



# **Use storage pools**

## StorageGRID software

NetApp

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# Use storage pools

## What is a storage pool?

A storage pool is a logical grouping of Storage Nodes.

When you install StorageGRID, one storage pool per site is automatically created. You can configure additional storage pools as needed for your storage requirements.



Storage Nodes can be configured during installation to contain object data and object metadata, or only object metadata. Metadata-only Storage Nodes can't be used in storage pools. For more information, see [Types of Storage Nodes](#).

Storage pools have two attributes:

- **Storage grade:** For Storage Nodes, the relative performance of backing storage.
- **Site:** The data center where objects will be stored.

Storage pools are used in ILM rules to determine where object data is stored and the type of storage used. When you configure ILM rules for replication, you select one or more storage pools.

## Guidelines for creating storage pools

Configure and use storage pools to protect against data loss by distributing data across multiple sites. Replicated copies and erasure-coded copies require different storage pool configurations.

See [Examples of enabling site-loss protection using replication and erasure coding](#).

### Guidelines for all storage pools

- Keep storage pool configurations as simple as possible. Don't create more storage pools than necessary.
- Create storage pools with as many nodes as possible. Each storage pool should contain two or more nodes. A storage pool with insufficient nodes can cause ILM backlogs if a node becomes unavailable.
- Avoid creating or using storage pools that overlap (contain one or more of the same nodes). If storage pools overlap, more than one copy of object data might be saved on the same node.
- In general, don't use the All Storage Nodes storage pool (StorageGRID 11.6 and earlier) or the All Sites site. These items are automatically updated to include any new sites you add in an expansion, which might not be the behavior you want.

### Guidelines for storage pools used for replicated copies

- For site-loss protection using [replication](#), specify one or more site-specific storage pools in the [placement instructions for each ILM rule](#).

One storage pool is automatically created for each site during StorageGRID installation.

Using a storage pool for each site ensures that replicated object copies are placed exactly where you expect (for example, one copy of every object at each site for site-loss protection).

- If you add a site in an expansion, create a new storage pool that contains only the new site. Then, [update ILM rules](#) to control which objects are stored on the new site.
- If the number of copies is less than the number of storage pools, the system distributes the copies to balance disk usage among the pools.
- If the storage pools overlap (contain the same Storage Nodes), all copies of the object might be saved at only one site. You must ensure that the selected storage pools don't contain the same Storage Nodes.

## Guidelines for storage pools used for erasure-coded copies

- For site-loss protection using [erasure coding](#), create storage pools that consist of at least three sites. If a storage pool includes only two sites, you can't use that storage pool for erasure coding. No erasure-coding schemes are available for a storage pool that has two sites.
- The number of Storage Nodes and sites contained in the storage pool determine which [erasure-coding schemes](#) are available.
- If possible, a storage pool should include more than the minimum number of Storage Nodes required for the erasure-coding scheme you select. For example, if you use a 6+3 erasure-coding scheme, you must have at least nine Storage Nodes. However, having at least one additional Storage Node per site is recommended.
- Distribute Storage Nodes across sites as evenly as possible. For example, to support a 6+3 erasure-coding scheme, configure a storage pool that includes at least three Storage Nodes at three sites.
- If you have high throughput requirements, using a storage pool that includes multiple sites is not recommended if the network latency between sites is greater than 100 ms. As latency increases, the rate at which StorageGRID can create, place, and retrieve object fragments decreases sharply due to the decrease in TCP network throughput.

The decrease in throughput affects the maximum achievable rates of object ingest and retrieval (when Balanced or Strict are selected as the ingest behavior) or could lead to ILM queue backlogs (when Dual commit is selected as the ingest behavior). See [ILM rule ingest behavior](#).



If your grid includes only one site, you are prevented from using the All Storage Nodes storage pool (StorageGRID 11.6 and earlier) or the All Sites site in an erasure-coding profile. This behavior prevents the profile from becoming invalid if a second site is added.

## Enable site-loss protection

If your StorageGRID deployment includes more than one site, you can use replication and erasure coding with appropriately configured storage pools to enable site-loss protection.

Replication and erasure coding require different storage pool configurations:

- To use replication for site-loss protection, use the site-specific storage pools that are automatically created during StorageGRID installation. Then create ILM rules with [placement instructions](#) that specify multiple storage pools so that one copy of each object will be placed at each site.
- To use erasure coding for site-loss protection, [create storage pools that consist of multiple sites](#). Then create ILM rules that use one storage pool consisting of multiple sites and any available erasure-coding schema.



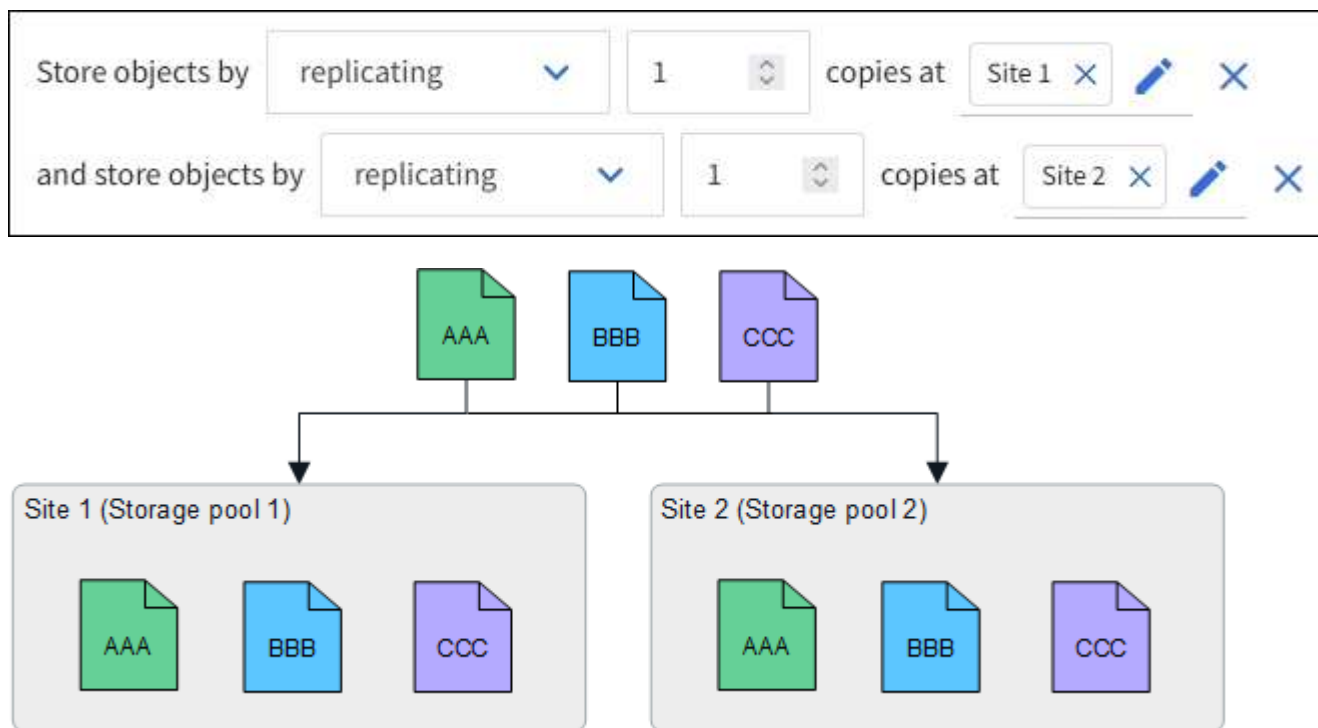
When configuring your StorageGRID deployment for site-loss protection, you must also take into account the effects of [ingest options](#) and [consistency](#).

## Replication example

By default, one storage pool is created for each site during StorageGRID installation. Having storage pools that consist of only one site enables you to configure ILM rules that use replication for site-loss protection. In this example:

- Storage pool 1 contains Site 1
- Storage pool 2 contains Site 2
- The ILM rule contains two placements:
  - Store objects by replicating 1 copy at Site 1
  - Store objects by replicating 1 copy at Site 2

ILM rule placements:



If one site is lost, copies of the objects are available at the other site.

## Erasure coding example

Having storage pools that consist of more than one site per storage pool enables you to configure ILM rules that use erasure coding for site-loss protection. In this example:

- Storage pool 1 contains Sites 1 through 3
- The ILM rule contains one placement: Store objects by erasure coding using a 4+2 EC scheme at Storage pool 1, which contains three sites

ILM rule placements:

Store objects by **erasure coding** using **4+2 EC at Storage pool 1 (3 sites)**

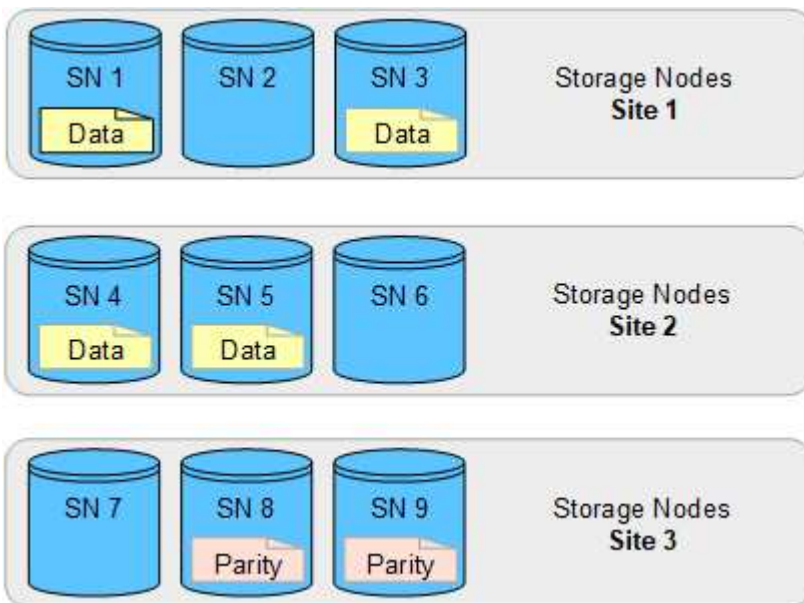
In this example:

- The ILM rule uses a 4+2 erasure-coding scheme.
- Each object is sliced into four equal data fragments, and two parity fragments are computed from the object data.
- Each of the six fragments is stored on a different node across three data center sites to provide data protection for node failures or site loss.

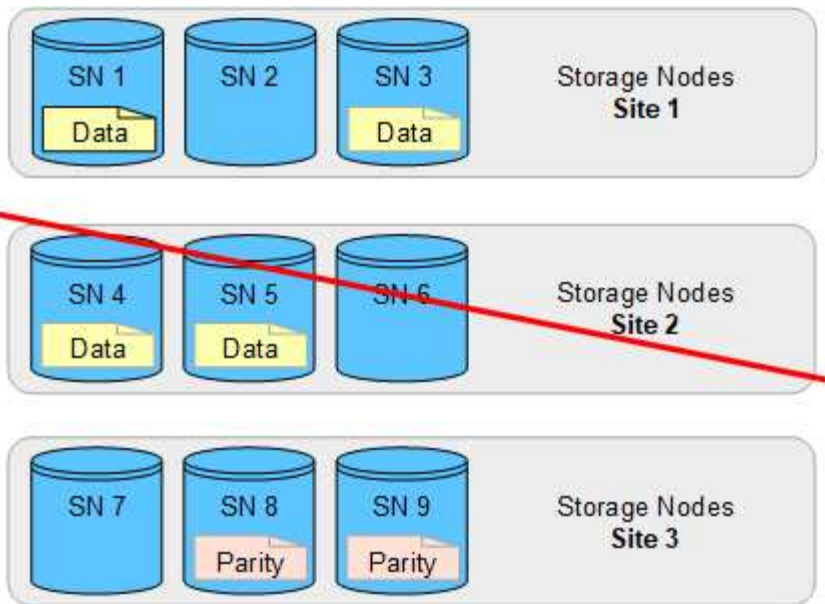


Erasure coding is allowed in storage pools containing any number of sites *except* two sites.

ILM rule using 4+2 erasure-coding scheme:



If one site is lost, data can still be recovered:



## Create a storage pool

You create storage pools to determine where the StorageGRID system stores object data and the type of storage used. Each storage pool includes one or more sites and one or more storage grades.



When you install StorageGRID 11.9 on a new grid, storage pools are automatically created for each site. However, if you initially installed StorageGRID 11.6 or earlier, storage pools aren't automatically created for each site.

If you want to create Cloud Storage Pools to store object data outside of your StorageGRID system, see the [information about using Cloud Storage Pools](#).

### Before you begin

- You are signed in to the Grid Manager using a [supported web browser](#).
- You have [specific access permissions](#).
- You have reviewed the guidelines for creating storage pools.

### About this task

Storage pools determine where object data is stored. The number of storage pools you need depends on the number of sites in your grid and on the types of copies you want: replicated or erasure-coded.

- For replication and single-site erasure coding, create a storage pool for each site. For example, if you want to store replicated object copies at three sites, create three storage pools.
- For erasure coding at three or more sites, create one storage pool that includes an entry for each site. For example, if you want to erasure code objects across three sites, create one storage pool.



Don't include the All Sites site in a storage pool that will be used in an erasure-coding profile. Instead, add a separate entry to the storage pool for each site that will store erasure-coded data. See [this step](#) for an example.

- If you have more than one storage grade, don't create a storage pool that includes different storage grades

at a single site. See the [Guidelines for creating storage pools](#).

## Steps

1. Select **ILM > Storage pools**.

The Storage pools tab lists all defined storage pools.



For new installations of StorageGRID 11.6 or earlier, the All Storage Nodes storage pool is automatically updated whenever you add new data center sites. Don't use this pool in ILM rules.

2. To create a new storage pool, select **Create**.
3. Enter a unique name for the storage pool. Use a name that will be easy to identify when you configure erasure-coding profiles and ILM rules.
4. From the **Site** drop-down list, select a site for this storage pool.

When you select a site, the number of Storage Nodes in the table are automatically updated.

In general, don't use the All Sites site in any storage pool. ILM rules that use an All Sites storage pool place objects at any available site, giving you less control of object placement. Also, an All Sites storage pool uses the Storage Nodes at a new site immediately, which might not be the behavior you expect.

5. From the **Storage grade** drop-down list, select the type of storage that will be used if an ILM rule uses this storage pool.

The storage grade, *includes all storage grades*, includes all Storage Nodes at the selected site. If you created additional storage grades for the Storage Nodes in your grid, they are listed in the drop-down.

6. If you want to use the storage pool in a multi-site erasure-coding profile, select **Add more nodes** to add an entry for each site to the storage pool.



You are warned if you add more than one entry with different storage grades for a site.

To remove an entry, select the delete icon .

7. When you are satisfied with your selections, select **Save**.

The new storage pool is added to the list.

## View storage pool details

You can view the details of a storage pool to determine where the storage pool is used and to see which nodes and storage grades are included.

### Before you begin

- You are signed in to the Grid Manager using a [supported web browser](#).
- You have [specific access permissions](#).

## Steps

1. Select **ILM > Storage pools**.

The Storage pools table includes the following information for each storage pool that includes Storage Nodes:

- **Name:** The unique display name of the storage pool.
- **Node count:** The number of nodes in the storage pool.
- **Storage usage:** The percentage of the total usable space that has been used for object data on this node. This value does not include object metadata.
- **Total capacity:** The size of the storage pool, which equals the total amount of usable space for object data for all nodes in the storage pool.
- **ILM usage:** How the storage pool is currently being used. A storage pool might be unused or it might be used in one or more ILM rules, erasure-coding profiles, or both.

2. To view details for a specific storage pool, select its name.

The details page for the storage pool appears.

3. View the **Nodes** tab to learn about the Storage Nodes included in the storage pool.

The table includes the following information for each node:

- Node name
- Site name
- Storage grade
- Storage usage: The percentage of the total usable space for object data that has been used for the Storage Node.



The same Storage usage (%) value is also shown in the Storage Used - Object Data chart for each Storage Node (select **NODES** > **Storage Node** > **Storage**).

4. View the **ILM usage** tab to determine if the storage pool is currently being used in any ILM rules or erasure-coding profiles.
5. Optionally, go to the **ILM rules page** to learn about and manage any rules that use the storage pool.

See the [instructions for working with ILM rules](#).

## Edit storage pool

You can edit a storage pool to change its name or to update sites and storage grades.

### Before you begin

- You are signed in to the Grid Manager using a [supported web browser](#).
- You have [specific access permissions](#).
- You have reviewed the [guidelines for creating storage pools](#).
- If you plan to edit a storage pool that is used by a rule in the active ILM policy, you have considered how your changes will affect object data placement.

### About this task

If you are adding a new site or storage grade to a storage pool that is used in the active ILM policy, be aware

that the Storage Nodes in the new site or storage grade will not be used automatically. To force StorageGRID to use a new site or storage grade, you must activate a new ILM policy after saving the edited storage pool.

### Steps

1. Select **ILM > Storage pools**.
2. Select the checkbox for the storage pool you want to edit.

You can't edit the All Storage Nodes storage pool (StorageGRID 11.6 and earlier).

3. Select **Edit**.
4. As required, change the storage pool name.
5. As required, select other sites and storage grades.

You are prevented from changing the site or storage grade if the storage pool is used in an erasure-coding profile and the change would cause the erasure-coding scheme to become invalid. For example, if a storage pool used in a erasure-coding profile currently includes a storage grade with only one site, you are prevented from using a storage grade with two sites because the change would make the erasure-coding scheme invalid.



Adding or removing sites from an existing storage pool won't move any existing erasure-encoded data. If you want to move the existing data from the site, you must create a new storage pool and EC profile to re-encode the data.

6. Select **Save**.

### After you finish

If you added a new site or storage grade to a storage pool used in the active ILM policy, activate a new ILM policy to force StorageGRID to use the new site or storage grade. For example, clone your existing ILM policy and then activate the clone. See [Work with ILM rules and ILM policies](#).

## Remove a storage pool

You can remove a storage pool that is not being used.

### Before you begin

- You are signed in to the Grid Manager using a [supported web browser](#).
- You have the [required access permissions](#).

### Steps

1. Select **ILM > Storage pools**.
2. Look at the ILM usage column in the table to determine whether you can remove the storage pool.

You can't remove a storage pool if it is being used in an ILM rule or in an erasure-coding profile. As required, select **storage pool name > ILM usage** to determine where the storage pool is used.

3. If the storage pool you want to remove is not being used, select the checkbox.
4. Select **Remove**.
5. Select **OK**.

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