Testing the MetroCluster configuration

ONTAP MetroCluster

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April 12, 2021

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Testing the MetroCluster configuration

You can test failure scenarios to confirm the correct operation of the MetroCluster configuration.

Verifying negotiated switchover

You can test the negotiated (planned) switchover operation to confirm uninterrupted data availability.

This test validates that data availability is not affected (except for Microsoft Server Message Block (SMB) and Solaris Fibre Channel protocols) by switching the cluster over to the second data center.

This test should take about 30 minutes.

This procedure has the following expected results:

- The `metrocluster switchover` command will present a warning prompt.

  If you respond **`yes`** to the prompt, the site the command is issued from will switch over the partner site.

For MetroCluster IP configurations:

- For ONTAP 9.4 and earlier:
  - Mirrored aggregates will become degraded after the negotiated switchover.
- For ONTAP 9.5 and later:
  - Mirrored aggregates will remain in normal state if the remote storage is accessible.
  - Mirrored aggregates will become degraded after the negotiated switchover if access to the remote storage is lost.
- For ONTAP 9.8 and later:
  - Unmirrored aggregates that are located at the disaster site will become unavailable if access to the remote storage is lost. This might lead to a controller outage.

1. Confirm that all nodes are in the configured state and normal mode:

   `metrocluster node show`

   ```
   cluster_A::>  metrocluster node show

   Cluster                     Configuration State    Mode
   --------------------------- ---------------------
   -------------------------
    Local: cluster_A              configured             normal
   Remote: cluster_B              configured             normal
   ```

2. Begin the switchover operation:

metrocluster switchover

```
cluster_A::> metrocluster switchover
Warning: negotiated switchover is about to start. It will stop all
the data Vservers on cluster "cluster_B" and
automatically re-start them on cluster "cluster_A". It will
finally gracefully shutdown cluster "cluster_B".
```

3. Confirm that the local cluster is in the configured state and switchover mode:

metrocluster node show

```
cluster_A::>  metrocluster node show

Cluster                           Configuration State    Mode
--------------------------------- ---------------------
------------------------
Local: cluster_A                   configured             switchover
Remote: cluster_B                  not-reachable          -
              configured                 normal
```

4. Confirm that the switchover operation was successful:

metrocluster operation show

```
cluster_A::>  metrocluster operation show

cluster_A::> metrocluster operation show
  Operation: switchover
      State: successful
 Start Time: 2/6/2016 13:28:50
   End Time: 2/6/2016 13:29:41
     Errors: -
```

5. Use the `vserver show` and `network interface show` commands to verify that DR SVMs and LIFs have come online.

Verifying healing and manual switchback

You can test the healing and manual switchback operations to verify that data availability is not affected (except for SMB and Solaris FC configurations) by switching back the cluster to the original data center after a negotiated switchover.

This test should take about 30 minutes.

The expected result of this procedure is that services should be switched back to their home nodes.

1. Verify that healing is completed: `metrocluster node show`

   The following example shows the successful completion of the command:

```
cluster_A::> metrocluster node show
DR                              Configuration  DR
Group Cluster Node              State          Mirroring Mode
----- ------- ----------------- -------------- ---------
--------------------
1     cluster_A
              node_A_1          configured     enabled   heal roots
completed
      cluster_B
              node_B_2          unreachable    -         switched over
42 entries were displayed.metrocluster operation show
```

2. Verify that all aggregates are mirrored: `storage aggregate show`

   The following example shows that all aggregates have a RAID Status of mirrored:

```
cluster_A::> storage aggregate show
cluster Aggregates:
Aggregate Size     Available Used% State   #Vols  Nodes       RAID
Status
--------- -------- --------- ----- ------- ------ ----------
------------
data_cluster
            4.19TB    4.13TB    2% online       8 node_A_1    raid_dp,
                                                               mirrored,
                                                               normal
root_cluster
           715.5GB   212.7GB   70% online       1 node_A_1    raid4,
                                                               mirrored,
                                                               normal
cluster_B Switched Over Aggregates:
Aggregate Size     Available Used% State   #Vols  Nodes       RAID
Status
--------- -------- --------- ----- ------- ------ ----------
------------
data_cluster_B
            4.19TB    4.11TB    2% online       5 node_A_1    raid_dp,
                                                               mirrored,
                                                               normal
root_cluster_B    -         -     - unknown      - node_A_1    -
```

3. Boot nodes from the disaster site.
4. Check the status of switchback recovery: `metrocluster node show`

```
cluster_A::> metrocluster node show
DR                              Configuration  DR
Group Cluster Node              State          Mirroring Mode
----- ------- ----------------- -------------- ---------
--------------------
1     cluster_A
            node_A_1            configured     enabled   heal roots
completed
      cluster_B
            node_B_2            configured     enabled   waiting for
switchback
                                                         recovery
2 entries were displayed.
```

5. Perform the switchback: `metrocluster switchback`

```
cluster_A::> metrocluster switchback
[Job 938] Job succeeded: Switchback is successful.Verify switchback
```

6. Confirm status of the nodes: `metrocluster node show`

```
cluster_A::> metrocluster node show
DR                              Configuration  DR
Group Cluster Node              State          Mirroring Mode
----- ------- ------------------ -------------- ---------
--------------------
1     cluster_A
              node_A_1         configured     enabled   normal
      cluster_B
              node_B_2         configured     enabled   normal

2 entries were displayed.
```

7. Confirm status of the metrocluster operation: `metrocluster operation show`

   The output should show a successful state.

```
cluster_A::> metrocluster operation show
  Operation: switchback
      State: successful
 Start Time: 2/6/2016 13:54:25
   End Time: 2/6/2016 13:56:15
     Errors: -
```

Loss of a single FC-to-SAS bridge

You can test the failure of a single FC-to-SAS bridge to make sure there is no single point of failure.

This test should take about 15 minutes.

This procedure has the following expected results:

- Errors should be generated as the bridge is switched off.
- No failover or loss of service should occur.
- Only one path from the controller module to the drives behind the bridge is available.

Starting with ONTAP 9.8, the `storage bridge` command is replaced with `system bridge`. The following steps show the `storage bridge` command, but if you are running ONTAP 9.8 or later, the `system bridge` command is preferred.

1. Turn off the power supplies of the bridge.
2. Confirm that the bridge monitoring indicates an error: `storage bridge show`

```
cluster_A::> storage bridge show

                                                                  Is
Monitor
Bridge      Symbolic Name Vendor  Model      Bridge WWN        Monitored
Status
---------- ------------- ------- --------- ---------------- ---------
-------
ATTO_10.65.57.145
         bridge_A_1    Atto    FibreBridge 6500N
                                           200000108662d46c true
error
```

3. Confirm that drives behind the bridge are available with a single path: `storage disk error show`

```
cluster_A::> storage disk error show
Disk              Error Type        Error Text
----------------- -----------------
-------------------------------------------
1.0.0             onedomain         1.0.0 (5000cca057729118): All paths
to this array LUN are connected to the same fault domain. This is a
single point of failure.
1.0.1             onedomain         1.0.1 (5000cca057727364): All paths
to this array LUN are connected to the same fault domain. This is a
single point of failure.
1.0.2             onedomain         1.0.2 (5000cca05772e9d4): All paths
to this array LUN are connected to the same fault domain. This is a
single point of failure.
...
1.0.23            onedomain         1.0.23 (5000cca05772e9d4): All paths
to this array LUN are connected to the same fault domain. This is a
single point of failure.
```

Verifying operation after power line disruption

You can test the MetroCluster configuration's response to the failure of a PDU.

The best practice is for each power supply unit (PSU) in a component to be connected to separate power supplies. If both PSUs are connected to the same power distribution unit (PDU) and an electrical disruption occurs, the site could down or a complete shelf might become unavailable. Failure of one power line is tested to confirm that there is no cabling mismatch that could cause a service disruption.

This test should take about 15 minutes.

This test requires turning off power to all left-hand PDUs and then all right-hand PDUs on all of the racks containing the MetroCluster components.

This procedure has the following expected results:

- Errors should be generated as the PDUs are disconnected.
- No failover or loss of service should occur.

1. Turn off the power of the PDUs on the left-hand side of the rack containing the MetroCluster components.
2. Monitor the result on the console by using the system environment sensors show -state fault and storage shelf show -errors commands.

```
cluster_A::> system environment sensors show -state fault

Node Sensor             State Value/Units Crit-Low Warn-Low Warn-Hi
Crit-Hi
---- -------------------- ------ ----------- -------- --------
------- -------
node_A_1
        PSU1            fault
                            PSU_OFF
        PSU1 Pwr In OK  fault
                            FAULT
node_A_2
        PSU1            fault
                            PSU_OFF
        PSU1 Pwr In OK  fault
                            FAULT
4 entries were displayed.

cluster_A::> storage shelf show -errors
    Shelf Name: 1.1
     Shelf UID: 50:0a:09:80:03:6c:44:d5
 Serial Number: SHFHU1443000059

Error Type          Description
------------------  --------------------------
Power               Critical condition is detected in storage shelf
power supply unit "1". The unit might fail.Reconnect PSU1
```

3. Turn the power back on to the left-hand PDUs.
4. Make sure that ONTAP clears the error condition.
5. Repeat the previous steps with the right-hand PDUs.

Verifying operation after a switch fabric failure

You can disable a switch fabric to show that data availability is not affected by the loss.

This test should take about 15 minutes.

The expected result of this procedure is that disabling a fabric results in all cluster interconnect and disk traffic flowing to the other fabric.

In the examples shown, switch fabric 1 is disabled. This fabric consists of two switches, one at each MetroCluster site:

- FC_switch_A_1 on cluster_A
- FC_switch_B_1 on cluster_B

1. Disable connectivity to one of the two switch fabrics in the MetroCluster configuration:
   a. Disable the first switch in the fabric: `switchdisable`

   ```
   FC_switch_A_1::> switchdisable
   ```

   b. Disable the second switch in the fabric: `switchdisable`

   ```
   FC_switch_B_1::> switchdisable
   ```

2. Monitor the result on the console of the controller modules.

   You can use the following commands to check the cluster nodes to make sure that all data is still being served. The command output shows missing paths to disks. This is expected.

   - vserver show
   - network interface show
   - aggr show
   - system node runnodename-command storage show disk -p
   - storage disk error show

3. Reenable connectivity to one of the two switch fabrics in the MetroCluster configuration:
   a. Reenable the first switch in the fabric: `switchenable`

   ```
   FC_switch_A_1::> switchenable
   ```

   b. Reenable the second switch in the fabric: `switchenable`

```
FC_switch_B_1::> switchenable
```

4. Wait at least 10 minutes and then repeat the above steps on the other switch fabric.

Verifying operation after loss of a single storage shelf

You can test the failure of a single storage shelf to verify that there is no single point of failure.

This procedure has the following expected results:

- An error message should be reported by the monitoring software.
- No failover or loss of service should occur.
- Mirror resynchronization starts automatically after the hardware failure is restored.

1. Check the storage failover status: `storage failover show`

```
cluster_A::> storage failover show

Node           Partner        Possible State Description
-------------- -------------- --------
-------------------------------------
node_A_1       node_A_2       true     Connected to node_A_2
node_A_2       node_A_1       true     Connected to node_A_1
2 entries were displayed.
```

2. Check the aggregate status: `storage aggregate show`

```
cluster_A::> storage aggregate show

cluster Aggregates:
Aggregate     Size Available Used% State   #Vols  Nodes
RAID Status
--------- -------- --------- ----- ------- ------ ----------------
------------
node_A_1data01_mirrored
            4.15TB    3.40TB   18% online       3 node_A_1
raid_dp,

mirrored,

normal
node_A_1root
           707.7GB   34.29GB   95% online       1 node_A_1
raid_dp,

mirrored,

normal
node_A_2_data01_mirrored
            4.15TB    4.12TB    1% online       2 node_A_2
raid_dp,

mirrored,

normal
node_A_2_data02_unmirrored
            2.18TB    2.18TB    0% online       1 node_A_2
raid_dp,

normal
node_A_2_root
           707.7GB   34.27GB   95% online       1 node_A_2
raid_dp,

mirrored,

normal
```

3. Verify that all data SVMs and data volumes are online and serving data: `vserver show -type datanetwork interface show -fields is-home falsevolume show !vol0,!MDV*`

```
cluster_A::> vserver show -type data

cluster_A::> vserver show -type data
                               Admin      Operational Root
Vserver     Type    Subtype    State      State       Volume
Aggregate
----------- ------- ---------- ---------- ----------- ----------
----------
SVM1        data    sync-source           running     SVM1_root
node_A_1_data01_mirrored
SVM2        data    sync-source           running     SVM2_root
node_A_2_data01_mirrored

cluster_A::> network interface show -fields is-home false
There are no entries matching your query.

cluster_A::> volume show !vol0,!MDV*
Vserver   Volume       Aggregate    State      Type       Size
Available Used%
--------- ------------ ------------ ---------- ---- ----------
---------- -----
SVM1
          SVM1_root
                       node_A_1data01_mirrored
                                    online     RW         10GB
9.50GB    5%
SVM1
          SVM1_data_vol
                       node_A_1data01_mirrored
                                    online     RW         10GB
9.49GB    5%
SVM2
          SVM2_root
                       node_A_2_data01_mirrored
                                    online     RW         10GB
9.49GB    5%
SVM2
          SVM2_data_vol
                       node_A_2_data02_unmirrored
                                    online     RW          1GB
972.6MB    5%
```

4. Identify a shelf in Pool 1 for node node_A_2 to power off to simulate a sudden hardware failure: `storage aggregate show -r -node node-name !*root`

   The shelf you select must contain drives that are part of a mirrored data aggregate.

In the following example, shelf ID 31 is selected to fail.

```
cluster_A::> storage aggregate show -r -node node_A_2 !*root
Owner Node: node_A_2
 Aggregate: node_A_2_data01_mirrored (online, raid_dp, mirrored)
(block checksums)
  Plex: /node_A_2_data01_mirrored/plex0 (online, normal, active,
pool0)
   RAID Group /node_A_2_data01_mirrored/plex0/rg0 (normal, block
checksums)
                                                                  Usable
Physical
     Position Disk                        Pool Type     RPM     Size
Size Status
     -------- --------------------------- ---- ----- ------ --------
-------- ----------
     dparity  2.30.3                       0   BSAS    7200  827.7GB
828.0GB (normal)
     parity   2.30.4                       0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.6                       0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.8                       0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.5                       0   BSAS    7200  827.7GB
828.0GB (normal)

  Plex: /node_A_2_data01_mirrored/plex4 (online, normal, active,
pool1)
   RAID Group /node_A_2_data01_mirrored/plex4/rg0 (normal, block
checksums)
                                                                  Usable
Physical
     Position Disk                        Pool Type     RPM     Size
Size Status
     -------- --------------------------- ---- ----- ------ --------
-------- ----------
     dparity  1.31.7                       1   BSAS    7200  827.7GB
828.0GB (normal)
     parity   1.31.6                       1   BSAS    7200  827.7GB
828.0GB (normal)
     data     1.31.3                       1   BSAS    7200  827.7GB
828.0GB (normal)
     data     1.31.4                       1   BSAS    7200  827.7GB
828.0GB (normal)
     data     1.31.5                       1   BSAS    7200  827.7GB
```

```
828.0GB (normal)

 Aggregate: node_A_2_data02_unmirrored (online, raid_dp) (block
checksums)
  Plex: /node_A_2_data02_unmirrored/plex0 (online, normal, active,
pool0)
   RAID Group /node_A_2_data02_unmirrored/plex0/rg0 (normal, block
checksums)
                                                                  Usable
Physical
     Position Disk                        Pool Type     RPM     Size
Size Status
     -------- --------------------------- ---- ----- ------ --------
-------- ----------
     dparity  2.30.12                       0   BSAS    7200  827.7GB
828.0GB (normal)
     parity   2.30.22                       0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.21                       0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.20                       0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.14                       0   BSAS    7200  827.7GB
828.0GB (normal)
15 entries were displayed.
```

5. Physically power off the shelf that you selected.
6. Check the aggregate status again: `storage aggregate show``storage aggregate show -r -node node_A_2 !*root`

   The aggregate with drives on the powered-off shelf should have a `degraded` RAID status, and drives on the affected plex should have a `failed` status, as shown in the following example:

```
cluster_A::> storage aggregate show
Aggregate     Size Available Used% State   #Vols  Nodes
RAID Status
--------- -------- --------- ----- ------- ------ ----------------
------------
node_A_1data01_mirrored
            4.15TB    3.40TB   18% online       3 node_A_1
raid_dp,

mirrored,

normal
```

```
node_A_1root
           707.7GB   34.29GB   95% online       1 node_A_1
raid_dp,

mirrored,

normal
node_A_2_data01_mirrored
            4.15TB    4.12TB    1% online       2 node_A_2
raid_dp,

mirror

degraded
node_A_2_data02_unmirrored
            2.18TB    2.18TB    0% online       1 node_A_2
raid_dp,

normal
node_A_2_root
           707.7GB   34.27GB   95% online       1 node_A_2
raid_dp,

mirror

degraded
cluster_A::> storage aggregate show -r -node node_A_2 !*root
Owner Node: node_A_2
 Aggregate: node_A_2_data01_mirrored (online, raid_dp, mirror
degraded) (block checksums)
  Plex: /node_A_2_data01_mirrored/plex0 (online, normal, active,
pool0)
   RAID Group /node_A_2_data01_mirrored/plex0/rg0 (normal, block
checksums)
                                                             Usable
Physical
     Position Disk                       Pool Type     RPM     Size
Size Status
     -------- -------------------------- ---- ----- ------ --------
-------- ----------
     dparity  2.30.3                      0   BSAS    7200  827.7GB
828.0GB (normal)
     parity   2.30.4                      0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.6                      0   BSAS    7200  827.7GB
828.0GB (normal)
```

```
     data     2.30.8                        0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.5                        0   BSAS    7200  827.7GB
828.0GB (normal)

  Plex: /node_A_2_data01_mirrored/plex4 (offline, failed, inactive,
pool1)
   RAID Group /node_A_2_data01_mirrored/plex4/rg0 (partial, none
checksums)
                                                                  Usable
Physical
     Position Disk                        Pool Type     RPM     Size
Size Status
     -------- --------------------------- ---- ----- ------ --------
-------- ----------
     dparity  FAILED                       -   -          -  827.7GB
-  (failed)
     parity   FAILED                       -   -          -  827.7GB
-  (failed)
     data     FAILED                       -   -          -  827.7GB
-  (failed)
     data     FAILED                       -   -          -  827.7GB
-  (failed)
     data     FAILED                       -   -          -  827.7GB
-  (failed)

 Aggregate: node_A_2_data02_unmirrored (online, raid_dp) (block
checksums)
  Plex: /node_A_2_data02_unmirrored/plex0 (online, normal, active,
pool0)
   RAID Group /node_A_2_data02_unmirrored/plex0/rg0 (normal, block
checksums)
                                                                  Usable
Physical
     Position Disk                        Pool Type     RPM     Size
Size Status
     -------- --------------------------- ---- ----- ------ --------
-------- ----------
     dparity  2.30.12                      0   BSAS    7200  827.7GB
828.0GB (normal)
     parity   2.30.22                      0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.21                      0   BSAS    7200  827.7GB
828.0GB (normal)
     data     2.30.20                      0   BSAS    7200  827.7GB
828.0GB (normal)
```

```
      data     2.30.14                    0   BSAS    7200  827.7GB
  828.0GB (normal)
  15 entries were displayed.
```

7. Verify that the data is being served and that all volumes are still online: `vserver show -type datanetwork interface show -fields is-home falsevolume show !vol0,!MDV*`

```
cluster_A::> vserver show -type data

cluster_A::> vserver show -type data
                               Admin      Operational Root
Vserver     Type    Subtype    State      State       Volume
Aggregate
----------- ------- ---------- ---------- ----------- ----------
----------
SVM1        data    sync-source           running     SVM1_root
node_A_1_data01_mirrored
SVM2        data    sync-source           running     SVM2_root
node_A_1_data01_mirrored

cluster_A::> network interface show -fields is-home false
There are no entries matching your query.

cluster_A::> volume show !vol0,!MDV*
Vserver   Volume       Aggregate    State      Type       Size
Available Used%
--------- ------------ ------------ ---------- ---- ----------
---------- -----
SVM1
          SVM1_root
                       node_A_1data01_mirrored
                                    online     RW         10GB
9.50GB    5%
SVM1
          SVM1_data_vol
                       node_A_1data01_mirrored
                                    online     RW         10GB
9.49GB    5%
SVM2
          SVM2_root
                       node_A_1data01_mirrored
                                    online     RW         10GB
9.49GB    5%
SVM2
          SVM2_data_vol
                       node_A_2_data02_unmirrored
                                    online     RW          1GB
972.6MB    5%
```

8. Physically power on the shelf.

   Resynchronization starts automatically.

9. Verify that resynchronization has started: `storage aggregate show`

   The affected aggregate should have a `resyncing` RAID status, as shown in the following example:

```
cluster_A::> storage aggregate show
cluster Aggregates:
Aggregate     Size Available Used% State   #Vols  Nodes
RAID Status
--------- -------- --------- ----- ------- ------ ----------------
------------
node_A_1_data01_mirrored
            4.15TB    3.40TB   18% online       3 node_A_1
raid_dp,

mirrored,

normal
node_A_1_root
           707.7GB   34.29GB   95% online       1 node_A_1
raid_dp,

mirrored,

normal
node_A_2_data01_mirrored
            4.15TB    4.12TB    1% online       2 node_A_2
raid_dp,

resyncing
node_A_2_data02_unmirrored
            2.18TB    2.18TB    0% online       1 node_A_2
raid_dp,

normal
node_A_2_root
           707.7GB   34.27GB   95% online       1 node_A_2
raid_dp,

resyncing
```

10. Monitor the aggregate to confirm that resynchronization is complete: `storage aggregate show`

    The affected aggregate should have a `normal` RAID status, as shown in the following example:

```
cluster_A::> storage aggregate show
cluster Aggregates:
Aggregate     Size Available Used% State   #Vols  Nodes
RAID Status
--------- -------- --------- ----- ------- ------ ----------------
------------
node_A_1data01_mirrored
            4.15TB    3.40TB   18% online       3 node_A_1
raid_dp,

mirrored,

normal
node_A_1root
           707.7GB   34.29GB   95% online       1 node_A_1
raid_dp,

mirrored,

normal
node_A_2_data01_mirrored
            4.15TB    4.12TB    1% online       2 node_A_2
raid_dp,

normal
node_A_2_data02_unmirrored
            2.18TB    2.18TB    0% online       1 node_A_2
raid_dp,

normal
node_A_2_root
           707.7GB   34.27GB   95% online       1 node_A_2
raid_dp,

resyncing
```