NetApp

Manage local tiers (aggregates)

ONTAP 9

NetApp
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You can add local tiers (aggregates), manage their usage, and add capacity (disks) to them using System Manager or the CLI.

You can perform the following tasks:

- **Prepare to add a local tier (aggregate)**

  Before you add a local tier, you can learn about RAID groups and RAID protection levels and policies for local tiers. You can learn about mirrored and unmirrored local tiers and how to quickly zero drives before provisioning them. You also perform a manual assignment of disk ownership before provisioning a local tier.

- **Add (create) a local tier (aggregate)**

  To add a local tier, you follow a specific workflow. You determine the number of disks or disk partitions that you need for the local tier and decide which method to use to create the local tier. You can add local tiers automatically by letting ONTAP assign the configuration, or you can manually specify the configuration.

- **Manage the use of local tiers (aggregates)**

  For existing local tiers, you can rename them, set their media costs, or determine their drive and RAID group information. You can modify the RAID configuration of a local tier and assign local tiers to storage VMs (SVMs). You can modify the RAID configuration of a local tier and assign local tiers to storage VMs (SVMs). You can determine which volumes reside on a local tier and how much space they use on a local tier. You can control how much space that volumes can use. You can relocate local tier ownership with an HA pair. You can also delete a local tier.

- **Add capacity (disks) to a local tier (aggregate)**

  Using different methods, you follow a specific workflow to add capacity. You can add disks to a local tier and add drives to a node or shelf. If needed, you can correct misaligned spare partitions.

Prepare to add a local tier (aggregate)

Prepare to add a local tier (aggregate)

Before you add a local tier, you should understand the following topics:

- Learn about RAID groups, RAID protection levels, and RAID policies for local tiers.
    - Local tiers (aggregates) and RAID groups
- Learn about mirrored and unmirrored local tiers and how to quickly zero drives before provisioning them.
    - Mirrored and unmirrored local tiers (aggregates)
    - Fast zeroing of drives
- Perform a manual assignment of disk ownership before provisioning a local tier.
    - Manually assign disk ownership

Local tiers (aggregates) and RAID groups

Modern RAID technologies protect against disk failure by rebuilding a failed disk's data on a spare disk. The system compares index information on a "parity disk" with data on the remaining healthy disks to reconstruct the missing data, all without downtime or a significant performance cost.

A local tier (aggregate) consists of one or more *RAID groups.* The *RAID type* of the local tier determines the number of parity disks in the RAID group and the number of simultaneous disk failures that the RAID configuration protects against.

The default RAID type, RAID-DP (RAID-double parity), requires two parity disks per RAID group and protects against data loss in the event of two disks failing at the same time. For RAID-DP, the recommended RAID group size is between 12 and 20 HDDs and between 20 and 28 SSDs.

You can spread out the overhead cost of parity disks by creating RAID groups at the higher end of the sizing recommendation. This is especially the case for SSDs, which are much more reliable than capacity drives. For local tiers that use HDDs, you should balance the need to maximize disk storage against countervailing factors like the longer rebuild time required for larger RAID groups.

Mirrored and unmirrored local tiers (aggregates)

ONTAP has an optional feature called *SyncMirror* which you can use to synchronously mirror local tier (aggregate) data in copies, or *plexes*, stored in different RAID groups. Plexes ensure against data loss if more disks fail than the RAID type protects against, or if there is a loss of connectivity to RAID group disks.

When you create a local tier with System Manager or using the CLI, you can specify that the local tier is mirrored or unmirrored.

How unmirrored local tiers (aggregates) work

If you do not specify that the local tiers are mirrored, then they are created as unmirrored local tiers (aggregates). Unmirrored local tiers have only one *plex* (a copy of their data), which contains all of the RAID groups belonging to that local tier.

The following diagram shows an unmirrored local tier composed of disks, with its one plex. The local tier has four RAID groups: rg0, rg1, rg2, and rg3. Each RAID group has six data disks, one parity disk, and one dparity (double parity) disk. All disks used by the local tier come from the same pool, "pool0".

The following diagram shows an unmirrored local tier with array LUNs, with its one plex. It has two RAID groups, rg0 and rg1. All array LUNs used by the local tier come from the same pool, "pool0".

How mirrored local tiers (aggregates) work

Mirrored aggregates have two *plexes* (copies of their data), which use the SyncMirror functionality to duplicate the data to provide redundancy.

When you create a local tier, you can specify that it is a mirrored local tier. Also, you can add a second plex to

an existing unmirrored local tier to make it a mirrored tier. Using SyncMirror functionality, ONTAP copies the data in the original plex (plex0) to the new plex (plex1). The plexes are physically separated (each plex has its own RAID groups and its own pool), and the plexes are updated simultaneously.

This configuration provides added protection against data loss if more disks fail than the RAID level of the aggregate protects against or if there is a loss of connectivity, because the unaffected plex continues to serve data while you fix the cause of the failure. After the plex that had a problem is fixed, the two plexes resynchronize and reestablish the mirror relationship.

The disks and array LUNs on the system are divided into two pools: "pool0" and "pool1". Plex0 gets its storage from pool0 and plex1 gets its storage from pool1.

The following diagram shows a local tier composed of disks with the SyncMirror functionality enabled and implemented. A second plex has been created for the local tier, "plex1". The data in plex1 is a copy of the data in plex0, and the RAID groups are also identical. The 32 spare disks are allocated to pool0 or pool1 using 16 disks for each pool.

The following diagram shows an local tier composed of array LUNs with the SyncMirror functionality enabled and implemented. A second plex has been created for the local tier, "plex1". Plex1 is a copy of plex0, and the RAID groups are also identical.

Legend

⊙ Array LUN in the local tier
⊙⊙⊙⊙ ONTAP RAID group

Fast zeroing of drives

Beginning with ONTAP 9.4, you can automatically and quickly zero drives (both SSDs and HDDs) before provisioning without experiencing long wait times.

For systems that are freshly installed with ONTAP 9.4 or later or systems that are reinitialized with ONTAP 9.4 or later, drive zeroing takes place automatically and is completed in seconds.

If you need to manually zero a drive, you can use one of the following methods:

CLI command

Use a CLI command to fast-zero drives

About this task

Admin privileges are required to use this command.

Steps

1. Enter the CLI command:

```
storage disk zerospares
```

Boot menu options

Select options from the boot menu to fast-zero drives

About this task

- The fast zeroing enhancement does not support systems upgraded from a release earlier than ONTAP 9.4.
- If any node on the cluster contains a local tier (aggregate) with fast-zeroed drives, then you cannot revert the cluster to ONTAP 9.2 or earlier.

Steps

1. From the boot menu, select one of the following options:
   - (4) Clean configuration and initialize all disks
   - (9a) Unpartition all disks and remove their ownership information
   - (9b) Clean configuration and initialize node with whole disks

Manually assign disk ownership

Disks must be owned by a node before they can be used in a local tier (aggregate).

If your cluster is not configured to use automatic disk ownership assignment, you must assign ownership manually.

You cannot reassign ownership of a disk that is in use in a local tier.

Steps

1. Using the CLI, display all unowned disks:

```
storage disk show -container-type unassigned
```

2. Assign each disk:

```
storage disk assign -disk disk_name -owner owner_name
```

You can use the wildcard character to assign more than one disk at once. If you are reassigning a spare disk that is already owned by a different node, you must use the "-force" option.

Add (create) a local tier (aggregate)

Add a local tier (create an aggregate)

To add a local tier (create an aggregate), you follow a specific workflow. You determine the number of disks or disk partitions that you need for the local tier and decide which method to use to create the local tier. You can add local tiers automatically by letting ONTAP assign the configuration, or you can manually specify the configuration.

- Workflow to add a local tier (aggregate)
- Determine the number of disks or disk partitions required for a local tier (aggregate)
- Decide which local tier (aggregate) creation method to use
- Add local tiers (aggregates) automatically
- Add local tiers (aggregates) manually

Workflow to add a local tier (aggregate)

Creating local tiers (aggregates) provides storage to volumes on your system.

The workflow for creating local tiers (aggregates) is specific to the interface you use—System Manager or the CLI:

System Manager workflow

Use System Manager to add (create) a local tier

System Manager creates local tiers based on recommended best practices for configuring local tiers.

Beginning with ONTAP 9.11.1, you can decide to configure local tiers manually if you want a different configuration than the one recommended during the automatic process to add a local tier.

CLI workflow

Use the CLI to add (create) an aggregate

Beginning with ONTAP 9.2, ONTAP can provide recommended configurations when you create aggregates (auto-provisioning). If the recommended configurations, based on best practices, are appropriate in your environment, you can accept them to create the aggregates. Otherwise, you can create aggregates manually.

Determine the number of disks or disk partitions required for a local tier (aggregate)

You must have enough disks or disk partitions in your local tier (aggregate) to meet system and business requirements. You should also have the recommended number of hot spare disks or hot spare disk partitions to minimize the potential of data loss.

Root-data partitioning is enabled by default on certain configurations. Systems with root-data partitioning enabled use disk partitions to create local tiers. Systems that do not have root-data partitioning enabled use unpartitioned disks.

You must have enough disks or disk partitions to meet the minimum number required for your RAID policy and enough to meet your minimum capacity requirements.

> ℹ️ In ONTAP, the usable space of the drive is less than the physical capacity of the drive. You can find the usable space of a specific drive and the minimum number of disks or disk partitions required for each RAID policy in the Hardware Universe.

Determine usable space of a specific disk

The procedure you follow depends on the interface you use—System Manager or the CLI:

System Manager

Use System Manager to determine usable space of disks

Perform the following steps to view the usable size of a disk:

Steps

1. Go to **Storage > Tiers**
2. Click ⋮ next to the name of the local tier.
3. Select the **Disk Information** tab.

CLI

Use the CLI to determine usable space of disks

Perform the following step to view the usable size of a disk:

Step

1. Display spare disk information:

```
storage aggregate show-spare-disks
```

In addition to the number of disks or disk partitions necessary to create your RAID group and meet your capacity requirements, you should also have the minimum number of hot spare disks or hot spare disk partitions recommended for your aggregate:

- For all flash aggregates, you should have a minimum of one hot spare disk or disk partition.

  > ⓘ The AFF C190 defaults to no spare drive. This exception is fully supported.

- For non-flash homogenous aggregates, you should have a minimum of two hot spare disks or disk partitions.
- For SSD storage pools, you should have a minimum of one hot spare disk for each HA pair.
- For Flash Pool aggregates, you should have a minimum of two spare disks for each HA pair. You can find more information on the supported RAID policies for Flash Pool aggregates in the Hardware Universe.
- To support the use of the Maintenance Center and to avoid issues caused by multiple concurrent disk failures, you should have a minimum of four hot spares in multi-disk carriers.

Related information

NetApp Hardware Universe

NetApp Technical Report 3838: Storage Subsystem Configuration Guide

Decide which method to use to create local tiers (aggregates)

Although ONTAP provides best-practice recommendations for adding local tiers automatically (creating aggregates with auto-provisioning), you must determine whether the recommended configurations are supported in your environment. If they are not, you must make decisions about RAID policy and disk configuration and then create the local

tiers manually.

When a local tier is created automatically, ONTAP analyzes available spare disks in the cluster and generates a recommendation about how spare disks should be used to add local tiers according to best practices. ONTAP displays the recommended configurations. You can accept the recommendations or add the local tiers manually.

Before you can accept ONTAP recommendations

If any of the following disk conditions are present, they must be addressed before accepting the recommendations from ONTAP:

- Missing disks
- Fluctuation in spare disk numbers
- Unassigned disks
- Non-zeroed spares
- Disks undergoing maintenance testing

The `storage aggregate auto-provision` man page contains more information about these requirements.

When you must use the manual method

In many cases, the recommended layout of the local tier will be optimal for your environment. However, if your cluster is running ONTAP 9.1 or earlier, or your environment includes the following configurations, you must create the local tier using the manual method.

> ⓘ Beginning with ONTAP 9.11.1, you can manually add local tiers with System Manager.

- Aggregates using third-party array LUNs
- Virtual disks with Cloud Volumes ONTAP or ONTAP Select
- MetroCluster system
- SyncMirror
- MSATA disks
- FlashPool tiers (aggregates)
- Multiple disk types or sizes are connected to the node

Select the method to create local tiers (aggregates)

Choose which method you want to use:

- Add (create) local tiers (aggregates) automatically
- Add (create) local tiers (aggregates) manually

Related information
ONTAP 9 commands

Add local tiers automatically (create aggregates with auto-provisioning)

If the best-practice recommendation that ONTAP provides for automatically adding a local tier (creating an aggregate with auto-provisioning) is appropriate in your environment, you can accept the recommendation and let ONTAP add the local tier.

The process you follow depends on the interface that you use—System Manager or the CLI.

System Manager

Use System Manager to automatically add a local tier

Steps

1. In System Manager, click **Storage > Tiers**.

2. From the **Tiers** page, click **＋ Add Local Tier** to create a new local tier:

   The **Add Local Tier** page shows the recommended number of local tiers that can be created on the nodes and the usable storage available.

3. Click **Recommended details** to view the configuration recommended by System Manager.

   System Manager displays the following information beginning with ONTAP 9.8:

   - **Local tier name** (you can edit the local tier name beginning with ONTAP 9.10.1)
   - **Node name**
   - **Usable size**
   - **Type of storage**

   Beginning with ONTAP 9.10.1, additional information is displayed:

   - **Disks**: showing the number, size, and type of the disks
   - **Layout**: showing the RAID group layout, including which disks are parity or data and which slots are unused.
   - **Spare disks**: showing the node name, the number and size of spare disks, and the type of storage.

4. Perform one of the following steps:

If you want to…	Then do this…
Accept the recommendations from System Manager.	Proceed to the step for configuring the Onboard Key Manager for encryption.
Manually configure the local tiers and *not* use the recommendations from System Manager.	Proceed to Add a local tier (create aggregate) manually: • For ONTAP 9.10.1 and earlier, follow the steps to use the CLI. • Beginning with ONTAP 9.11.1, follow the steps to use System Manager.

5. (Optional): If the Onboard Key Manager has been installed, you can configure it for encryption. Check the **Configure Onboard Key Manager for encryption** check box.

   a. Enter a passphrase.

   b. Enter the passphrase again to confirm it.

   c. Save the passphrase for future use in case the system needs to be recovered.

   d. Back up the key database for future use.

6. Click **Save** to create the local tier and add it to your storage solution.

CLI

Use the CLI to create an aggregate with auto-provisioning

You run the `storage aggregate auto-provision` command to generate aggregate layout recommendations. You can then create aggregates after reviewing and approving ONTAP recommendations.

What you'll need

ONTAP 9.2 or later must be running on your cluster.

About this task

The default summary generated with the `storage aggregate auto-provision` command lists the recommended aggregates to be created, including names and usable size. You can view the list and determine whether you want to create the recommended aggregates when prompted.

You can also display a detailed summary by using the `-verbose` option, which displays the following reports:

- Per node summary of new aggregates to create, discovered spares, and remaining spare disks and partitions after aggregate creation
- New data aggregates to create with counts of disks and partitions to be used
- RAID group layout showing how spare disks and partitions will be used in new data aggregates to be created
- Details about spare disks and partitions remaining after aggregate creation

If you are familiar with the auto-provision method and your environment is correctly prepared, you can use the `-skip-confirmation` option to create the recommended aggregate without display and confirmation. The `storage aggregate auto-provision` command is not affected by the CLI session `-confirmations` setting.

The `storage aggregate auto-provision` man page contains more information about the aggregate layout recommendations.

Steps

1. Run the `storage aggregate auto-provision` command with the desired display options.
   - no options: Display standard summary
   - `-verbose` option: Display detailed summary
   - `-skip-confirmation` option: Create recommended aggregates without display or confirmation

2. Perform one of the following steps:

If you want to…	Then do this…

Accept the recommendations from ONTAP.	Review the display of recommended aggregates, and then respond to the prompt to create the recommended aggregates. ``` Do you want to create recommended aggregates? {y|n}:y Info: Creating node1_SSD_1 ... Creating node2_SSD_1 ... ```
Manually configure the local tiers and **not** use the recommendations from ONTAP.	Proceed to Add a local tier (create aggregate) manually.

Related information

ONTAP 9 Commands

Add local tiers (create aggregates) manually

If you do not want to add a local tier (create a aggregate) using the best-practice recommendations from ONTAP, you can perform the process manually.

The process you follow depends on the interface that you use—System Manager or the CLI.

System Manager

Use System Manager to add a local tier manually

Beginning with ONTAP 9.11.1, if you do not want to use the configuration recommended by System Manager to create a local tier, you can specify the configuration you want.

Steps

1. In System Manager, click **Storage > Tiers**.

2. From the **Tiers** page, click ➕ Add Local Tier to create a new local tier:

   The **Add Local Tier** page shows the recommended number of local tiers that can be created on the nodes and the usable storage available.

3. When System Manager displays the storage recommendation for the local tier, click **Switch to Manual Local Tier Creation** in the **Spare Disks** section.

   The **Add Local Tier** page displays fields that you use to configure the local tier.

4. In the first section of the **Add Local Tier** page, complete the following:

   a. Enter the name of the local tier.

   b. (Optional): Check the **Mirror this local tier** check box if you want to mirror the local tier.

   c. Select a disk type.

   d. Select the number of disks.

5. In the **RAID Configuration** section, complete the following:

   a. Select the RAID type.

   b. Select the RAID group size.

   c. Click RAID allocation to view how the disks are allocated in the group.

6. (Optional): If the Onboard Key Manager has been installed, you can configure it for encryption in the **Encryption** section of the page. Check the **Configure Onboard Key Manager for encryption** check box.

   a. Enter a passphrase.

   b. Enter the passphrase again to confirm it.

   c. Save the passphrase for future use in case the system needs to be recovered.

   d. Back up the key database for future use.

7. Click **Save** to create the local tier and add it to your storage solution.

CLI

Use the CLI to create an aggregate manually

Before you create aggregates manually, you should review disk configuration options and simulate creation.

Then you can issue the `storage aggregate create` command and verify the results.

What you'll need

You must have determined the number of disks and the number of hot spare disks you need in the

aggregate.

About this task

If root-data-data partitioning is enabled and you have 24 solid-state drives (SSDs) or fewer in your configuration, it is recommended that your data partitions be assigned to different nodes.

The procedure for creating aggregates on systems with root-data partitioning and root-data-data partitioning enabled is the same as the procedure for creating aggregates on systems using unpartitioned disks. If root-data partitioning is enabled on your system, you should use the number of disk partitions for the `-diskcount` option. For root-data-data partitioning, the `-diskcount` option specifies the count of disks to use.

> (i) When creating multiple aggregates for use with FlexGroups, aggregates should be as close in size as possible.

The `storage aggregate create` man page contains more information about aggregate creation options and requirements.

Steps

1. View the list of spare disk partitions to verify that you have enough to create your aggregate:

   `storage aggregate show-spare-disks -original-owner node_name`

   Data partitions are displayed under `Local Data Usable`. A root partition cannot be used as a spare.

2. Simulate the creation of the aggregate:

   `storage aggregate create -aggregate aggregate_name -node node_name -raidtype raid_dp -diskcount number_of_disks_or_partitions -simulate true`

3. If any warnings are displayed from the simulated command, adjust the command and repeat the simulation.

4. Create the aggregate:

   `storage aggregate create -aggregate aggr_name -node node_name -raidtype raid_dp -diskcount number_of_disks_or_partitions`

5. Display the aggregate to verify that it was created:

   `storage aggregate show-status aggregate_name`

Related information

ONTAP 9 commands

Manage the use of local tiers (aggregates)

Manage the use of local tiers (aggregates)

After you have created local tiers (aggregates), you can manage how they are used.

You can perform the following tasks:

- Rename a local tier (aggregate)
- Set the media cost of a local tier (aggregate)
- Determine drive and RAID group information for a local tier (aggregate)
- Assign local tiers (aggregates) to storage VMs (SVMs)
- Determine which volumes reside on a local tier (aggregate)
- Determine and control a volume's space usages in a local tier (aggregate)
- Determine space usage in a local tier (aggregate)
- Relocate local tier (aggregate) ownership within an HA pair
- Delete a local tier (aggregate)

Rename a local tier (aggregate)

You can rename a local tier (aggregate). The method you follow depends on the interface you use—System Manager or the CLI:

System Manager

Use System Manager to rename a local tier (aggregate)

Beginning with ONTAP 9.10.1, you can modify the name of a local tier (aggregate).

Steps

1. In System Manager, click **Storage > Tiers**.
2. Click ⋮ next to the name of the local tier.
3. Select **Rename**.
4. Specify a new name for the local tier.

CLI
Use the CLI to rename a local tier (aggregate)

Step

1. Using the CLI, rename the local tier (aggregate):

   storage aggregate rename -aggregate *aggr-name* -newname *aggr-new-name*

   The following example renames an aggregate named "aggr5" as "sales-aggr":

   ```
   > storage aggregate rename -aggregate aggr5 -newname sales-aggr
   ```

Set media cost of a local tier (aggregate)

Beginning with ONTAP 9.11.1, you can use System Manager to set the media cost of a

local tier (aggregate).

Steps

1. In System Manager, click **Storage > Tiers**, then click **Set Media Cost** in the desired local tier (aggregate) tiles.

2. Select **active and inactive tiers** to enable comparison.

3. Enter a currency type and amount.

When you enter or change the media cost, the change is made in all media types.

Determine drive and RAID group information for a local tier (aggregate)

Some local tier (aggregate) administration tasks require that you know what types of drives compose the local tier, their size, checksum, and status, whether they are shared with other local tiers, and the size and composition of the RAID groups.

Step

1. Show the drives for the aggregate, by RAID group:

   `storage aggregate show-status aggr_name`

   The drives are displayed for each RAID group in the aggregate.

   You can see the RAID type of the drive (data, parity, dparity) in the `Position` column. If the `Position` column displays `shared`, then the drive is shared: if it is an HDD, it is a partitioned disk; if it is an SSD, it is part of a storage pool.

Example: A Flash Pool aggregate using an SSD storage pool and data partitions

```
cluster1::> storage aggregate show-status nodeA_fp_1

Owner Node: cluster1-a
 Aggregate: nodeA_fp_1 (online, mixed_raid_type, hybrid) (block checksums)
  Plex: /nodeA_fp_1/plex0 (online, normal, active, pool0)
   RAID Group /nodeA_fp_1/plex0/rg0 (normal, block checksums, raid_dp)

                                         Usable  Physical
    Position Disk         Pool Type    RPM    Size      Size Status
    -------- ----------   ---- -----  ------ -------- -------- -------
    shared   2.0.1          0   SAS   10000  472.9GB  547.1GB (normal)
    shared   2.0.3          0   SAS   10000  472.9GB  547.1GB (normal)
    shared   2.0.5          0   SAS   10000  472.9GB  547.1GB (normal)
    shared   2.0.7          0   SAS   10000  472.9GB  547.1GB (normal)
    shared   2.0.9          0   SAS   10000  472.9GB  547.1GB (normal)
    shared   2.0.11         0   SAS   10000  472.9GB  547.1GB (normal)


   RAID Group /nodeA_flashpool_1/plex0/rg1
   (normal, block checksums, raid4) (Storage Pool: SmallSP)

                                         Usable  Physical
    Position Disk         Pool Type    RPM    Size      Size Status
    -------- ----------   ---- -----  ------ -------- -------- -------
    shared   2.0.13         0   SSD      -   186.2GB  745.2GB (normal)
    shared   2.0.12         0   SSD      -   186.2GB  745.2GB (normal)

8 entries were displayed.
```

Assign local tiers (aggregates) to storage VMs (SVMs)

If you assign one or more local tiers (aggregates) to a storage virtual machine (storage VM or SVM, formerly known as Vserver), then you can use only those local tiers to contain volumes for that storage VM (SVM).

What you'll need

The storage VM and the local tiers you want to assign to that storage VM must already exist.

About this task

Assigning local tiers to your storage VMs helps you keep your storage VMs isolated from each other; this is especially important in a multi-tenancy environment.

Steps

1. Check the list of local tiers (aggregates) already assigned to the SVM:

   ```
   vserver show -fields aggr-list
   ```

The aggregates currently assigned to the SVM are displayed. If there are no aggregates assigned, "-" is displayed.

2. Add or remove assigned aggregates, depending on your requirements:

If you want to…	Use this command…
Assign additional aggregates	`vserver add-aggregates`
Unassign aggregates	`vserver remove-aggregates`

The listed aggregates are assigned to or removed from the SVM. If the SVM already has volumes that use an aggregate that is not assigned to the SVM, a warning message is displayed, but the command is completed successfully. Any aggregates that were already assigned to the SVM and that were not named in the command are unaffected.

Example

In the following example, the aggregates aggr1 and aggr2 are assigned to SVM svm1:

```
vserver add-aggregates -vserver svm1 -aggregates aggr1,aggr2
```

Determine which volumes reside on a local tier (aggregate)

You might need to determine which volumes reside on a local tier (aggregate) before performing operations on the local tier, such as relocating it or taking it offline.

Steps

1. To display the volumes that reside on an aggregate, enter

```
volume show -aggregate aggregate_name
```

All volumes that reside on the specified aggregate are displayed.

Determine and control a volume's space usage in a local tier (aggregate)

You can determine which FlexVol volumes are using the most space in a local tier (aggregate) and specifically which features within the volume.

The `volume show-footprint` command provides information about a volume's footprint, or its space usage within the containing aggregate.

The `volume show-footprint` command shows details about the space usage of each volume in an aggregate, including offline volumes. This command bridges the gap between the output of the `volume show-space` and `aggregate show-space` commands. All percentages are calculated as a percent of aggregate size.

The following example shows the `volume show-footprint` command output for a volume called testvol:

```
cluster1::> volume show-footprint testvol

      Vserver : thevs
      Volume  : testvol

      Feature                                       Used      Used%
      --------------------------------           ----------    -----
      Volume Data Footprint                        120.6MB        4%
      Volume Guarantee                              1.88GB       71%
      Flexible Volume Metadata                     11.38MB        0%
      Delayed Frees                                 1.36MB        0%
      Total Footprint                               2.01GB       76%
```

The following table explains some of the key rows of the output of the `volume show-footprint` command and what you can do to try to decrease space usage by that feature:

Row/feature name	Description/contents of row	Some ways to decrease
`Volume Data Footprint`	The total amount of space used in the containing aggregate by a volume's data in the active file system and the space used by the volume's Snapshot copies. This row does not include reserved space.	• Deleting data from the volume. • Deleting Snapshot copies from the volume.
`Volume Guarantee`	The amount of space reserved by the volume in the aggregate for future writes. The amount of space reserved depends on the guarantee type of the volume.	Changing the type of guarantee for the volume to `none`.
`Flexible Volume Metadata`	The total amount of space used in the aggregate by the volume's metadata files.	No direct method to control.
`Delayed Frees`	Blocks that ONTAP used for performance and cannot be immediately freed. For SnapMirror destinations, this row has a value of `0` and is not displayed.	No direct method to control.
`File Operation Metadata`	The total amount of space reserved for file operation metadata.	No direct method to control.
`Total Footprint`	The total amount of space that the volume uses in the aggregate. It is the sum of all of the rows.	Any of the methods used to decrease space used by a volume.

Determine space usage in a local tier (aggregate)

You can view how much space is used by all of the volumes in one or more local tiers (aggregates) so that you can take actions to free more space.

You can view space usage by all volumes in one or more aggregates with the `aggregate show-space` command. This helps you see which volumes are consuming the most space in their containing aggregates so that you can take actions to free more space.

The used space in an aggregate is directly affected by the space used in the FlexVol volumes it contains. Measures that you take to increase space in a volume also affect space in the aggregate.

The following rows are included in the `aggregate show-space` command output:

- **Volume Footprints**

  The total of all volume footprints within the aggregate. It includes all of the space that is used or reserved by all data and metadata of all volumes in the containing aggregate.

- **Aggregate Metadata**

  The total file system metadata required by the aggregate, such as allocation bitmaps and inode files.

- **Snapshot Reserve**

  The amount of space reserved for aggregate Snapshot copies, based on volume size. It is considered used space and is not available to volume or aggregate data or metadata.

- **Snapshot Reserve Unusable**

  The amount of space originally allocated for aggregate Snapshot reserve that is unavailable for aggregate Snapshot copies because it is being used by volumes associated with the aggregate. Can occur only for aggregates with a non-zero aggregate Snapshot reserve.

- **Total Used**

  The sum of all space used or reserved in the aggregate by volumes, metadata, or Snapshot copies.

- **Total Physical Used**

  The amount of space being used for data now (rather than being reserved for future use). Includes space used by aggregate Snapshot copies.

The following example shows the `aggregate show-space` command output for an aggregate whose Snapshot reserve is 5%. If the Snapshot reserve was 0, the row would not be displayed.

```
cluster1::> storage aggregate show-space

                    Aggregate : wqa_gx106_aggr1

    Feature                            Used        Used%
    -------------------------------    ----------  ------
    Volume Footprints                    101.0MB      0%
    Aggregate Metadata                    300KB       0%
    Snapshot Reserve                     5.98GB       5%

    Total Used                           6.07GB       5%
    Total Physical Used                 34.82KB       0%
```

Relocate ownership of a local tier (aggregate) within an HA pair

You can change the ownership of local tiers (aggregates) among the nodes in an HA pair without interrupting service from the local tiers.

Both nodes in an HA pair are physically connected to each other's disks or array LUNs. Each disk or array LUN is owned by one of the nodes.

Ownership of all disks or array LUNs within a local tier (aggregate) changes temporarily from one node to the other when a takeover occurs. However, local tiers relocation operations can also permanently change the ownership (for example, if done for load balancing). The ownership changes without any data-copy processes or physical movement of the disks or array LUNs.

About this task

- Because volume count limits are validated programmatically during local tier relocation operations, it is not necessary to check for this manually.

  If the volume count exceeds the supported limit, the local tier relocation operation fails with a relevant error message.

- You should not initiate local tier relocation when system-level operations are in progress on either the source or the destination node; likewise, you should not start these operations during the local tier relocation.

  These operations can include the following:

    ◦ Takeover

    ◦ Giveback

    ◦ Shutdown

    ◦ Another local tier relocation operation

    ◦ Disk ownership changes

    ◦ Local tier or volume configuration operations

    ◦ Storage controller replacement

    ◦ ONTAP upgrade

- ONTAP revert

- If you have a MetroCluster configuration, you should not initiate local tier relocation while disaster recovery operations (*switchover*, *healing*, or *switchback*) are in progress.

- If you have a MetroCluster configuration and initiate local tier relocation on a switched-over local tier, the operation might fail because it exceeds the DR partner's volume limit count.

- You should not initiate local tier relocation on aggregates that are corrupt or undergoing maintenance.

- Before initiating the local tier relocation, you should save any core dumps on the source and destination nodes.

Steps

1. View the aggregates on the node to confirm which aggregates to move and ensure they are online and in good condition:

   ```
   storage aggregate show -node source-node
   ```

   The following command shows six aggregates on the four nodes in the cluster. All aggregates are online. Node1 and Node3 form an HA pair and Node2 and Node4 form an HA pair.

   ```
   cluster::> storage aggregate show
   Aggregate      Size Available Used% State    #Vols  Nodes  RAID Status
   ---------  -------- --------- ----- -------  ------ ------  -----------
   aggr_0     239.0GB   11.13GB   95% online        1 node1  raid_dp,
                                                                 normal
   aggr_1     239.0GB   11.13GB   95% online        1 node1  raid_dp,
                                                                 normal
   aggr_2     239.0GB   11.13GB   95% online        1 node2  raid_dp,
                                                                 normal
   aggr_3     239.0GB   11.13GB   95% online        1 node2  raid_dp,
                                                                 normal
   aggr_4     239.0GB   238.9GB    0% online        5 node3  raid_dp,
                                                                 normal
   aggr_5     239.0GB   239.0GB    0% online        4 node4  raid_dp,
                                                                 normal
   6 entries were displayed.
   ```

2. Issue the command to start the aggregate relocation:

   ```
   storage aggregate relocation start -aggregate-list aggregate-1, aggregate-2…
   -node source-node -destination destination-node
   ```

   The following command moves the aggregates aggr_1 and aggr_2 from Node1 to Node3. Node3 is Node1's HA partner. The aggregates can be moved only within the HA pair.

```
cluster::> storage aggregate relocation start -aggregate-list aggr_1,
aggr_2 -node node1 -destination node3
Run the storage aggregate relocation show command to check relocation
status.
node1::storage aggregate>
```

3. Monitor the progress of the aggregate relocation with the `storage aggregate relocation show` command:

   `storage aggregate relocation show -node source-node`

   The following command shows the progress of the aggregates that are being moved to Node3:

```
cluster::> storage aggregate relocation show -node node1
Source Aggregate    Destination    Relocation Status
------ -----------  -------------  -----------------------
node1
       aggr_1       node3          In progress, module: wafl
       aggr_2       node3          Not attempted yet
2 entries were displayed.
node1::storage aggregate>
```

   When the relocation is complete, the output of this command shows each aggregate with a relocation status of "Done".

Delete a local tier (aggregate)

You can delete a local tier (aggregate) if there are no volumes on the local tier.

The `storage aggregate delete` command deletes a storage aggregate. The command fails if there are volumes present on the aggregate. If the aggregate has an object store attached to it, then in addition to deleting the aggregate, the command deletes the objects in the object store as well. No changes are made to the object store configuration as part of this command.

The following example deletes an aggregate named "aggr1":

```
> storage aggregate delete -aggregate aggr1
```

Commands for aggregate relocation

There are specific ONTAP commands for relocating aggregate ownership within an HA pair.

If you want to…	Use this command…

Start the aggregate relocation process	`storage aggregate relocation start`
Monitor the aggregate relocation process	`storage aggregate relocation show`

Related information

ONTAP 9 Commands

Commands for managing aggregates

You use the `storage aggregate` command to manage your aggregates.

If you want to…	Use this command…
Display the size of the cache for all Flash Pool aggregates	`storage aggregate show -fields hybrid-cache-size-total -hybrid-cache-size -total >0`
Display disk information and status for an aggregate	`storage aggregate show-status`
Display spare disks by node	`storage aggregate show-spare-disks`
Display the root aggregates in the cluster	`storage aggregate show -has-mroot true`
Display basic information and status for aggregates	`storage aggregate show`
Display the type of storage used in an aggregate	`storage aggregate show -fields storage-type`
Bring an aggregate online	`storage aggregate online`
Delete an aggregate	`storage aggregate delete`
Put an aggregate into the restricted state	`storage aggregate restrict`
Rename an aggregate	`storage aggregate rename`
Take an aggregate offline	`storage aggregate offline`
Change the RAID type for an aggregate	`storage aggregate modify -raidtype`

Related information

ONTAP 9 Commands

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

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

Using different methods, you follow a specific workflow to add capacity.

- Workflow to add capacity to a local tier (aggregate)
- Methods to create space in a local tier (aggregate)

You can add disks to a local tier and add drives to a node or shelf.

If needed, you can correct misaligned spare partitions.

- Add disks to a local tier (aggregate)
- Add drives to a node or shelf
- Correct misaligned spare partitions

Workflow to add capacity to a local tier (expanding an aggregate)

To add capacity to a local tier (expand an aggregate) you must first identify which local tier you want to add to, determine how much new storage is needed, install new disks, assign disk ownership, and create a new RAID group, if needed.

You can use either System Manager or the CLI to add capacity.

Methods to create space in an local tier (aggregate)

If a local tier (aggregate) runs out of free space, various problems can result that range from loss of data to disabling a volume's guarantee. There are multiple ways to make more space in a local tier.

All of the methods have various consequences. Prior to taking any action, you should read the relevant section in the documentation.

The following are some common ways to make space in local tier, in order of least to most consequences:

- Add disks to the local tier.
- Move some volumes to another local tier with available space.
- Shrink the size of volume-guaranteed volumes in the local tier.

- Delete unneeded volume Snapshot copies if the volume's guarantee type is "none".

- Delete unneeded volumes.

- Enable space-saving features, such as deduplication or compression.

- (Temporarily) disable features that are using a large amount of metadata .

Add capacity to a local tier (add disks to an aggregate)

You can add disks to an local tier (aggregate) so that it can provide more storage to its associated volumes.

System Manager (ONTAP 9.8 and later)

Use System Manager to add capacity (ONTAP 9.8 and later)

You can add capacity to a local tier by adding capacity disks.

> ⓘ Beginning with ONTAP 9.12.1, you can use System Manager to view the committed capacity of a local tier to determine if additional capacity is required for the local tier. See Monitor capacity in System Manager.

About this task

You perform this task only if you have installed ONTAP 9.8 or later. If you installed an earlier version of ONTAP, refer to Use System Manager to add capacity (ONTAP 9.7 or earlier).

Steps

1. Click **Storage > Tiers**.

2. Click ⋮ next to the name of the local tier to which you want to add capacity.

3. Click **Add Capacity**.

> ⓘ If there are no spare disks that you can add, then the **Add Capacity** option is not shown, and you cannot increase the capacity of the local tier.

4. Perform the following steps, based on the version of ONTAP that is installed:

If this version of ONTAP is installed…	Perform these steps…
ONTAP 9.8, 9.9, or 9.10.1	1. If the node contains multiple storage tiers, then select the number of disks you want to add to the local tier. Otherwise, if the node contains only a single storage tier, the added capacity is estimated automatically. 2. Click **Add**.
Beginning with ONTAP 9.11.1	1. Select the disk type and number of disks. 2. If you want to add disks to a new RAID group, check the check box. The RAID allocation is displayed. 3. Click **Save**.

5. (Optional) The process takes some time to complete. If you want to run the process in the background, select **Run in Background**.

6. After the process completes, you can view the increased capacity amount in the local tier information at **Storage > Tiers**.

System Manager (ONTAP 9.7 and earlier)

Use System Manager to add capacity (ONTAP 9.7 and earlier)

You can add capacity to a local tier (aggregate) by adding capacity disks.

About this task

You perform this task only if you have installed ONTAP 9.7 or earlier. If you installed ONTAP 9.8 or later, refer to Use System Manager to add capacity (ONTAP 9.8 or later).

Steps

1. (For ONTAP 9.7 only) 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. (For ONTAP 9.7 only) Click **Switch to the new experience**.

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

CLI

Use the CLI to add capacity

The procedure for adding partitioned disks to an aggregate is similar to the procedure for adding unpartitioned disks.

What you'll need

You must know what the RAID group size is for the aggregate you are adding the storage to.

About this task

When you expand an aggregate, you should be aware of whether you are adding partition or unpartitioned disks to the aggregate. When you add unpartitioned drives to an existing aggregate, the size of the existing RAID groups is inherited by the new RAID group, which can affect the number of parity disks required. If an unpartitioned disk is added to a RAID group composed of partitioned disks, the new disk is partitioned, leaving an unused spare partition.

When you provision partitions, you must ensure that you do not leave the node without a drive with both partitions as spare. If you do, and the node experiences a controller disruption, valuable information about the problem (the core file) might not be available to provide to the technical support.

> ⓘ Do not use the `disklist` command to expand your aggregates. This could cause partition misalignment.

Steps

1. Show the available spare storage on the system that owns the aggregate:

   ```
   storage aggregate show-spare-disks -original-owner node_name
   ```

   You can use the `-is-disk-shared` parameter to show only partitioned drives or only unpartitioned drives.

```
cl1-s2::> storage aggregate show-spare-disks -original-owner cl1-s2
-is-disk-shared true

Original Owner: cl1-s2
 Pool0
  Shared HDD Spares
                                                         Local
Local
                                                          Data
Root Physical
 Disk                           Type    RPM Checksum        Usable
Usable    Size Status
 -------------------------- ----- ------ -------------- --------
-------- -------- --------
 1.0.1                       BSAS   7200 block          753.8GB
73.89GB  828.0GB zeroed
 1.0.2                       BSAS   7200 block          753.8GB
0B  828.0GB zeroed
 1.0.3                       BSAS   7200 block          753.8GB
0B  828.0GB zeroed
 1.0.4                       BSAS   7200 block          753.8GB
0B  828.0GB zeroed
 1.0.8                       BSAS   7200 block          753.8GB
0B  828.0GB zeroed
 1.0.9                       BSAS   7200 block          753.8GB
0B  828.0GB zeroed
 1.0.10                      BSAS   7200 block               0B
73.89GB  828.0GB zeroed
2 entries were displayed.
```

2. Show the current RAID groups for the aggregate:

```
storage aggregate show-status aggr_name
```

```
cl1-s2::> storage aggregate show-status -aggregate data_1

Owner Node: cl1-s2
 Aggregate: data_1 (online, raid_dp) (block checksums)
  Plex: /data_1/plex0 (online, normal, active, pool0)
   RAID Group /data_1/plex0/rg0 (normal, block checksums)
                                                          Usable
Physical
     Position Disk                       Pool Type     RPM      Size
Size Status
     -------- ------------------------- ---- ----- ------ --------
-------- ----------
     shared   1.0.10                      0   BSAS    7200  753.8GB
828.0GB (normal)
     shared   1.0.5                       0   BSAS    7200  753.8GB
828.0GB (normal)
     shared   1.0.6                       0   BSAS    7200  753.8GB
828.0GB (normal)
     shared   1.0.11                      0   BSAS    7200  753.8GB
828.0GB (normal)
     shared   1.0.0                       0   BSAS    7200  753.8GB
828.0GB (normal)
5 entries were displayed.
```

3. Simulate adding the storage to the aggregate:

   ```
   storage aggregate add-disks -aggregate aggr_name -diskcount
   number_of_disks_or_partitions -simulate true
   ```

   You can see the result of the storage addition without actually provisioning any storage. If any
   warnings are displayed from the simulated command, you can adjust the command and repeat the
   simulation.

   ```
   cl1-s2::> storage aggregate add-disks data_1 -diskcount 5 -simulate
   true

   Addition of disks would succeed for aggregate "data_1" on node "cl1-
   s2". The
   following disks would be used to add to the aggregate: 1.0.2, 1.0.3,
   1.0.4, 1.0.8, 1.0.9.
   ```

4. Add the storage to the aggregate:

   ```
   storage aggregate add-disks -aggregate aggr_name -raidgroup new -diskcount
   number_of_disks_or_partitions
   ```

When creating a Flash Pool aggregate, if you are adding disks with a different checksum than the aggregate, or if you are adding disks to a mixed checksum aggregate, you must use the `-checksumstyle` parameter.

If you are adding disks to a Flash Pool aggregate, you must use the `-disktype` parameter to specify the disk type.

You can use the `-disksize` parameter to specify a size of the disks to add. Only disks with approximately the specified size are selected for addition to the aggregate.

```
cl1-s2::> storage aggregate add-disks -aggregate data_1 -raidgroup
new -diskcount 5
```

5. Verify that the storage was added successfully:

```
storage aggregate show-status -aggregate aggr_name
```

```
cl1-s2::> storage aggregate show-status -aggregate data_1

Owner Node: cl1-s2
 Aggregate: data_1 (online, raid_dp) (block checksums)
  Plex: /data_1/plex0 (online, normal, active, pool0)
   RAID Group /data_1/plex0/rg0 (normal, block checksums)
                                                          Usable
Physical
     Position Disk                     Pool Type    RPM    Size
Size Status
     -------- ------------------------- ---- ----- ------ --------
-------- ----------
     shared   1.0.10                     0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.5                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.6                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.11                     0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.0                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.2                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.3                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.4                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.8                      0   BSAS   7200  753.8GB
828.0GB (normal)
     shared   1.0.9                      0   BSAS   7200  753.8GB
828.0GB (normal)
10 entries were displayed.
```

6. Verify that the node still has at least one drive with both the root partition and the data partition as spare:

```
storage aggregate show-spare-disks -original-owner node_name
```

```
cl1-s2::> storage aggregate show-spare-disks -original-owner cl1-s2
-is-disk-shared true

Original Owner: cl1-s2
 Pool0
  Shared HDD Spares
                                                       Local
Local
                                                        Data
Root Physical
 Disk                            Type    RPM Checksum           Usable
Usable    Size Status
 -------------------------- ----- ------ -------------- --------
-------- -------- --------
 1.0.1                           BSAS   7200 block             753.8GB
73.89GB  828.0GB zeroed
 1.0.10                          BSAS   7200 block                 0B
73.89GB  828.0GB zeroed
2 entries were displayed.
```

Add drives to a node or shelf

You add drives to a node or shelf to increase the number of hot spares or to add space to local tier (aggregate).

About this task

The drive you want to add must be supported by your platform.

[NetApp Hardware Universe](#)

The minimum number of drives you should add in a single procedure is six. Adding a single drive might reduce performance.

Steps

1. Check the NetApp Support Site for newer drive and shelf firmware and Disk Qualification Package files.

   If your node or shelf does not have the latest versions, update them before installing the new drive.

   Drive firmware is automatically updated (nondisruptively) on new drives that do not have current firmware versions.

2. Properly ground yourself.

3. Gently remove the bezel from the front of the platform.

4. Identify the correct slot for the new drive.

> **(i)** The correct slots for adding drives vary depending on the platform model and ONTAP version. In some cases you need to add drives to specific slots in sequence. For example, in an AFF A800 you add the drives at specific intervals leaving clusters of empty slots. Whereas, in an AFF A220 you add new drives to the next empty slots running from the outside towards the middle of the shelf.

See the NetApp Hardware Universe to identify the correct slots for your configuration.

5. Insert the new drive:

   a. With the cam handle in the open position, use both hands to insert the new drive.

   b. Push until the drive stops.

   c. Close the cam handle so that the drive is fully seated into the mid plane and the handle clicks into place. Be sure to close the cam handle slowly so that it aligns correctly with the face of the drive.

6. Verify that the drive's activity LED (green) is illuminated.

   When the drive's activity LED is solid, it means that the drive has power. When the drive's activity LED is blinking, it means that the drive has power and I/O is in progress. If the drive firmware is automatically updating, the LED blinks.

7. To add another drive, repeat Steps 4 through 6.

   The new drives are not recognized until they are assigned to a node. You can assign the new drives manually, or you can wait for ONTAP to automatically assign the new drives if your node follows the rules for drive auto-assignment.

8. After the new drives have all been recognized, verify that they have been added and their ownership is specified correctly.

Steps

1. Display the list of disks:

   ```
   storage aggregate show-spare-disks
   ```

   You should see the new drives, owned by the correct node.

2. Zero the newly added drives:

   ```
   storage disk zerospares
   ```

   Drives that have been used previously in an ONTAP local tier (aggregate) must be zeroed before they can be added to another aggregate. Zeroing the drives now can prevent delays in case you need to quickly increase the size of an local tier. The drive zeroing command runs in the background and can take hours to complete, depending on the size of the non-zeroed drives in the node.

Results

The new drives are ready. You can add them to a local tier (aggregate), place them onto the list of hot spares, or add them when you create a new local tier.

Correct misaligned spare partitions

When you add partitioned disks to a local tier (aggregate), you must leave a disk with

both the root and data partition available as a spare for every node. If you do not and your node experiences a disruption, ONTAP cannot dump the core to the spare data partition.

What you'll need

You must have both a spare data partition and a spare root partition on the same type of disk owned by the same node.

Steps

1. Using the CLI, display the spare partitions for the node:

   ```
   storage aggregate show-spare-disks -original-owner node_name
   ```

   Note which disk has a spare data partition (spare_data) and which disk has a spare root partition (spare_root). The spare partition will show a non-zero value under the `Local Data Usable` or `Local Root Usable` column.

2. Replace the disk with a spare data partition with the disk with the spare root partition:

   ```
   storage disk replace -disk spare_data -replacement spare_root -action start
   ```

   You can copy the data in either direction; however, copying the root partition takes less time to complete.

3. Monitor the progress of the disk replacement:

   ```
   storage aggregate show-status -aggregate aggr_name
   ```

4. After the replacement operation is complete, display the spares again to confirm that you have a full spare disk:

   ```
   storage aggregate show-spare-disks -original-owner node_name
   ```

   You should see a spare disk with usable space under both "Local Data Usable" and `Local Root Usable`.

Example

You display your spare partitions for node c1-01 and see that your spare partitions are not aligned:

```
c1::> storage aggregate show-spare-disks -original-owner c1-01

Original Owner: c1-01
 Pool0
  Shared HDD Spares
                              Local      Local
                              Data        Root   Physical
  Disk     Type   RPM Checksum Usable    Usable     Size
  -------  ----- ---- -------- -------  ------- --------
  1.0.1    BSAS   7200 block    753.8GB      0B    828.0GB
  1.0.10   BSAS   7200 block        0B  73.89GB   828.0GB
```

You start the disk replacement job:

```
c1::> storage disk replace -disk 1.0.1 -replacement 1.0.10 -action start
```

While you are waiting for the replacement operation to finish, you display the progress of the operation:

```
c1::> storage aggregate show-status -aggregate aggr0_1

Owner Node: c1-01
 Aggregate: aggr0_1 (online, raid_dp) (block checksums)
  Plex: /aggr0_1/plex0 (online, normal, active, pool0)
   RAID Group /aggr0_1/plex0/rg0 (normal, block checksums)
                                     Usable Physical
 Position Disk      Pool Type   RPM    Size     Size Status
 -------- -------  ---- ---- ----- -------- -------- ----------
  shared   1.0.1    0   BSAS  7200  73.89GB  828.0GB (replacing,copy in
progress)
  shared   1.0.10   0   BSAS  7200  73.89GB  828.0GB (copy 63% completed)
  shared   1.0.0    0   BSAS  7200  73.89GB  828.0GB (normal)
  shared   1.0.11   0   BSAS  7200  73.89GB  828.0GB (normal)
  shared   1.0.6    0   BSAS  7200  73.89GB  828.0GB (normal)
  shared   1.0.5    0   BSAS  7200  73.89GB  828.0GB (normal)
```

After the replacement operation is complete, confirm that you have a full spare disk:

```
ie2220::> storage aggregate show-spare-disks -original-owner c1-01

Original Owner: c1-01
 Pool0
  Shared HDD Spares
                          Local    Local
                          Data      Root  Physical
 Disk    Type   RPM Checksum Usable  Usable     Size
 ------  ----- ---- -------- -------- ------- --------
 1.0.1   BSAS  7200 block     753.8GB  73.89GB  828.0GB
```