Manage RAID configurations

ONTAP 9

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Manage RAID configurations

Overview of managing RAID configurations

You can perform various procedures to manage RAID configurations in your system.

- **Aspects of managing RAID configurations**:
  - Default RAID policies for local tiers (aggregates)
  - RAID protection levels for disks
- **Drive and RAID group information for a local tier (aggregate)**
  - Determine drive and RAID group information for a local tier (aggregate)
- **RAID configuration conversions**
  - Convert from RAID-DP to RAID-TEC
  - Convert from RAID-TEC to RAID-DP
- **RAID group sizing**
  - Considerations for sizing RAID groups
  - Customize the size of your RAID group

Default RAID policies for local tiers (aggregates)

Either RAID-DP or RAID-TEC is the default RAID policy for all new local tiers (aggregates). The RAID policy determines the parity protection you have in the event of a disk failure.

RAID-DP provides double-parity protection in the event of a single or double disk failure. RAID-DP is the default RAID policy for the following local tier (aggregate) types:

- All flash local tiers
- Flash Pool local tiers
- Performance hard disk drive (HDD) local tiers

A new RAID policy called RAID-TEC is available. RAID-TEC is supported on all disk types and all platforms, including AFF. Local tiers that contain larger disks have a higher possibility of concurrent disk failures. RAID-TEC helps to mitigate this risk by providing triple-parity protection so that your data can survive up to three simultaneous disk failures. RAID-TEC is the default RAID policy for capacity HDD local tiers with disks that are 6 TB or larger.

RAID protection levels for disks

ONTAP supports three levels of RAID protection for local tiers (aggregates). The level of RAID protection determines the number of parity disks available for data recovery in the event of disk failures.

With RAID protection, if there is a data disk failure in a RAID group, ONTAP can replace the failed disk with a spare disk and use parity data to reconstruct the data of the failed disk.

- **RAID4**

  With RAID4 protection, ONTAP can use one spare disk to replace and reconstruct the data from one failed disk within the RAID group.

- **RAID-DP**

  With RAID-DP protection, ONTAP can use up to two spare disks to replace and reconstruct the data from up to two simultaneously failed disks within the RAID group.

- **RAID-TEC**

  With RAID-TEC protection, ONTAP can use up to three spare disks to replace and reconstruct the data from up to three simultaneously failed disks within the RAID group.

Related information

NetApp Technical Report 3437: Storage Subsystem Resiliency Guide

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.
```

Convert from RAID-DP to RAID-TEC

If you want the added protection of triple-parity, you can convert from RAID-DP to RAID-TEC. RAID-TEC is recommended if the size of the disks used in your local tier (aggregate) is greater than 4 TiB.

What you'll need

The local tier (aggregate) that is to be converted must have a minimum of seven disks.

About this task

Hard disk drive (HDD) local tiers can be converted from RAID-DP to RAID-TEC. This includes HDD tiers in Flash Pool local tiers.

Steps

1. Verify that the aggregate is online and has a minimum of six disks:

   `storage aggregate show-status -aggregate` *`aggregate_name`*

2. Convert the aggregate from RAID-DP to RAID-TEC:

   ```
   storage aggregate modify -aggregate aggregate_name -raidtype raid_tec
   ```

3. Verify that the aggregate RAID policy is RAID-TEC:

   ```
   storage aggregate show aggregate_name
   ```

Convert from RAID-TEC to RAID-DP

If you reduce the size of your local tier (aggregate) and no longer need triple parity, you can convert your RAID policy from RAID-TEC to RAID-DP and reduce the number of disks you need for RAID parity.

What you'll need

The maximum RAID group size for RAID-TEC is larger than the maximum RAID group size for RAID-DP. If the largest RAID-TEC group size is not within the RAID-DP limits, you cannot convert to RAID-DP.

Steps

1. Verify that the aggregate is online and has a minimum of six disks:

   ```
   storage aggregate show-status -aggregate aggregate_name
   ```

2. Convert the aggregate from RAID-TEC to RAID-DP:

   ```
   storage aggregate modify -aggregate aggregate_name -raidtype raid_dp
   ```

3. Verify that the aggregate RAID policy is RAID-DP:

   ```
   storage aggregate show aggregate_name
   ```

Considerations for sizing RAID groups

Configuring an optimum RAID group size requires a trade-off of factors. You must decide which factors—speed of RAID rebuild, assurance against risk of data loss due to drive failure, optimizing I/O performance, and maximizing data storage space—are most important for the (local tier) aggregate that you are configuring.

When you create larger RAID groups, you maximize the space available for data storage for the same amount of storage used for parity (also known as the "parity tax"). On the other hand, when a disk fails in a larger RAID group, reconstruction time is increased, impacting performance for a longer period of time. In addition, having more disks in a RAID group increases the probability of a multiple disk failure within the same RAID group.

HDD or array LUN RAID groups

You should follow these guidelines when sizing your RAID groups composed of HDDs or array LUNs:

- All RAID groups in an local tier (aggregate) should have the same number of disks.

  While you can have up to 50% less or more than the number of disks in different raid groups on one local

tier, this might lead to performance bottlenecks in some cases, so it is best avoided.

- The recommended range of RAID group disk numbers is between 12 and 20.

  The reliability of performance disks can support a RAID group size of up to 28, if needed.

- If you can satisfy the first two guidelines with multiple RAID group disk numbers, you should choose the larger number of disks.

SSD RAID groups in Flash Pool local tiers (aggregates)

The SSD RAID group size can be different from the RAID group size for the HDD RAID groups in a Flash Pool local tier (aggregate). Usually, you should ensure that you have only one SSD RAID group for a Flash Pool local tier, to minimize the number of SSDs required for parity.

SSD RAID groups in SSD local tiers (aggregates)

You should follow these guidelines when sizing your RAID groups composed of SSDs:

- All RAID groups in a local tier (aggregate) should have a similar number of drives.

  The RAID groups do not have to be exactly the same size, but you should avoid having any RAID group that is less than one half the size of other RAID groups in the same local tier when possible.

- For RAID-DP, the recommended range of RAID group size is between 20 and 28.

Customize the size of your RAID groups

You can customize the size of your RAID groups to ensure that your RAID group sizes are appropriate for the amount of storage you plan to include for a local tier (aggregate).

About this task

For standard local tiers (aggregates), you change the size of RAID groups for each local tier separately. For Flash Pool local tiers, you can change the RAID group size for the SSD RAID groups and the HDD RAID groups independently.

The following list outlines some facts about changing the RAID group size:

- By default, if the number of disks or array LUNs in the most recently created RAID group is less than the new RAID group size, disks or array LUNs will be added to the most recently created RAID group until it reaches the new size.
- All other existing RAID groups in that local tier remain the same size, unless you explicitly add disks to them.
- You can never cause a RAID group to become larger than the current maximum RAID group size for the local tier.
- You cannot decrease the size of already created RAID groups.
- The new size applies to all RAID groups in that local tier (or, in the case of a Flash Pool local tier, all RAID groups for the affected RAID group type—SSD or HDD).

Steps

1. Use the applicable command:

If you want to…	Enter the following command…
Change the maximum RAID group size for the SSD RAID groups of a Flash Pool aggregate	`storage aggregate modify -aggregate aggr_name -cache-raid-group-size size`
Change the maximum size of any other RAID groups	`storage aggregate modify -aggregate aggr_name -maxraidsize size`

Examples

The following command changes the maximum RAID group size of the aggregate n1_a4 to 20 disks or array LUNs:

```
storage aggregate modify -aggregate n1_a4 -maxraidsize 20
```

The following command changes the maximum RAID group size of the SSD cache RAID groups of the Flash Pool aggregate n1_cache_a2 to 24:

```
storage aggregate modify -aggregate n1_cache_a2 -cache-raid-group-size 24
```

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