



Recovering from storage volume failure where the system drive is intact

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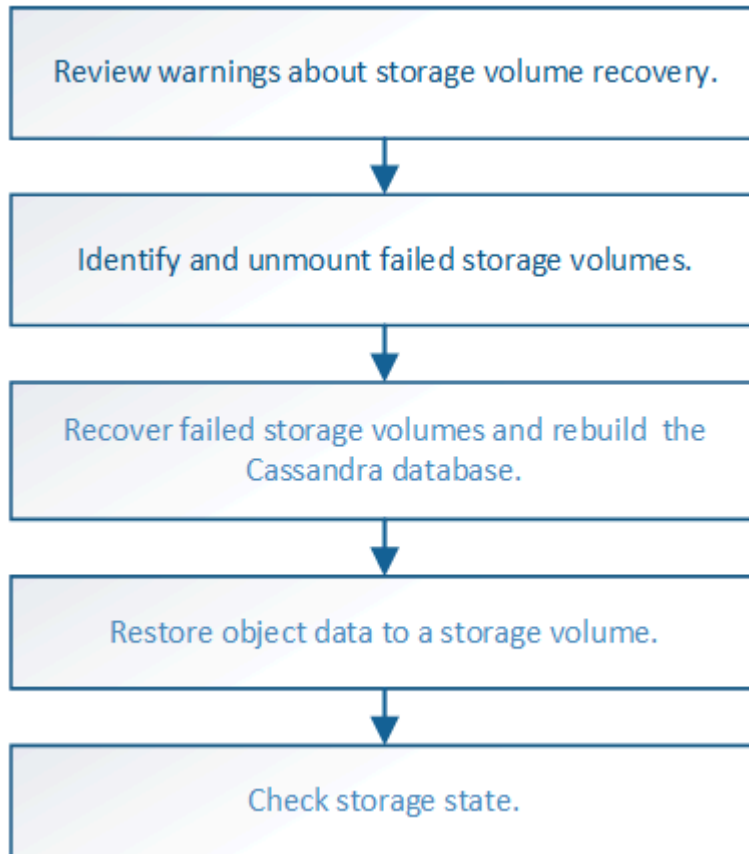
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Recovering from storage volume failure where the system drive is intact

You must complete a series of tasks to recover a software-based Storage Node where one or more storage volumes on the Storage Node have failed, but the system drive is intact. If only storage volumes have failed, the Storage Node is still available to the StorageGRID system.

About this task

This recovery procedure applies to software-based Storage Nodes only. If storage volumes have failed on an appliance Storage Node, use the procedure for “Recovering a StorageGRID appliance Storage Node.”



Related information

[Recovering a StorageGRID appliance Storage Node](#)

Steps

- [Reviewing warnings about storage volume recovery](#)
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Reviewing warnings about storage volume recovery

Before recovering failed storage volumes for a Storage Node, you must review the following warnings.

The storage volumes (or rangedbs) in a Storage Node are identified by a hexadecimal number, which is known as the volume ID. For example, 0000 is the first volume and 000F is the sixteenth volume. The first object store (volume 0) on each Storage Node uses up to 4 TB of space for object metadata and Cassandra database operations; any remaining space on that volume is used for object data. All other storage volumes are used exclusively for object data.

If volume 0 fails and needs to be recovered, the Cassandra database might be rebuilt as part of the volume recovery procedure. Cassandra might also be rebuilt in the following circumstances:

- A Storage Node is brought back online after having been offline for more than 15 days.
- The system drive and one or more storage volumes fails and is recovered.

When Cassandra is rebuilt, the system uses information from other Storage Nodes. If too many Storage Nodes are offline, some Cassandra data might not be available. If Cassandra has been rebuilt recently, Cassandra data might not yet be consistent across the grid. Data loss can occur if Cassandra is rebuilt when too many Storage Nodes are offline or if two or more Storage Nodes are rebuilt within 15 days of each other.



If more than one Storage Node has failed (or is offline), contact technical support. Do not perform the following recovery procedure. Data loss could occur.



If this is the second Storage Node failure in less than 15 days after a Storage Node failure or recovery, contact technical support. Rebuilding Cassandra on two or more Storage Nodes within 15 days can result in data loss.



If more than one Storage Node at a site has failed, a site recovery procedure might be required. Contact technical support.

How site recovery is performed by technical support



If ILM rules are configured to store only one replicated copy and the copy exists on a storage volume that has failed, you will not be able to recover the object.



If you encounter a Services: Status - Cassandra (SVST) alarm during recovery, see the monitoring and troubleshooting instructions to recover from the alarm by rebuilding Cassandra. After Cassandra is rebuilt, alarms should clear. If alarms do not clear, contact technical support.

Related information

[Monitor & troubleshoot](#)

[Warnings and considerations for grid node recovery](#)

Identifying and unmounting failed storage volumes

When recovering a Storage Node with failed storage volumes, you must identify and

unmount the failed volumes. You must verify that only the failed storage volumes are reformatted as part of the recovery procedure.

What you'll need

You must be signed in to the Grid Manager using a supported browser.

About this task

You should recover failed storage volumes as soon as possible.

The first step of the recovery process is to detect volumes that have become detached, need to be unmounted, or have I/O errors. If failed volumes are still attached but have a randomly corrupted file system, the system might not detect any corruption in unused or unallocated parts of the disk.



You must finish this procedure before performing manual steps to recover the volumes, such as adding or re-attaching the disks, stopping the node, starting the node, or rebooting. Otherwise, when you run the `reformat_storage_block_devices.rb` script, you might encounter a file system error that causes the script to hang or fail.



Repair the hardware and properly attach the disks before running the `reboot` command.

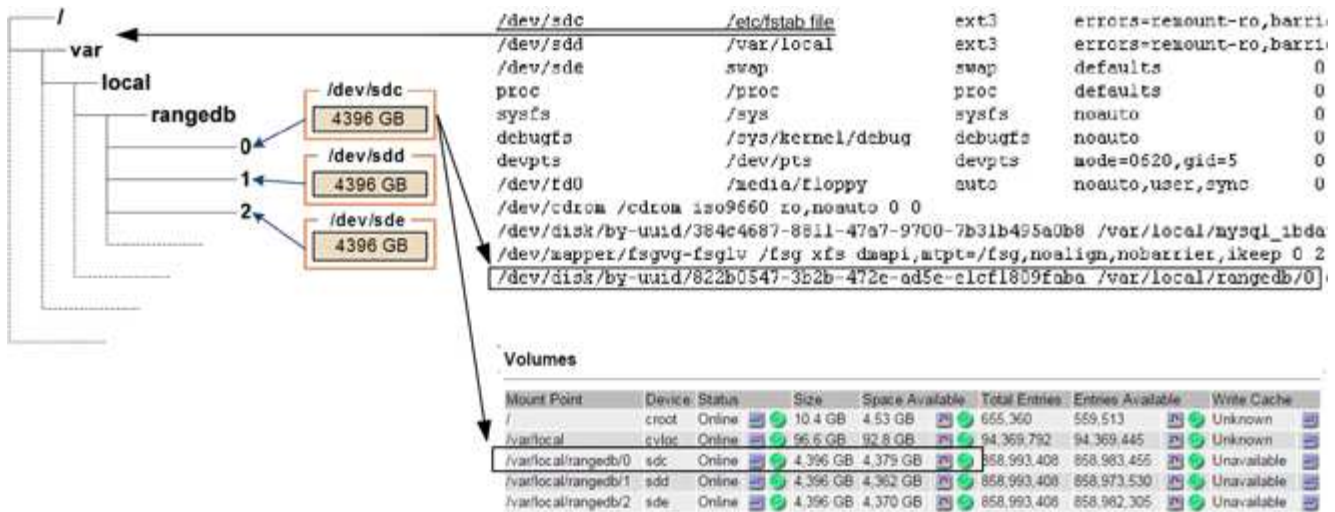


Identify failed storage volumes carefully. You will use this information to verify which volumes must be reformatted. Once a volume has been reformatted, data on the volume cannot be recovered.

To correctly recover failed storage volumes, you need to know both the device names of the failed storage volumes and their volume IDs.

At installation, each storage device is assigned a file system universal unique identifier (UUID) and is mounted to a `rangedb` directory on the Storage Node using that assigned file system UUID. The file system UUID and the `rangedb` directory are listed in the `/etc/fstab` file. The device name, `rangedb` directory, and the size of the mounted volume are displayed in the Grid Manager.

In the following example, device `/dev/sdc` has a volume size of 4 TB, is mounted to `/var/local/rangedb/0`, using the device name `/dev/disk/by-uuid/822b0547-3b2b-472e-ad5e-e1cf1809faba` in the `/etc/fstab` file:



Steps

1. Complete the following steps to record the failed storage volumes and their device names:
 - a. Select **Support > Tools > Grid Topology**.
 - b. Select **site > failed Storage Node > LDR > Storage > Overview > Main**, and look for object stores with alarms.

Object Stores

ID	Total	Available	Stored Data	Stored (%)	Health
0000	96.6 GB	96.6 GB	823 KB	0.001 %	Error
0001	107 GB	107 GB	0 B	0 %	No Errors
0002	107 GB	107 GB	0 B	0 %	No Errors

- c. Select **site > failed Storage Node > SSM > Resources > Overview > Main**. Determine the mount point and volume size of each failed storage volume identified in the previous step.

Object stores are numbered in hex notation. For example, 0000 is the first volume and 000F is the sixteenth volume. In the example, the object store with an ID of 0000 corresponds to `/var/local/rangedb/0` with device name `sdc` and a size of 107 GB.

Volumes

Mount Point	Device	Status	Size	Space Available	Total Entries	Entries Available	Write Cache
/	croot	Online	10.4 GB	4.17 GB	655,360	554,806	Unknown
/var/local	cvloc	Online	96.6 GB	96.1 GB	94,369,792	94,369,423	Unknown
/var/local/rangedb/0	sdc	Online	107 GB	107 GB	104,857,600	104,856,202	Enabled
/var/local/rangedb/1	sdd	Online	107 GB	107 GB	104,857,600	104,856,536	Enabled
/var/local/rangedb/2	sde	Online	107 GB	107 GB	104,857,600	104,856,536	Enabled

2. Log in to the failed Storage Node:
 - a. Enter the following command: `ssh admin@grid_node_IP`
 - b. Enter the password listed in the `Passwords.txt` file.

- c. Enter the following command to switch to root: `su -`
- d. Enter the password listed in the `Passwords.txt` file.

When you are logged in as root, the prompt changes from `$` to `#`.

3. Run the following script to stop the storage services and unmount a failed storage volume:

```
sn-unmount-volume object_store_ID
```

The `object_store_ID` is the ID of the failed storage volume. For example, specify `0` in the command for an object store with ID `0000`.

4. If prompted, press **y** to stop the storage services on the Storage Node.



If the storage services are already stopped, you are not prompted. The Cassandra service is stopped only for volume `0`.

```
root@Storage-180:~ # sn-unmount-volume 0
Storage services (ldr, chunk, dds, cassandra) are not down.
Storage services must be stopped before running this script.
Stop storage services [y/N]? y
Shutting down storage services.
Storage services stopped.
Unmounting /var/local/rangedb/0
/var/local/rangedb/0 is unmounted.
```

In a few seconds, the storage services are stopped and the volume is unmounted. Messages appear indicating each step of the process. The final message indicates that the volume is unmounted.

Recovering failed storage volumes and rebuilding the Cassandra database

You must run a script that reformats and remounts storage on failed storage volumes, and rebuilds the Cassandra database on the Storage Node if the system determines that it is necessary.

- You must have the `Passwords.txt` file.
- The system drives on the server must be intact.
- The cause of the failure must have been identified and, if necessary, replacement storage hardware must already have been acquired.
- The total size of the replacement storage must be the same as the original.
- You have checked that a Storage Node decommissioning is not in progress, or you have paused the node decommission procedure. (In the Grid Manager, select **Maintenance > Maintenance Tasks > Decommission.**)

- You have checked that an expansion is not in progress. (In the Grid Manager, select **Maintenance > Maintenance Tasks > Expansion.**)
- You have reviewed the warnings about storage volume recovery.

Reviewing warnings about storage volume recovery

1. As needed, replace failed physical or virtual storage associated with the failed storage volumes that you identified and unmounted earlier.

After you replace the storage, make sure you rescan or reboot to make sure that it is recognized by the operating system, but do not remount the volumes. The storage is remounted and added to `/etc/fstab` in a later step.

2. Log in to the failed Storage Node:
 - a. Enter the following command: `ssh admin@grid_node_IP`
 - b. Enter the password listed in the `Passwords.txt` file.
 - c. Enter the following command to switch to root: `su -`
 - d. Enter the password listed in the `Passwords.txt` file.

When you are logged in as root, the prompt changes from `$` to `#`.

1. Use a text editor (`vi` or `vim`) to delete failed volumes from the `/etc/fstab` file and then save the file.



Commenting out a failed volume in the `/etc/fstab` file is insufficient. The volume must be deleted from `fstab` as the recovery process verifies that all lines in the `fstab` file match the mounted file systems.

2. Reformat any failed storage volumes and rebuild the Cassandra database if it is necessary. Enter: `reformat_storage_block_devices.rb`
 - If storage services are running, you will be prompted to stop them. Enter: **y**
 - You will be prompted to rebuild the Cassandra database if it is necessary.
 - Review the warnings. If none of them apply, rebuild the Cassandra database. Enter: **y**
 - If more than one Storage Node is offline or if another Storage Node has been rebuilt in the last 15 days. Enter: **n**

The script will exit without rebuilding Cassandra. Contact technical support.

- For each rangedb drive on the Storage Node, when you are asked: Reformat the rangedb drive `<name>` (device `<major number>:<minor number>`)? `[y/n]`?, enter one of the following responses:
 - **y** to reformat a drive that had errors. This reformats the storage volume and adds the reformatted storage volume to the `/etc/fstab` file.
 - **n** if the drive contains no errors, and you do not want to reformat it.



Selecting **n** exits the script. Either mount the drive (if you think the data on the drive should be retained and the drive was unmounted in error) or remove the drive. Then, run the `reformat_storage_block_devices.rb` command again.



Some StorageGRID recovery procedures use Reaper to handle Cassandra repairs. Repairs occur automatically as soon as the related or required services have started. You might notice script output that mentions “reaper” or “Cassandra repair.” If you see an error message indicating the repair has failed, run the command indicated in the error message.

In the following example output, the drive `/dev/sdf` must be reformatted, and Cassandra did not need to be rebuilt:

```
root@DC1-S1:~ # reformat_storage_block_devices.rb
Storage services must be stopped before running this script.
Stop storage services [y/N]? **y**
Shutting down storage services.
Storage services stopped.
Formatting devices that are not in use...
Skipping in use device /dev/sdc
Skipping in use device /dev/sdd
Skipping in use device /dev/sde
Reformat the rangedb drive /dev/sdf (device 8:64)? [Y/n]? **y**
Successfully formatted /dev/sdf with UUID c817f87f-f989-4a21-
8f03-b6f42180063f
Skipping in use device /dev/sdg
All devices processed
Running: /usr/local/ldr/setup_rangedb.sh 12075630
Cassandra does not need rebuilding.
Starting services.

Reformatting done.  Now do manual steps to
restore copies of data.
```


Related information

[Reviewing warnings about storage volume recovery](#)

Restoring object data to a storage volume where the system drive is intact

After recovering a storage volume on a Storage Node where the system drive is intact, you can restore the object data that was lost when the storage volume failed.

What you'll need

- You must have confirmed that the recovered Storage Node has a Connection State of **Connected***  on the ***Nodes > Overview** tab in the Grid Manager.

About this task

Object data can be restored from other Storage Nodes, an Archive Node, or a Cloud Storage Pool, assuming that the grid's ILM rules were configured such that object copies are available.



If an ILM rule was configured to store only one replicated copy and that copy existed on a storage volume that failed, you will not be able to recover the object.



If the only remaining copy of an object is in a Cloud Storage Pool, StorageGRID must issue multiple requests to the Cloud Storage Pool endpoint to restore object data. Before performing this procedure, contact technical support for help in estimating the recovery time frame and the associated costs.



If the only remaining copy of an object is on an Archive Node, object data is retrieved from the Archive Node. Due to the latency associated with retrievals from external archival storage systems, restoring object data to a Storage Node from an Archive Node takes longer than restoring copies from other Storage Nodes.

To restore object data, you run the `repair-data` script. This script begins the process of restoring object data and works with ILM scanning to ensure that ILM rules are met. You use different options with the `repair-data` script, based on whether you are restoring replicated data or erasure coded data, as follows:

- **Replicated data:** Two commands are available for restoring replicated data, based on whether you need to repair the entire node or only certain volumes on the node:

```
repair-data start-replicated-node-repair
```

```
repair-data start-replicated-volume-repair
```

- **Erasure coded (EC) data:** Two commands are available for restoring erasure coded data, based on whether you need to repair the entire node or only certain volumes on the node:

```
repair-data start-ec-node-repair
```

```
repair-data start-ec-volume-repair
```

Repairs of erasure coded data can begin while some Storage Nodes are offline. Repair will complete after all nodes are available. You can track repairs of erasure coded data with this command:

```
repair-data show-ec-repair-status
```



The EC repair job temporarily reserves a large amount of storage. Storage alerts might be triggered, but will resolve when the repair is complete. If there is not enough storage for the reservation, the EC repair job will fail. Storage reservations are released when the EC repair job completes, whether the job failed or succeeded.

For more information on using the `repair-data` script, enter `repair-data --help` from the command line of the primary Admin Node.

Steps

1. Log in to the primary Admin Node:
 - a. Enter the following command: `ssh admin@primary_Admin_Node_IP`
 - b. Enter the password listed in the `Passwords.txt` file.
 - c. Enter the following command to switch to root: `su -`
 - d. Enter the password listed in the `Passwords.txt` file.

When you are logged in as root, the prompt changes from `$` to `#`.

2. Use the `/etc/hosts` file to find the hostname of the Storage Node for the restored storage volumes. To see a list of all nodes in the grid, enter the following: `cat /etc/hosts`
3. If all storage volumes have failed, repair the entire node. (If only some volumes have failed, go to the next step.)



You cannot run `repair-data` operations for more than one node at the same time. To recover multiple nodes, contact technical support.

- If your grid includes replicated data, use the `repair-data start-replicated-node-repair` command with the `--nodes` option to repair the entire Storage Node.

This command repairs the replicated data on a Storage Node named SG-DC-SN3:

```
repair-data start-replicated-node-repair --nodes SG-DC-SN3
```



As object data is restored, the **Objects Lost** alert is triggered if the StorageGRID system cannot locate replicated object data. Alerts might be triggered on Storage Nodes throughout the system. You should determine the cause of the loss and if recovery is possible. See the instructions for monitoring and troubleshooting StorageGRID.

- If your grid contains erasure coded data, use the `repair-data start-ec-node-repair` command with the `--nodes` option to repair the entire Storage Node.

This command repairs the erasure coded data on a Storage Node named SG-DC-SN3:

```
repair-data start-ec-node-repair --nodes SG-DC-SN3
```

The operation returns a unique `repair ID` that identifies this `repair_data` operation. Use this `repair ID` to track the progress and result of the `repair_data` operation. No other feedback is returned as the recovery process completes.



Repairs of erasure coded data can begin while some Storage Nodes are offline. Repair will complete after all nodes are available.

- If your grid has both replicated and erasure coded data, run both commands.

4. If only some of the volumes have failed, repair the affected volumes.

Enter the volume IDs in hexadecimal. For example, 0000 is the first volume and 000F is the sixteenth volume. You can specify one volume, a range of volumes, or multiple volumes that are not in a sequence.

All the volumes must be on the same Storage Node. If you need to restore volumes for more than one Storage Node, contact technical support.

- If your grid contains replicated data, use the `start-replicated-volume-repair` command with the `--nodes` option to identify the node. Then add either the `--volumes` or `--volume-range` option, as shown in the following examples.

Single volume: This command restores replicated data to volume 0002 on a Storage Node named SG-DC-SN3:

```
repair-data start-replicated-volume-repair --nodes SG-DC-SN3
--volumes 0002
```

Range of volumes: This command restores replicated data to all volumes in the range 0003 to 0009 on a Storage Node named SG-DC-SN3:

```
repair-data start-replicated-volume-repair --nodes SG-DC-SN3 --volume
-range 0003-0009
```

Multiple volumes not in a sequence: This command restores replicated data to volumes 0001, 0005, and 0008 on a Storage Node named SG-DC-SN3:

```
repair-data start-replicated-volume-repair --nodes SG-DC-SN3
--volumes 0001,0005,0008
```



As object data is restored, the **Objects Lost** alert is triggered if the StorageGRID system cannot locate replicated object data. Alerts might be triggered on Storage Nodes throughout the system. You should determine the cause of the loss and if recovery is possible. See the instructions for monitoring and troubleshooting StorageGRID.

- If your grid contains erasure coded data, use the `start-ec-volume-repair` command with the `--nodes` option to identify the node. Then add either the `--volumes` or `--volume-range` option, as shown in the following examples.

Single volume: This command restores erasure coded data to volume 0007 on a Storage Node named SG-DC-SN3:

```
repair-data start-ec-volume-repair --nodes SG-DC-SN3 --volumes 0007
```

Range of volumes: This command restores erasure coded data to all volumes in the range 0004 to 0006 on a Storage Node named SG-DC-SN3:

```
repair-data start-ec-volume-repair --nodes SG-DC-SN3 --volume-range
0004-0006
```

Multiple volumes not in a sequence: This command restores erasure coded data to volumes 000A, 000C, and 000E on a Storage Node named SG-DC-SN3:

```
repair-data start-ec-volume-repair --nodes SG-DC-SN3 --volumes
000A,000C,000E
```

The `repair-data` operation returns a unique `repair ID` that identifies this `repair_data` operation. Use this `repair ID` to track the progress and result of the `repair_data` operation. No other feedback is returned as the recovery process completes.



Repairs of erasure coded data can begin while some Storage Nodes are offline. Repair will complete after all nodes are available.

- If your grid has both replicated and erasure coded data, run both commands.

5. Monitor the repair of replicated data.

- Select **Nodes > Storage Node being repaired > ILM**.
- Use the attributes in the Evaluation section to determine if repairs are complete.

When repairs are complete, the Awaiting - All attribute indicates 0 objects.

- To monitor the repair in more detail, select **Support > Tools > Grid Topology**.
- Select **grid > Storage Node being repaired > LDR > Data Store**.
- Use a combination of the following attributes to determine, as well as possible, if replicated repairs are complete.



Cassandra inconsistencies might be present, and failed repairs are not tracked.

- **Repairs Attempted (XRPA):** Use this attribute to track the progress of replicated repairs. This attribute increases each time a Storage Node tries to repair a high-risk object. When this attribute does not increase for a period longer than the current scan period (provided by the **Scan Period — Estimated** attribute), it means that ILM scanning found no high-risk objects that need to be repaired on any nodes.



High-risk objects are objects that are at risk of being completely lost. This does not include objects that do not satisfy their ILM configuration.

- **Scan Period — Estimated (XSCM):** Use this attribute to estimate when a policy change will be applied to previously ingested objects. If the **Repairs Attempted** attribute does not increase for a period longer than the current scan period, it is probable that replicated repairs are done. Note that the scan period can change. The **Scan Period — Estimated (XSCM)** attribute applies to the entire grid and is the maximum of all node scan periods. You can query the **Scan Period — Estimated** attribute history for the grid to determine an appropriate time frame.

6. Monitor the repair of erasure coded data, and retry any requests that might have failed.

a. Determine the status of erasure coded data repairs:

- Use this command to see the status of a specific repair-data operation:

```
repair-data show-ec-repair-status --repair-id repair ID
```

- Use this command to list all repairs:

```
repair-data show-ec-repair-status
```

The output lists information, including repair ID, for all previously and currently running repairs.

```
root@DC1-ADM1:~ # repair-data show-ec-repair-status

Repair ID Scope  Start Time  End Time  State  Est Bytes
Affected/Repaired Retry Repair
=====
=====
949283 DC1-S-99-10 (Volumes: 1,2) 2016-11-30T15:27:06.9 Success
17359 17359 No
949292 DC1-S-99-10 (Volumes: 1,2) 2016-11-30T15:37:06.9 Failure
17359 0 Yes
949294 DC1-S-99-10 (Volumes: 1,2) 2016-11-30T15:47:06.9 Failure
17359 0 Yes
949299 DC1-S-99-10 (Volumes: 1,2) 2016-11-30T15:57:06.9 Failure
17359 0 Yes
```

b. If the output shows that the repair operation failed, use the --repair-id option to retry the repair.

This command retries a failed node repair, using the repair ID 83930030303133434:

```
repair-data start-ec-node-repair --repair-id 83930030303133434
```

This command retries a failed volume repair, using the repair ID 83930030303133434:

```
repair-data start-ec-volume-repair --repair-id 83930030303133434
```

Related information

[Administer StorageGRID](#)

[Monitor & troubleshoot](#)

Checking the storage state after recovering storage volumes

After recovering storage volumes, you must verify that the desired state of the Storage Node is set to online and ensure that the state will be online by default whenever the Storage Node server is restarted.

What you'll need

- You must be signed in to the Grid Manager using a supported browser.
- The Storage Node has been recovered, and data recovery is complete.

Steps

1. Select **Support > Tools > Grid Topology**.
2. Check the values of **Recovered Storage Node > LDR > Storage > Storage State — Desired** and **Storage State — Current**.

The value of both attributes should be Online.

3. If the Storage State — Desired is set to Read-only, complete the following steps:
 - a. Click the **Configuration** tab.
 - b. From the **Storage State — Desired** drop-down list, select **Online**.
 - c. Click **Apply Changes**.
 - d. Click the **Overview** tab and confirm that the values of **Storage State — Desired** and **Storage State — Current** are updated to Online.

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