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

ONTAP 9

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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.

```
┌─────────────────┐
│ Identify aggregate │
│   to expand     │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ Identify how much │
│  new storage is  │
│ needed, compute  │
│ number of disks  │
└─────────────────┘
         │
         ▼
      ╱╲
     ╱Space╲
    ╱available for╲──No──►┌─────────────────┐
    ╲  disks? ╱           │  Add a disk shelf │
     ╲    ╱               └─────────────────┘
      ╲╱                           │
       │                           │
      Yes                          │
       │                           │
       ▼                           │
┌─────────────────┐                │
│  Add new disks   │                │
│    to node      │                │
└─────────────────┘                │
         │                         │
         ▼◄────────────────────────┘
      ╱╲
     ╱ Is auto-╲
    ╱assignment of╲──No──►┌─────────────────┐
   ╱disk ownership ╲      │    Manually      │
    ╲  enabled? ╱         │  assign disks    │
     ╲       ╱            └─────────────────┘
      ╲╱                           │
       │                           │
      Yes                          │
       │                           │
       ▼◄────────────────────────┘
┌─────────────────┐
│ Expand aggregate │
└─────────────────┘
```

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

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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 -aggregate aggr_test
-diskcount 5 -simulate true

Disks would be added to aggregate "aggr_test" on node "cl1-s2" in
the
following manner:

First Plex

  RAID Group rg0, 5 disks (block checksum, raid_dp)
                                                    Usable
Physical
    Position   Disk                       Type         Size
Size
    ---------- ------------------------- ---------- --------
--------
    shared     1.11.4                     SSD          415.8GB
415.8GB
    shared     1.11.18                    SSD          415.8GB
415.8GB
    shared     1.11.19                    SSD          415.8GB
415.8GB
    shared     1.11.20                    SSD          415.8GB
415.8GB
    shared     1.11.21                    SSD          415.8GB
415.8GB


Aggregate capacity available for volume use would be increased by
1.83TB.
```

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.

> **ⓘ** 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. Optional (ONTAP 9.3 and earlier only): 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. In ONTAP 9.3 and earlier, zeroing can take hours to complete, depending on the size of the non-zeroed drives in the node. Zeroing the drives now can prevent delays in case you need to quickly increase the size of an local tier. This is not an issue in ONTAP 9.4 or later where drives are zeroed using *fast zeroing* which takes only seconds.

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
```