contains the various values that you use to configure the volume or LUN.

- If you do not change the values, leave them commented.
- If you modify the values, remove the commenting.

2. Run the associated run file.

The run file contains the test cases that are required to create or modify the values when reading the inputs from the variable file.

3. Enter your user login credentials.

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