Consistency Groups management

ONTAP 9

NetApp
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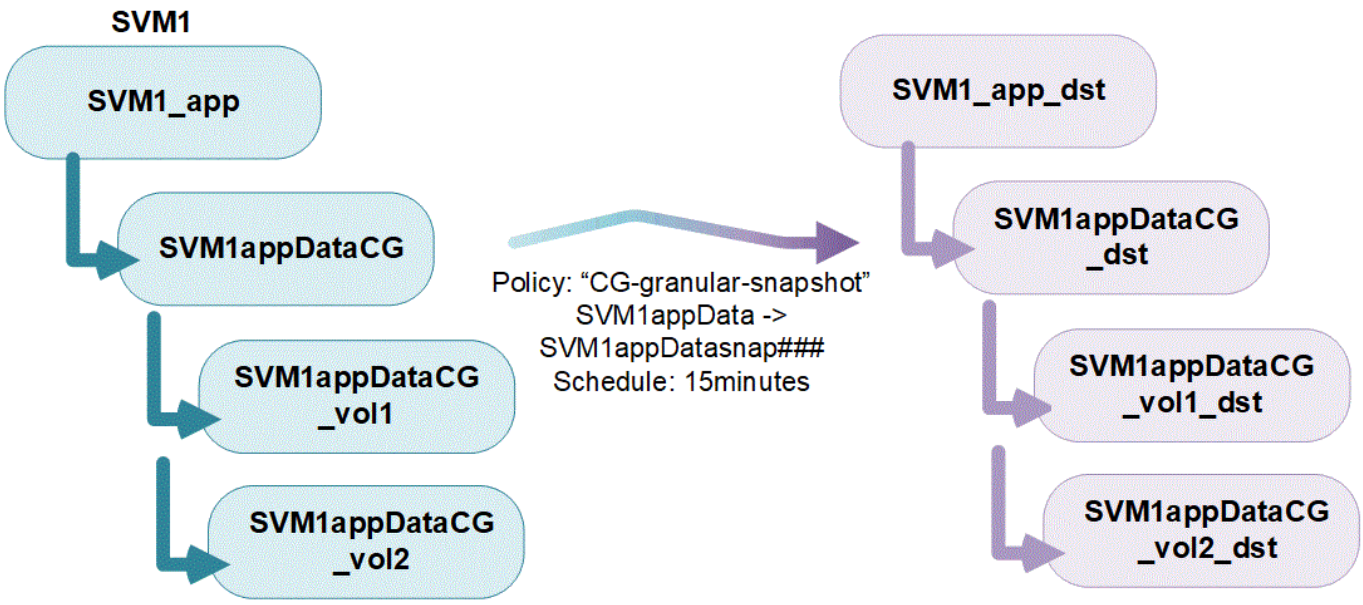
Consistency groups overview

A consistency group is a collection of volumes that provides a write-order consistency guarantee for an application workload spanning multiple volumes.

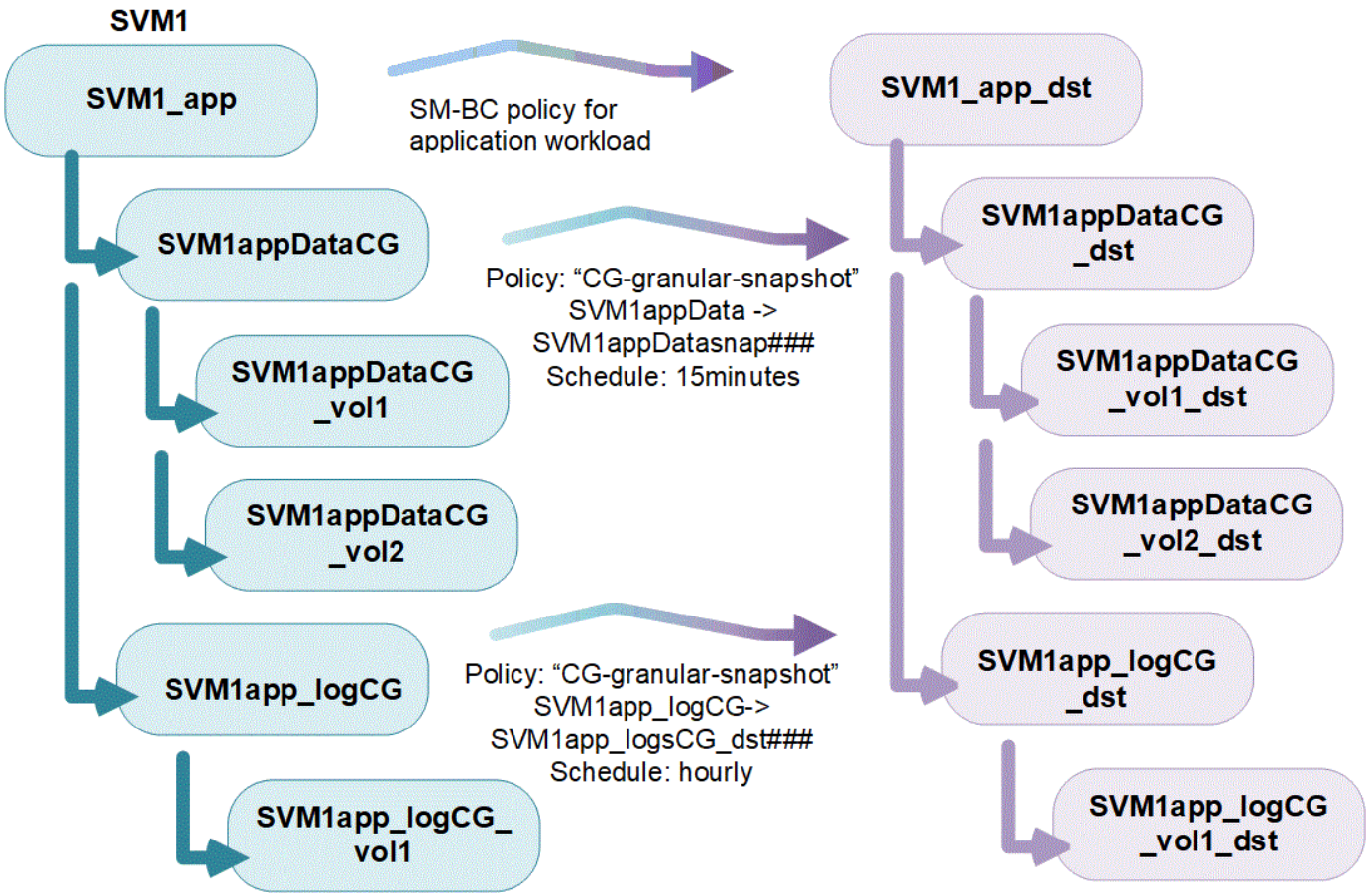
Consistency groups facilitate application workload management, providing easy management of local and remote protection policies and providing simultaneous crash-consistent or application-consistent Snapshot copies of a collection of volumes at a point in time. Snapshots in consistency groups enable an entire application workload to be restored.

Consistency groups support any FlexVol volume regardless of protocol (NAS, SAN, or NVMe) and can be managed through the ONTAP REST API or in System Manager under the **Storage > Consistency Groups** menu item.

Consistency groups can exist as individual entities or in a hierarchical relationship. An individual consistency group is a collection of volumes. Volumes can have their own volume-granular snapshot policy. In addition, the consistency group the volume is associated with can have its own snapshot policy. The consistency group can only have one SM-BC relationship and shared SM-BC policy, which can be used to recover the entire consistency group.



Larger application workloads might require multiple consistency groups. In these situations, multiple consistency groups can be placed together in a hierarchical relationship. In this configuration, single consistency groups become the child components of a parent consistency group. The parent consistency group can include up to five child consistency groups. Like in individual consistency groups, a remote SM-BC protection policy can be applied to the entire configuration of consistency groups (parent and children) to recover the application workload.



Beginning with ONTAP 9.12.1, consistency groups support cloning and modifying the members of the consistency by adding or removing volumes in both System Manager and the ONTAP REST API. Beginning in ONTAP 9.12.1, the ONTAP REST API also supports:

- Creating a consistency group with new NFS or SMB volumes or NVMe namespaces.
- Adding new or existing NFS or SMB volumes or NVMe namespaces to an existing consistency group.

For more information about the ONTAP REST API, refer to ONTAP REST API reference documentation.

Protection

Consistency groups offer local protection through Snapshot policies and remote protection through SnapMirror Business Continuity (SM-BC). Creating a consistency group does not automatically enable protection. Local and/or remote protection policies can be set when creating or after creating a consistency group.

To configure local protection with consistency groups, see Protect a consistency group. Beginning in ONTAP 9.11.1, consistency groups offer two-phase consistency group snapshot creation.

In order to utilize remote protection, you must meet the requirements for SnapMirror Business Continuity deployments.

SM-BC relationships cannot be established on volumes mounted for NAS access.

Application and component tags

Beginning in ONTAP 9.12.1, consistency groups support component and application tagging. Application and component tags are a management tool, enabling you to filter and identify different workloads in your consistency groups.

Application tags apply to individual and parent consistency groups. Application tags provide labeling for workloads such as MongoDB, Oracle, or SQL Server. The default application tag for consistency groups is Other. Children in hierarchal consistency groups have component tags instead of application tags. The options for component tags are "data", "logs", or "other". The default value is Other.

You can apply tags when creating a consistency group or after the consistency group has been created. If the consistency group has an SM-BC relationship, you must use **Other** as the application or component tag.

Consistency groups in MetroCluster configurations

Beginning with ONTAP 9.11.1, you can provision consistency groups with new volumes on a cluster within a MetroCluster configuration. These volumes are provisioned on mirrored aggregates.

After they are provisioned, you can move volumes associated with consistency groups between mirrored and unmirrored aggregates. Therefore, they can be located on mirrored aggregates, unmirrored aggregates, or both. You can modify mirrored aggregates containing volumes associated with consistency groups to become unmirrored. Similarly, you can modify unmirrored aggregates containing volumes associated with consistency groups to enable mirroring.

Volumes associated with consistency groups placed on mirrored aggregates and their Snapshots, including any consistency group Snapshots, are replicated to the remote site (site B). The contents of the volumes on site B are consistency group semantics-compliant. You can access replicated consistency group Snapshots using consistency group Snapshot REST API and System Manager on clusters running ONTAP 9.11.1 or later.

If some or all of the volumes associated with a consistency group are located on unmirrored aggregates that are not currently accessible, GET or DELETE operations on the consistency group behave as if the local volumes or hosting aggregates are offline.

Consistency group configuration replication

If site B is running ONTAP 9.10.1 or earlier, only the volumes associated with the consistency groups located on mirrored aggregates are replicated to site B. The consistency group configurations are only replicated to site B, if both sites are running ONTAP 9.11.1 or later.After site B is upgraded to ONTAP 9.11.1, data for consistency groups on site A that have all their associated volumes placed on mirrored aggregates are replicated to site B.

Upgrade considerations

Consistency groups created with SM-BC in ONTAP 9.8 and 9.9.1 will automatically be upgraded and become manageable under **Storage > Consistency Groups** in System Manager or the ONTAP REST API when upgrading to ONTAP 9.10.1. For more information about upgrading, see SM-BC upgrade and revert considerations.

Consistency group snapshots created with the ONTAP REST API can be managed through System Manager's Consistency Group interface and through consistency group API endpoints.

Snapshots created with the ONTAPI commands `cg-start` and `cg-commit` will not be recognized as consistency group Snapshots and thus cannot be managed through System Manager's Consistency Group

interface or the consistency group endpoints in the ONTAP API.

Learn more about consistency groups

Consistency group limits

When planning and managing your consistency groups, account for object limits at the scope of both the cluster and the parent or child consistency group.

Consistency Groups	Scope	Minimum	Maximum
Number of consistency groups	Cluster	0	Same as maximum volume count in cluster
Number of parent consistency groups	Cluster	0	Same as maximum volume count in cluster
Number of individual and parent consistency groups	Cluster	0	Same as maximum volume count in cluster
Consistency group	Same as maximum volume count in cluster	1	80
Number of volumes in the child of a parent consistency group	Parent consistency group	1	80
Number of volumes in a child consistency group	Child consistency group	1	80

Number of child consistency groups in a parent consistency group	Parent consistency group	1	5

If you are using SM-BC, refer to SM-BC restrictions and limitations for limits.

Configure a single consistency group

Consistency groups can be created with existing volumes or with new volumes. Once a volume is associated with a consistency group, it cannot be added with another consistency group.

In ONTAP 9.10.1 through 9.11.1, you cannot add or remove volumes from a consistency group once it has been created. Beginning in ONTAP 9.12.1, you can add or remove *existing* volumes to a consistency group after it has been created. For more information on this process, refer to Modify a consistency group.

Create a consistency group with new volumes

Steps

1. Select **Storage > Consistency groups**.
2. Select **+Add.** then **Using New LUNs**.
3. Name the consistency group. Designate the number of LUNs and capacity per LUN.
    a. **Application Type**: If you are using ONTAP 9.12.1 or later, select an application type. If no value is selected, the consistency group will be assigned the type of **Other** by default. Learn more about tagging consistency in Application and component tags. If you plan to create an SM-BC relationship, you must use **Other**.
4. Select the host operating system and LUN format. Enter the host initiator information.
5. To configure protection policies, add a child consistency group, or show more options about host initiators, select **More options**
6. Select **Save**.
7. Confirm your consistency group has been created by returning to the main consistency group menu where it will appear once the ONTAP job completes. If you set a protection policy, look under the appropriate policy, remote or local, which should display a green shield with a checkmark.

Create a consistency group with existing volumes

Steps

1. Select **Storage > Consistency groups**.
2. Select **+Add.** then **Using existing volumes**.
3. Name the consistency group and select the storage VM.
    a. **Application Type**: If you are using ONTAP 9.12.1 or later, select an application type. If no value is selected, the consistency group will be assigned the type of **Other** by default. Learn more about tagging consistency in Application and component tags. If the consistency group has an SM-BC relationship, you must use **Other**.
4. Select the existing volumes to include. Only volumes that are not already part of a consistency group will be available for selection.

If creating a consistency group with existing volumes, the consistency group supports FlexVol volumes. Volumes with Asynchronous or Synchronous SnapMirror relationships can be added to consistency groups, but they are not consistency group-aware. Consistency groups do not support S3 buckets, MetroCluster, or storage VMs with SVMDR relationships.

5. Select **Save**.
6. Confirm your consistency group has been created by returning to the main consistency group menu where it will appear once the ONTAP job completes. If you have chosen a protection policy, confirm it was properly set by selecting your consistency group from the menu. If you set a protection policy, look under the appropriate policy, remote or local, which should display a green shield with a checkmark.

Next steps

- Protect a consistency group
- Modify a consistency group
- Clone a consistency group

Configure a hierarchical consistency group

If your application workload consists of more than one subset of volumes, where each subset is consistent across its own associated volumes, ONTAP allows you to create a hierarchical consistency group.

Hierarchical consistency groups have a parent that can include up to five individual consistency groups. Hierarchical consistency groups can support different local Snapshot policies across consistency groups or individual volumes. If you use a remote SM-BC policy, that will apply for the entire hierarchical consistency group (parent and children).

For object limits on consistency groups, see Object limits for consistency groups.

Create a hierarchical consistency group with new volumes

Steps

1. Select **Storage > Consistency groups**.
2. Select **+Add.** then **Using New LUNs**.
3. Name the consistency group. Designate the number of LUNs and capacity per LUN.
    a. **Application Type**: If you are using ONTAP 9.12.1 or later, select an application type. If no value is selected, the consistency group will be assigned the type of **Other** by default. Learn more about tagging consistency in Application and component tags. If you plan to create an SM-BC relationship, you must use **Other**.
4. Select the host operating system and LUN format. Enter the host initiator information.
5. To configure protection policies, add a child consistency group, or show more options about host initiators, select **More options**.
6. To add a child consistency group, select **+Add child consistency group**.
7. Select the performance level, the number of LUNs, and capacity per LUN. Designate the host operating system, LUN format, and select a new or existing host initiator group.
8. **Optional**: select a local snapshot policy.

9. Repeat for up to five child consistency groups.
10. Select **Save**.
11. Confirm your consistency group has been created by returning to the main consistency group menu where it will appear once the ONTAP job completes. If you set a protection policy, look under the appropriate policy, remote or local, which should display a green shield with a checkmark in it.

Create a hierarchical consistency group with existing volumes

Steps

1. Select **Storage > Consistency groups**.
2. Select **+Add.** then **Using existing volumes**.
3. Select the storage VM.
4. Select the existing volumes to include. Only volumes that are not already part of a consistency group will be available for selection.
5. To add a child consistency group, select **+Add Child Consistency Group**. Create the necessary consistency groups, which will be named automatically.
    a. **Component Type**: If you are using ONTAP 9.12.1 or later, select a component type of "data", "logs", or "other". If no value is selected, the consistency group will be assigned the type of **Other** by default. Learn more about tagging consistency in Application and component tags. If you plan to create an SM-BC relationship, you must use **Other**.
6. Assign existing volumes to each consistency group.
    a. **Optional**: select a local Snapshot policy.
7. Repeat for up to five child consistency groups.
8. Select **Save**.
9. Confirm your consistency group has been created by returning to the main consistency group menu where it will appear once the ONTAP job completes. If you have chosen a protection policy, confirm it was properly set by selecting your consistency group from the menu. If you set a protection policy, look under the appropriate policy, remote or local, which should display a green shield with a checkmark in it.

Protect a consistency group

Consistency groups offer easily managed local and remote protection for SAN, NAS, and NVMe applications that span multiple volumes.

Creating a consistency group does not automatically enable protection. Local and/or remote protection policies can be set at the time of creation or after creating your consistency group. Protection policies can include local Snapshot copies or remote SnapMirror protection with SnapMirror Business Continuity (SM-BC). If you are utilizing nested consistency groups, you can set different protection policies for individual volumes. Beginning in ONTAP 9.11.1, consistency groups offer two-phase consistency group Snapshot creation.

If you are utilizing remote SM-BC protection, to ensure Snapshot copies of consistency groups created on your consistency group are copied to the destination, the policy labels in the source and destination cluster must match. SM-BC will not replicate Snapshot copies by default unless a rule with a SnapMirror label is added to the predefined AutomatedFailOver policy and the Snapshot copies are created with that label. To learn more about this process, refer to Configure protection for business continuity.

Recovery can occur for an entire consistency group, a single consistency group in a hierarchical configuration,

or for individual volumes within the consistency group. Recovery can be achieved by selecting the consistency group you want to recover from, selecting the Snapshot copy type, and then identifying the particular Snapshot copy to base the restoration on. For more information about this process, see Restore a volume from an earlier Snapshot copy.

Beginning with ONTAP 9.10.1, System Manager visualizes LUN maps under the **Protection > Relationships** menu. When you select a source relationship, System Manager displays a visualization of the source relationships. By selecting a volume, you can delve deeper into these relationships to see a list of the contained LUNs and the initiator group relationships. This information can be downloaded as an Excel workbook from the individual volume view. The task will run in the background.

Set a local Snapshot protection policy

Steps

1. Select the consistency group you have created from the Consistency group menu.
2. At the top right of the overview page for the consistency group, select **Edit**.
3. Check the box next to **Schedule Snapshot copies (local)**.
4. Select a Snapshot policy. To configure a new, custom policy, refer to Create a custom data protection policy.
5. Select **Save**.
6. Return to the consistency group overview menu. In the left column under **Snapshot Copies (Local)**, the status should say protected next to  .

Two-phase CG Snapshot creation

Beginning in ONTAP 9.11.1, consistency groups support two-phase commits for consistency group (CG) Snapshot creation. This feature is only available with the ONTAP REST API. Two-phase CG Snapshot creation is only available for Snapshot creation, not provisioning consistency groups or restoring consistency groups.

A two-phase CG Snapshot creation breaks the Snapshot creation process invoked with a POST request to the `/application/consistency-groups/{consistency_group_uuid}/snapshots` endpoint into a sequence of two phases. In the first phase initiated with a POST request, the API executes prechecks, triggers Snapshot creation, and starts a timer for designated interval. If the POST request in phase one completes with a 201 status code, you can invoke the second phase within the designated interval from the first phase, committing the Snapshot to the appropriate endpoint.

To use two-phase CG Snapshot creation, all nodes in the cluster must be running ONTAP 9.11.1. The two-phase CG Snapshot creation can be invoked with the `action=start` parameter. You can additionally use the `action_timeout` parameter that specifies the maximum number of seconds that the Snapshot creation process can take. The `action_timeout` parameter can be set equal to an integer between 5 and 120. The default value of `action_timeout` is 7.

Only one active invocation of a consistency group Snapshot creation operation is supported on a consistency group instance at a time, whether it be a one-phase or two-phase. Attempting to invoke a Snapshot creation while another one is in progress will result in a failure.

For more information about the ONTAP REST API, refer to the API reference or visit the ONTAP REST API page at the NetApp Developer Network for a complete list of API endpoints.

Create a two-phase commit

1. Invoke the Snapshot creation with a POST request to the consistency group endpoint using the

`action=start` parameter.

```
curl -k -X POST 'https://<IP_address>/application/consistency-
groups/<cg-uuid>/snapshots?action=start&action_timeout=7' -H "accept:
application/hal+json" -H "content-type: application/json" -d '
{
  "name": "<snapshot_name>",
  "consistency_type": "crash",
  "comment": "<comment>",
  "snapmirror_label": "<SnapMirror_label>"
}'
```

2. If the POST request succeeds, your output will include a snapshot uuid. Using that information, submit a PATCH request to commit the Snapshot.

```
curl -k -X PATCH 'https://<IP_address>/application/consistency-
groups/<cg_uuid>/snapshots/<snapshot_id>?action=commit' -H "accept:
application/hal+json" -H "content-type: application/json"
```

Set a remote SM-BC policy

Steps

1. Ensure you have met the prerequisites for using SM-BC. See SM-BC prerequisites

SM-BC relationships cannot be established on volumes mounted for NAS access.

1. Select the consistency group you have created from the Consistency group menu.
2. At the top right of the overview page, select **More** then **Protect**.
3. The source-side information should be autofilled on the left-hand side of the page.
4. Select the appropriate cluster and storage VM for the destination. Select a protection policy. Ensure that **Initialize relationship** is checked.
5. Click **Save**.
6. The consistency group will have to initialize and synchronize. When this is complete, under **SnapMirror (Remote)** the status should say “Protected” next to .

For more information about SM-BC, see SM-BC Overview.

Next Steps

Clone a consistency group
Configure Snapshot copies
Create custom data protection policies
Recover from Snapshot copies
Restore a volume from an earlier Snapshot copy
SM-BC Overview

Modify a consistency group

Beginning in ONTAP 9.12.1, you modify a consistency group in System Manager by removing volumes or adding existing volumes (expanding the consistency group). The expand and remove functionalities allow you to modify the constituent members of a consistency group and to combine new volumes with existing volumes.

Add volumes to a consistency group

When expanding a consistency group, Snapshot copies of the consistency group captured before the expand operation will be considered partial.

Considerations

- When expanding a consistency group, you cannot add volumes associated with another consistency group.
- Consistency groups support NAS, SAN, and NVMe protocols. For more information about consistency groups, refer to the Consistency groups overview.
- You can add up to 16 volumes at a time to a consistency group, provided that adjustments are within the overall consistency group object limits.
- You cannot add volumes to a consistency group in a SnapMirror Business Continuity (SM-BC) relationship. You must first break the SM-BC relationship to modify the consistency group.
- The ONTAP REST API supports adding *new* or existing volumes to a consistency group. For more information about the ONTAP REST API, refer to [ONTAP REST API reference documentation](https://docs.netapp.com/us-en/ontap-automation/reference/api_reference.html#access-a-copy-of-the-ontap-rest-api-reference-documentation).
- If you are using ONTAP 9.10.1 through 9.11.1, you cannot modify a consistency group. To change the configuration of a consistency group in ONTAP 9.10.1 or 9.11.1, you must delete the consistency group and create a new consistency group with the desire member volumes.

Steps

1. Go to the **Consistency Group** tab in System Manager. Select the consistency group that you want to modify to view the volumes associated with that consistency group.
2. If you are modifying a single consistency group, at the top of the **Volumes** menu, select **More** and then **Expand** to add a volume.

   If you are modifying a child consistency group, identify the parent consistency group you want to modify. Select the **>** button to view the child consistency groups, then select ⋮ next to the name of the child consistency group you want to modify. From that menu, select **Expand**.
3. Select the volume(s) you want to add to the consistency group. You can add up to 16 volumes at a time.
4. Select **Save**. When the operation completes, you can view the newly added volume(s) in the consistency group's **Volumes** menu.

Remove volumes from a consistency group

Volumes removed from a consistency group will no longer exist in the consistency group, but will not be deleted; they will still exist in the cluster.

Considerations

- You cannot remove volumes from a consistency group in a SnapMirror Business Continuity (SM-BC) relationship. You must first break the SM-BC relationship to modify the consistency group.
- If a consistency group has no volumes in it following the remove operation, the consistency group will be deleted.
- When a volume is removed from a consistency group, existing Snapshots of the consistency group remain but are invalid and cannot be used to restore the contents of the consistency group. Volume-granular Snapshots remain valid.
- If you delete a volume from the cluster, it is automatically removed from the consistency group.
- If you are using ONTAP 9.10.1 or 9.11.1, you can only remove volumes from a consistency group by deleting the volume from the cluster. To change the configuration of a consistency group in ONTAP 9.10.1 or 9.11.1, you must delete the consistency group and create a new consistency group with the desire member volumes.

Steps

1. Go to the **Consistency Group** tab in System Manager. Select the single or child consistency group that you want to modify.
2. In the **Volumes** menu, select the checkboxes next to the individual volume(s) you want to remove from the consistency group.
3. Select **Remove volumes from the consistency group**.
4. Confirm that you understand removing the volumes will cause all Snapshot copies of the consistency group to become invalid and select **Remove**.

Clone a consistency group

Beginning in ONTAP 9.12.1, you can clone a consistency group to create a copy of a consistency group and its contents. Cloning a consistency group creates a copy of the consistency group configuration, its metadata such as application type, and all the volumes and its contents such as files, directories, LUNs or NVMe namespaces.

When cloning a consistency group, you can clone it with its current configuration, but with volume contents as they are or based on an existing consistency group Snapshot.

Cloning a consistency group is only supported for the entire consistency group. You cannot clone an individual child consistency group in a hierarchical relationship: only the complete consistency group configuration can be cloned.

When you clone a consistency group, the following components are not cloned:

- iGroups
- LUN maps
- NVMe subsystems
- NVMe namespace subsystem maps

When you clone a consistency group, ONTAP will not create SMB shares for the cloned volumes if a share name is not specified. Cloned consistency groups will not be mounted if a junction path is not specified. If you attempt to clone a consistency group based on a Snapshot that does not reflect the consistency group's current configuration, the operation will fail.

After you clone a consistency group, you will need to perform the appropriate mapping operation. Refer to Map igroups to multiple LUNs or Map an NVMe namespace to a subsystem for more information.

Cloning a consistency group is not supported for a consistency group in a SnapMirror Business Continuity relationship or with any associated DP volumes.

Steps

1. Select the consistency group you want to clone from the **Consistency Group** menu.
2. At the top right of the overview page for the consistency group, select **Clone**.
3. Enter a name for the new, cloned consistency group or accept the default name.
   a. Choose if you want to enable **Thin Provisioning**.
   b. Choose **Split Clone** if you want to dissociate the consistency group from its source and allocate additional disk space for the cloned consistency group.
4. To clone the consistency group in its current state, choose **Add a new Snapshot copy**.

   To clone the consistency group based on a snapshot, choose **Use an existing Snapshot copy**. Selecting this option will open a new sub-menu. Choose the Snapshot that you want to use as the basis for the clone operation.

5. Select **Clone**.
6. Return to the **Consistency Group** menu to confirm your consistency group has been cloned.

Delete a consistency group

If you decide that you no longer need a consistency group, it can be deleted.

Deleting a consistency group deletes the instance of the consistency group and does **not** impact the constituent volumes or LUNs. Deleting a consistency group does not result in deletion of the Snapshots present on each volume, but they will no longer be accessible as consistency group Snapshots. They can, however, continue to be managed as ordinary volume granular snapshots.

Consistency groups will be deleted if all of the volumes in the consistency group are deleted.

If you are using a version of ONTAP between 9.10.1 to 9.12.0, volumes can only be removed from a consistency group if the volume itself is deleted, in which case the volume is automatically removed from the consistency group. Beginning in ONTAP 9.12.1, you remove volumes from a consistency group without deleting them. For more information on this process, refer to Modify a consistency group.

Steps

1. In the consistency group menu under **Storage > Consistency groups**, select the consistency group you would like to delete.
2. Next to the name of the consistency group, select ⋮ and then **Delete**.

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