



# Manage LUNs

## ONTAP 9

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# Manage LUNs

## Edit LUN QoS policy group

Beginning with ONTAP 9.10.1, you can use System Manager to assign or remove Quality of Service (QoS) policies on multiple LUNs at the same time.



If the QoS policy is assigned at the volume level, it must be changed at the volume level. You can only edit the QoS policy at the LUN level if it was originally assigned at the LUN level.

### Steps

1. In System Manager, click **Storage > LUNs**.
2. Select the LUN or LUNs you want to edit.

If you are editing more than one LUN at a time, the LUNs must belong to the same Storage Virtual Machine (SVM). If you select LUNs that do not belong to the same SVM, the option to edit the QoS Policy Group is not displayed.

3. Click **More** and select **Edit QoS Policy Group**.

## Convert a LUN into a namespace

Beginning with ONTAP 9.11.1, you can use the ONTAP CLI to in-place convert an existing LUN to an NVMe namespace.

### Before you begin

- Specified LUN should not have any existing maps to an igroup.
- LUN should not be in a MetroCluster configured SVM or in an SnapMirror active sync relationship.
- LUN should not be a protocol endpoint or bound to a protocol endpoint.
- LUN should not have non-zero prefix and/or suffix stream.
- LUN should not be part of a snapshot or on the destination side of SnapMirror relationship as a read-only LUN.

### Step

1. Convert a LUN to an NVMe namespace:

```
vserver nvme namespace convert-from-lun -vserver -lun-path
```


## Take a LUN offline

Beginning with ONTAP 9.10.1 you can use System Manager to take LUNs offline. Prior to ONTAP 9.10.1, you must use the ONTAP CLI to take LUNs offline.

## System Manager

### Steps

1. In System Manager, click **Storage>LUNs**.
2. Take a single LUN or multiple LUNs offline

If you want to...	Do this...
Take a single LUN offline	Next to the LUN name, click  and select <b>Take Offline</b> .
Take multiple LUNs offline	<ol style="list-style-type: none"><li>a. Select the LUNs you want to take offline.</li><li>b. Click <b>More</b> and select <b>Take Offline</b>.</li></ol>

### CLI

You can only take one LUN offline at a time when using the CLI.

### Step

1. Take the LUN offline:

```
lun offline <lun_name> -vserver <SVM_name>
```

## Resize a LUN

You can increase or decrease the size of a LUN.



Solaris LUNs cannot be resized.

### Increase the size of a LUN

The size to which you can increase your LUN varies depending upon your version of ONTAP.

ONTAP version	Maximum LUN size
ONTAP 9.12.1P2 and later	128 TB for AFF, FAS, and ASA platforms
ONTAP 9.8 and later	<ul style="list-style-type: none"><li>• 128 TB for All-Flash SAN Array (ASA) platforms</li><li>• 16 TB for non-ASA platforms</li></ul>
ONTAP 9.5, 9.6, 9.7	16TB

ONTAP 9.4 or earlier	<p>10 times the original LUN size, but not greater than 16TB, which is the maximum LUN size.</p> <p>For example, if you create a 100 GB LUN, you can only grow it to 1,000 GB.</p> <p>The actual maximum size of the LUN might not be exactly 16TB. ONTAP rounds down the limit to be slightly less.</p>
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You do not need to take the LUN offline to increase the size. However, after you have increased the size, you must rescan the LUN on the host for the host to recognize the change in size.

See the Command Reference page for the `lun resize` command for more information about resizing a LUN.

## Example 1. Steps

### System Manager

Increase the size of a LUN with ONTAP System Manager (9.7 and later).

1. In System Manager, click **Storage > LUNs**.
2. Click  and select **Edit**.
3. Under **Storage and Optimization** increase the size of the LUN and **Save**.

### CLI

Increase the size of a LUN with the ONTAP CLI.

1. Increase the size of the LUN:

```
lun resize -vserver <SVM_name> -volume <volume_name> -lun <lun_name>
-size <lun_size>
```

2. Verify the increased LUN size:

```
lun show -vserver <SVM_name>
```



ONTAP operations round down the actual maximum size of the LUN so it is slightly less than the expected value. Also, actual LUN size might vary slightly based on the OS type of the LUN. To obtain the exact resized value, run the following commands in advanced mode:

```
set -unit B
```

```
lun show -fields max-resize-size -volume volume_name -lun
lun_name
```

3. Rescan the LUN on the host.
4. Follow your host documentation to make the newly created LUN size visible to the host file system.

## Decrease the size of a LUN

Before you decrease the size of a LUN, the host needs to migrate the blocks containing the LUN data into the boundary of the smaller LUN size. You should use a tool such as SnapCenter to ensure that the LUN is properly decreased without truncating blocks containing LUN data. Manually decreasing the size of your LUN is not recommended.

After you decrease the size of your LUN, ONTAP automatically notifies the initiator that the LUN size has decreased. However, additional steps might be required on your host for the host to recognize the new LUN size. Check your host documentation for specific information about decreasing the size of the host file structure.

# Move a LUN

You can move a LUN across volumes within a storage virtual machine (SVM), but you cannot move a LUN across SVMs. LUNs moved across volumes within an SVM are moved immediately and without loss of connectivity.

## What you'll need

If your LUN is using Selective LUN Map (SLM), you should [modify the SLM reporting-nodes list](#) to include the destination node and its HA partner before you move your LUN.

## About this task

Storage efficiency features, such as deduplication, compression, and compaction are not preserved during a LUN move. They must be reapplied after the LUN move is completed.

Data protection through Snapshot copies occurs at the volume level. Therefore, when you move a LUN, it falls under the data protection scheme of the destination volume. If you do not have Snapshot copies established for the destination volume, Snapshot copies of the LUN are not created. Also, all of the Snapshot copies of the LUN stay in the original volume until those Snapshot copies are deleted.

You cannot move a LUN to the following volumes:

- A SnapMirror destination volume
- The SVM root volume

You cannot move the following types of LUNs:

- A LUN that has been created from a file
- A LUN that is in NVFail state
- A LUN that is in a load-sharing relationship
- A protocol-endpoint class LUN



For Solaris `os_type` LUNs that are 1 TB or larger, the host might experience a timeout during the LUN move. For this LUN type, you should unmount the LUN before initiating the move.


## Example 2. Steps

### System Manager

Move a LUN with ONTAP System Manager (9.7 and later).

Beginning with ONTAP 9.10.1, you can use System Manager to create a new volume when you move a single LUN. In ONTAP 9.8 and 9.9.1, the volume to which you are moving your LUN must exist before you begin the LUN move.

#### Steps

1. In System Manager, click **Storage>LUNs**.
2. Right click the LUN you want to move, then click  and select **Move LUN**.

In ONTAP 9.10.1, select to move the LUN to **An existing volume** or to a **New volume**.

If you select to create a new volume, provide the volume specifications.

3. Click **Move**.

### CLI

Move a LUN with the ONTAP CLI.

1. Move the LUN:

```
lun move start
```

During a very brief period, the LUN is visible on both the origin and destination volume. This is expected and is resolved upon completion of the move.

2. Track the status of the move and verify successful completion:

```
lun move show
```

### Related information

- [Selective LUN Map](#)

## Delete LUNs

You can delete a LUN from a storage virtual machine (SVM) if you no longer need the LUN.

### What you'll need

The LUN must be unmapped from its igroup before you can delete it.

#### Steps

1. Verify that the application or host is not using the LUN.

## 2. Unmap the LUN from the igroup:

```
lun mapping delete -vserver <SVM_name> -volume <volume_name> -lun <LUN_name> -igroup <igroup_name>
```

## 3. Delete the LUN:

```
lun delete -vserver <SVM_name> -volume <volume_name> -lun <LUN_name>
```

## 4. Verify that you deleted the LUN:

```
lun show -vserver <SVM_name>
```

Vserver	Path	State	Mapped	Type	Size
vs5	/vol/vol16/lun8	online	mapped	windows	10.00GB

# What to know before copying LUNs

You should be aware of certain things before copying a LUN.

Cluster administrators can copy a LUN across storage virtual machines (SVMs) within the cluster by using the `lun copy` command. Cluster administrators must establish the storage virtual machine (SVM) peering relationship using the `vserver peer create` command before an inter-SVM LUN copy operation is performed. There must be enough space in the source volume for a SIS clone.

LUNs in Snapshot copies can be used as source LUNs for the `lun copy` command. When you copy a LUN using the `lun copy` command, the LUN copy is immediately available for read and write access. The source LUN is unchanged by creation of a LUN copy. Both the source LUN and the LUN copy exist as unique LUNs with different LUN serial numbers. Changes made to the source LUN are not reflected in the LUN copy, and changes made to the LUN copy are not reflected in the source LUN. The LUN mapping of the source LUN is not copied to the new LUN; the LUN copy must be mapped.

Data protection through Snapshot copies occurs at the volume level. Therefore, if you copy a LUN to a volume different from the volume of the source LUN, the destination LUN falls under the data protection scheme of the destination volume. If you do not have Snapshot copies established for the destination volume, Snapshot copies are not created of the LUN copy.

Copying LUNs is a nondisruptive operation.

You cannot copy the following types of LUNs:

- A LUN that has been created from a file
- A LUN that is in NVFAIL state

- A LUN that is in a load-sharing relationship
- A protocol-endpoint class LUN

## Examine configured and used space of a LUN

Knowing the configured space and actual space used for your LUNs can help you determine the amount of space that can be reclaimed when doing space reclamation, the amount of reserved space that contains data, and the total configured size versus the actual size used for a LUN.

### Step

1. View the configured space versus the actual space used for a LUN:

```
lun show
```

The following example show the configured space versus the actual space used by the LUNs in the vs3 storage virtual machine (SVM):

```
lun show -vserver vs3 -fields path, size, size-used, space-reserve
```

vserver	path	size	space-reserve	size-used
vs3	/vol/vol0/lun1	50.01GB	disabled	25.00GB
vs3	/vol/vol0/lun1_backup	50.01GB	disabled	32.15GB
vs3	/vol/vol0/lun2	75.00GB	disabled	0B
vs3	/vol/volspace/lun0	5.00GB	enabled	4.50GB

4 entries were displayed.

## Enable space allocation for SAN

Enable space allocation to allow your hosts and storage systems to cooperate on LUN space management.

Beginning with ONTAP 9.15.1, space allocation is enabled by default for newly created LUNs. Space allocation had been disabled by default in previous versions of ONTAP (9.14.1 and earlier).

Enabling the `space-allocation` setting allows the following benefits:

- **ONTAP can communicate to a host that no free space is available to service a write:** This communication is a more graceful way for hosts to handle out-of-space situations. The LUN remains online but is unable to service a write IO until space becomes available. Read IO can still be performed. The exact effect on a host OS depends on host configuration. In some cases, the OS retries write IO until it succeeds. In other cases, the filesystem could be placed offline.



If the `space-allocation` setting is not enabled, a LUN enters a state of `space-error` when it reaches a low space threshold and all IO fails. The LUN needs to be changed back to `online` state after the space problem has been resolved. Rescanning LUN devices might also be required on the host to restore paths and devices to an operational state.

- **A host can perform SCSI `UNMAP` (sometimes called `TRIM`) operations:** These operations allows a host to identify blocks of data on a LUN that are no longer required because they no longer contain valid data. Identification normally happens after file deletion. The storage system can then deallocate those data blocks so that the space can be consumed elsewhere. This deallocation greatly improves overall storage efficiency, especially with filesystems that have data high turnover.

### Before you begin

Enabling space allocation requires a host configuration that can correctly handle space allocation errors when a write cannot be completed. Leveraging SCSI `UNMAP` requires a configuration that can use logical block provisioning as defined in the SCSI SBC-3 standard.

The following hosts currently support SCSI thin provisioning when you enable space allocation:

- Citrix XenServer 6.5 and later
- ESXi 5.0 and later
- Oracle Linux 6.2 UEK kernel and later
- Red Hat Enterprise Linux 6.2 and later
- SUSE Linux Enterprise Server 11 and later
- Solaris 11.1 and later
- Windows

Space allocation is not supported on NVMe hosts.

### About this task

When you upgrade your cluster to ONTAP 9.15.1, the space allocation setting for all LUNs created prior to the software upgrade remains the same after the upgrade, regardless of host type. For example, if a LUN was created in ONTAP 9.13.1 for a VMware host with space allocation disabled, space allocation on that LUN remains disabled after upgrading to ONTAP 9.15.1.

### Steps

1. Enable space allocation:

```
lun modify -vserver <vserver_name> -volume <volume_name> -lun <lun_name>
-space-allocation enabled
```

2. Verify that space allocation is enabled:

```
lun show -vserver <vserver_name> -volume <volume_name> -lun <lun_name>
-fields space-allocation
```

3. Verify that space allocation is enabled on the host OS.



Some host configurations, ESX in particular, can automatically recognize the setting change and do not require user intervention. Other configurations might require a device rescan. Some filesystems and volume managers might require additional specific settings to enable space reclamation using `SCSI UNMAP`. Remounting of filesystems or a full OS reboot might be required. Consult the documentation for your specific OS for guidance.

## Control and monitor I/O performance to LUNs by using Storage QoS

You can control input/output (I/O) performance to LUNs by assigning LUNs to Storage QoS policy groups. You might control I/O performance to ensure that workloads achieve specific performance objectives or to throttle a workload that negatively impacts other workloads.

### About this task

Policy groups enforce a maximum throughput limit (for example, 100 MB/s). You can create a policy group without specifying a maximum throughput, which enables you to monitor performance before you control the workload.

You can also assign storage virtual machines (SVMs) with FlexVol volumes and LUNs to policy groups.

Note the following requirements about assigning a LUN to a policy group:

- The LUN must be contained by the SVM to which the policy group belongs.

You specify the SVM when you create the policy group.

- If you assign a LUN to a policy group, then you cannot assign the LUN's containing volume or SVM to a policy group.

For more information about how to use Storage QoS, see the [System administration reference](#).

### Steps

1. Use the `qos policy-group create` command to create a policy group.
2. Use the `lun create` command or the `lun modify` command with the `-qos-policy-group` parameter to assign a LUN to a policy group.
3. Use the `qos statistics` commands to view performance data.
4. If necessary, use the `qos policy-group modify` command to adjust the policy group's maximum throughput limit.

## Tools available to effectively monitor your LUNs

Tools are available to help you effectively monitor your LUNs and avoid running out of space.

- Active IQ Unified Manager is a free tool that enables you to manage all storage across all clusters in your environment.

- System Manager is a graphical user interface built into ONTAP that enables you to manually manage storage needs at the cluster level.
- OnCommand Insight presents a single view of your storage infrastructure and enables you to set up automatic monitoring, alerts, and reporting when your LUNs, volumes, and aggregates are running out of storage space.

## Capabilities and restrictions of transitioned LUNs

In a SAN environment, a disruption in service is required during the transition of a 7-Mode volume to ONTAP. You need to shut down your hosts to complete the transition. After transition, you must update your host configurations before you can begin serving data in ONTAP.

You need to schedule a maintenance window during which you can shut down your hosts and complete the transition.

LUNs that have been transitioned from Data ONTAP operating in 7-Mode to ONTAP have certain capabilities and restrictions that affect the way the LUNs can be managed.

You can do the following with transitioned LUNs:

- View the LUN using the `lun show` command
- View the inventory of LUNs transitioned from the 7-Mode volume using the `transition 7-mode show` command
- Restore a volume from a 7-Mode Snapshot copy

Restoring the volume transitions all of the LUNs captured in the Snapshot copy

- Restore a single LUN from a 7-Mode Snapshot copy using the `snapshot restore-file` command
- Create a clone of a LUN in a 7-Mode Snapshot copy
- Restore a range of blocks from a LUN captured in a 7-Mode Snapshot copy
- Create a FlexClone of the volume using a 7-Mode Snapshot copy

You cannot do the following with transitioned LUNs:

- Access Snapshot copy-backed LUN clones captured in the volume

### Related information

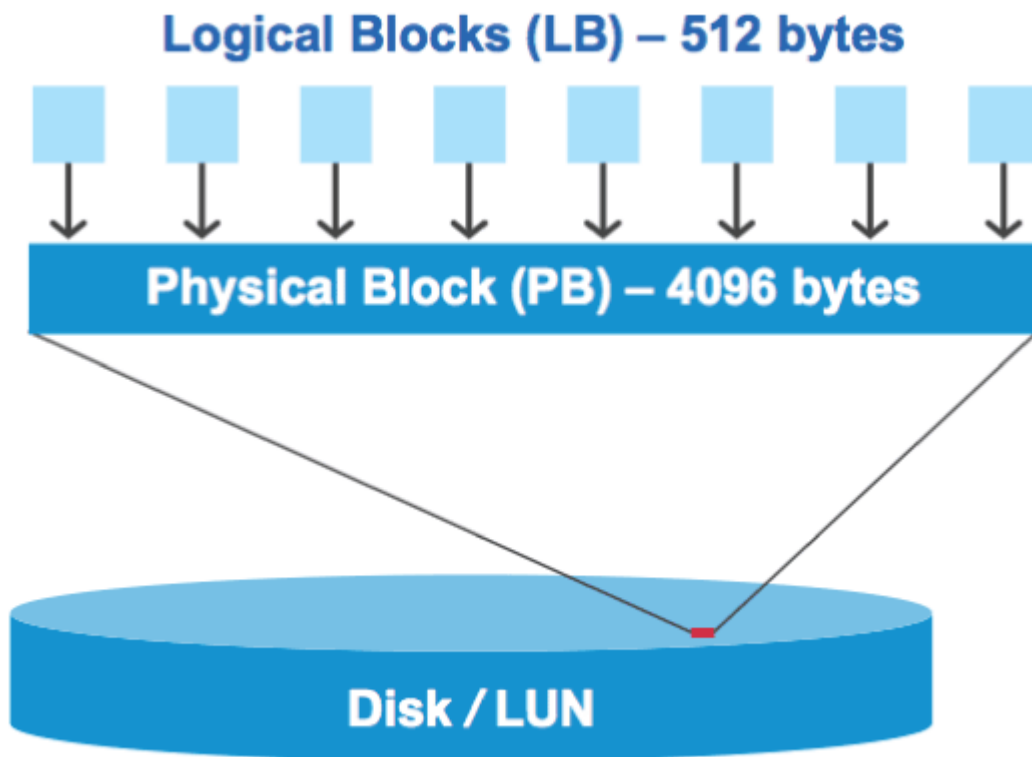
[Copy-based transition](#)

## I/O misalignments on properly aligned LUNs overview

ONTAP might report I/O misalignments on properly aligned LUNs. In general, these misalignment warnings can be disregarded as long as you are confident that your LUN is properly provisioned and your partitioning table is correct.

LUNs and hard disks both provide storage as blocks. Because the block size for disks on the host is 512 bytes, LUNs present blocks of that size to the host while actually using larger, 4-KB blocks to store data. The 512-byte data block used by the host is referred to as a logical block. The 4-KB data block used by the LUN to store

data is referred to as a physical block. This means that there are eight 512-byte logical blocks in each 4-KB physical block.



The host operating system can begin a read or write I/O operation at any logical block. I/O operations are only considered aligned when they begin at the first logical block in the physical block. If an I/O operation begins at a logical block that is not also the start of a physical block, the I/O is considered misaligned. ONTAP automatically detects the misalignment and reports it on the LUN. However, the presence of misaligned I/O does not necessarily mean that the LUN is also misaligned. It is possible for misaligned I/O to be reported on properly aligned LUNs.

If you require further investigation, see the Knowledge Base article [How to identify unaligned IO on LUNs?](#)

For more information about tools for correcting alignment problems, see the following documentation:

- [Windows Unified Host Utilities 7.1](#)
- [Provision SAN storage documentation](#)

## Achieve I/O alignment using LUN OS types

For ONTAP 9.7 or earlier, you should use the recommended ONTAP LUN `ostype` value that most closely matches your operating system to achieve I/O alignment with your OS partitioning scheme.

The partition scheme employed by the host operating system is a major contributing factor to I/O misalignments. Some ONTAP LUN `ostype` values use a special offset known as a “prefix” to enable the default partitioning scheme used by the host operating system to be aligned.



In some circumstances, a custom partitioning table might be required to achieve I/O alignment. However, for `ostype` values with a “prefix” value greater than 0, a custom partition might create misaligned I/O.

For more information on LUNs provisioned in ONTAP 9.7 or earlier, see the KB article [How to identify unaligned IO on LUNs](#).



By default, new LUNs that are provisioned in ONTAP 9.8 or later have a prefix and suffix size of zero for all LUN OS types. The I/O should be aligned with the supported host OS by default.

## Special I/O alignment considerations for Linux

Linux distributions offer a wide variety of ways to use a LUN including as raw devices for databases, various volume managers, and file systems. It is not necessary to create partitions on a LUN when used as a raw device or as physical volume in a logical volume.

For RHEL 5 and earlier and SLES 10 and earlier, if the LUN will be used without a volume manager, you should partition the LUN to have one partition that begins at an aligned offset, which is a sector that is an even multiple of eight logical blocks.

## Special I/O alignment considerations for Solaris LUNs

You need to consider various factors when determining whether you should use the `solaris` `ostype` or the `solaris_efi` `ostype`.

See the [Solaris Host Utilities Installation and Administration Guide](#) for detailed information.

## ESX boot LUNs report as misaligned

LUNs used as ESX boot LUNs are typically reported by ONTAP as misaligned. ESX creates multiple partitions on the boot LUN, making it very difficult to align. Misaligned ESX boot LUNs are not typically a performance problem because the total amount of misaligned I/O is small. Assuming that the LUN was correctly provisioned with the VMware `ostype`, no action is needed.

### Related information

[Guest VM file system partition/disk alignment for VMware vSphere, other virtual environments, and NetApp storage systems](#)

## Ways to address issues when LUNs go offline

When no space is available for writes, LUNs go offline to preserve data integrity. LUNs can run out of space and go offline for various reasons, and there are several ways you can address the issue.

If the...	You can...
Aggregate is full	<ul style="list-style-type: none"> <li>• Add more disks.</li> <li>• Use the <code>volume modify</code> command to shrink a volume that has available space.</li> <li>• If you have space-guarantee volumes that have available space, change the volume space guarantee to none with the <code>volume modify</code> command.</li> </ul>
Volume is full but there is space available in the containing aggregate	<ul style="list-style-type: none"> <li>• For space guarantee volumes, use the <code>volume modify</code> command to increase the size of your volume.</li> <li>• For thinly provisioned volumes, use the <code>volume modify</code> command to increase the maximum size of your volume.</li> </ul> <p>If volume autogrow is not enabled, use <code>volume modify -autogrow-mode</code> to enable it.</p> <ul style="list-style-type: none"> <li>• Delete Snapshot copies manually with the <code>volume snapshot delete</code> command, or use the <code>volume snapshot autodelete modify</code> command to automatically delete Snapshot copies.</li> </ul>

#### Related information

[Disk and local tier \(aggregate\) management](#)

[Logical storage management](#)

## Troubleshoot iSCSI LUNs not visible on the host

The iSCSI LUNs appear as local disks to the host. If the storage system LUNs are not available as disks on the host, you should verify the configuration settings.

Configuration setting	What to do
Cabling	Verify that the cables between the host and storage system are properly connected.

Configuration setting	What to do
Network connectivity	<p>Verify that there is TCP/IP connectivity between the host and storage system.</p> <ul style="list-style-type: none"> <li>From the storage system command line, ping the host interfaces that are being used for iSCSI: <pre>ping -node <i>node_name</i> -destination <i>host_ip_address_for_iSCSI</i></pre> </li> <li>From the host command line, ping the storage system interfaces that are being used for iSCSI: <pre>ping -node <i>node_name</i> -destination <i>host_ip_address_for_iSCSI</i></pre> </li> </ul>
System requirements	<p>Verify that the components of your configuration are qualified. Also, verify that you have the correct host operating system (OS) service pack level, initiator version, ONTAP version, and other system requirements. The Interoperability Matrix contains the most up-to-date system requirements.</p>
Jumbo frames	<p>If you are using jumbo frames in your configuration, verify that jumbo frames are enabled on all devices in the network path: the host Ethernet NIC, the storage system, and any switches.</p>
iSCSI service status	<p>Verify that the iSCSI service is licensed and started on the storage system.</p>
Initiator login	<p>Verify that the initiator is logged in to the storage system. If the <code>iscsi initiator show</code> command output shows no initiators are logged in, check the initiator configuration on the host. Also verify that the storage system is configured as a target of the initiator.</p>
iSCSI node names (IQNs)	<p>Verify that you are using the correct initiator node names in the igroup configuration. On the host, you can use the initiator tools and commands to display the initiator node name. The initiator node names configured in the igroup and on the host must match.</p>
LUN mappings	<p>Verify that the LUNs are mapped to an igroup. On the storage system console, you can use one of the following commands:</p> <ul style="list-style-type: none"> <li><code>lun mapping show</code> displays all LUNs and the igroups to which they are mapped.</li> <li><code>lun mapping show -igroup</code> displays the LUNs mapped to a specific igroup.</li> </ul>
iSCSI LIFs enable	<p>Verify that the iSCSI logical interfaces are enabled.</p>

## Related information

[NetApp Interoperability Matrix Tool](#)

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