Administer and monitor

Amazon FSx for NetApp ONTAP

NetApp
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Monitor storage operations with Tracker in NetApp Workload Factory

Monitor and track the execution of FSx for ONTAP, credentials, and link operations and monitor task progress with Tracker in NetApp Workload Factory.

About this task

Workload factory provides Tracker, a monitoring feature, so you can monitor and track the progress and status of FSx for ONTAP, credentials, and link operations, review details for operation tasks and subtasks, and diagnose any issues or failures.

Several actions are available in Tracker. You can filter jobs by time frame (last 24 hours, 7 days, 14 days, or 30 days), workload, status, and user; find jobs using the search function; and download the jobs table as a CSV file. You can refresh Tracker at any time. And you can quickly retry a failed operation or edit parameters for a failed operation and try the operation again.

Tracker supports two levels of monitoring depending on the operation. Each task, such as file system deployment, displays the task description, status, start time, task duration, user, region, proxy resource, task ID, and all related sub tasks. You can view API responses to understand what happened during the operation.

Tracker task levels with examples

- Level 1 (task): Tracks file system deployment.
- Level 2 (sub task): Tracks the sub tasks related to the file system deployment.

Operation status

Operation status in Tracker is as follows *in progress*, *success*, and *failed*.

Operation frequency

Operation frequency is based on the job type and the job schedule.

Events retention

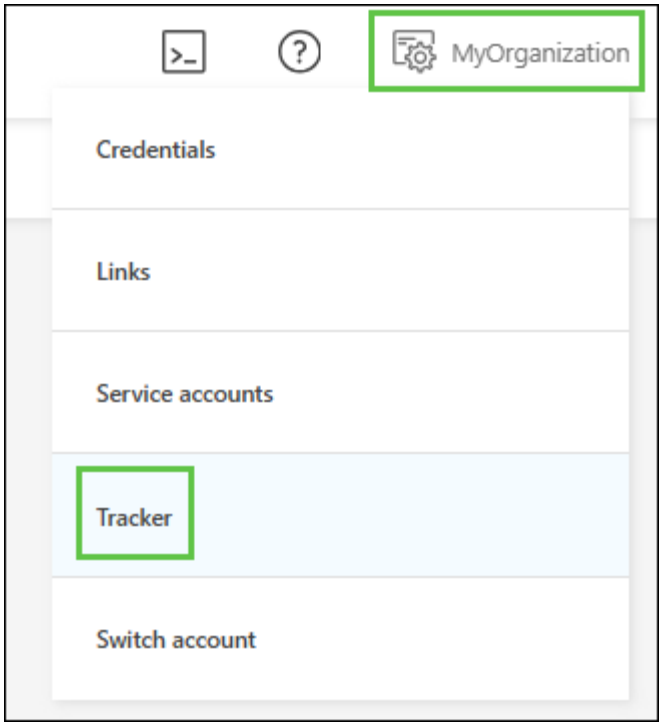
Events are retained in the user interface for 30 days.

Track and monitor operations

Track and monitor operations in the NetApp Console with Tracker.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Administration** and then **Links**.



4. In the Tracker tab, use the filters or search to narrow job results. You can also download a jobs report.

View API request

View the API request in the Codebox for a task in Tracker.

Steps

1. In Tracker, select a task.
2. Select the actions menu and then select **View API request**.

Retry a failed operation

Retry a failed operation in Tracker. You can also copy the error message of a failed operation.

Only x number of retries are allowed for a failed operation.

Steps

1. In Tracker, select a failed operation.
2. Select the actions menu and then select **Retry**.

Result

The operation is re-initiated.

Edit and retry a failed operation

Edit the parameters of the failed operation and retry the operation outside Tracker.

Steps

1. In Tracker, select a failed operation.

2. Select the actions menu and then select **Edit and retry**.

   You are redirected to the operation page where you can edit the parameters and retry the operation.

Result

The operation is re-initiated. Go to Tracker to view the status of the operation.

Implement file system best practices

Configuration analysis for FSx for ONTAP file systems

NetApp Workload Factory analyzes Amazon FSx for NetApp ONTAP file system configurations regularly to determine if any there are any issues. When issues are found, Workload Factory shows you what the issues are and explains what needs to change to ensure your file system storage achieves peak performance, cost efficiency, and compliance with best practices.

Key capabilities include:

- Daily configuration analysis
- Automatic best practice validations
- Proactive observability
- Insights to action
- AWS Well-Architected Framework advisor

Well-architected status

In the Workload Factory console at the file-system level, well-architected status is listed for all FSx for ONTAP file systems. Well-architected statuses are categorized as "issues", "not analyzed", or "well-architected". Selecting the well-architected status redirects you to the well-architected status tab within the file system where you can find the well-architected score, configuration categories, all configurations for the file system.

Well-architected score

The score includes all currently analyzed configurations and appears as a percentage. A 25% score means that 25% of the file system configurations are well-architected.

Configuration categories

The file system configurations are organized into categories aligned with the following five pillars of the AWS Well-Architected Framework.

- *Reliability*: Ensures that workloads perform their intended functions correctly and consistently, even when there are disruptions. An example configuration is FSx for ONTAP backups.
- *Security*: Emphasizes protecting data, systems, and assets through risk assessments and mitigation strategies.
- *Operational excellence*: Focuses on delivering the most optimal architecture and business value.
- *Cost optimization*: Aims to deliver business value while minimizing costs.
- *Performance efficiency*: Focuses on using resources efficiently to meet system requirements and to maintain optimal performance as demands change.

Analysis requirements

For a complete file system analysis, you must do the following:

- Associate a link. Link connectivity lets Workload Factory analyze all file system configurations like data protection and performance.

  Learn how to associate an existing link or to create and associate a new link.

- Grant *view, planning, and analysis* permissions in your AWS account.

  Learn how to grant permissions to an AWS account

What's next

Implement well-architected file system configurations

Implement well-architected file system configurations

Using configuration analysis insights and recommendations, leverage Workload Factory to implement best practices for your FSx for ONTAP file systems. You can easily review the well-architected status, learn about issues with your configurations, take action to improve the architecture of any systems that aren't optimized for reliability, security, efficiency, performance, and cost.

You can also dismiss the analysis of specific storage configurations that don't apply to your storage environment to avoid unnecessary alerts and inaccurate optimization results.

Learn about the configuration analysis and well-architected status in Workload Factory.

About this task

Workload factory analyzes Amazon FSx for NetApp ONTAP file system deployment configurations daily. The daily analysis provides the well-architected status, and insights and recommendations with options to automatically fix configuration issues so that your file system meets best practices.

Link connectivity allows Workload Factory to scan for issues with performance, data protection, and configurations. Connect to an FSx for ONTAP file system using a link for the most comprehensive analysis of your file system resources.

You have options to review the recommendations for configuration issues with your file systems and fix the issues from the Storage within the Workload Factory console.

Because requirements for storage configurations vary, you can dismiss the analysis of specific configurations that don't apply to your storage environment. This helps you avoid unnecessary alerts and inaccurate optimization results. When a specific configuration analysis is dismissed, the configuration isn't included in the total optimization score.

What is analyzed

Workload factory analyzes the well-architected status of the following configurations for FSx for ONTAP file systems:

- Reliability: SSD capacity threshold, scheduled local snapshots, FSx for ONTAP backups, remote data replication, and data reliability for long-term retention

- Security: NetApp Autonomous Ransomware Protection with AI (ARP/AI) disabled and unauthorized access to volumes
- Operational excellence: automatic capacity management, volume file capacity utilization threshold, volume utilization nearing full, cache relationship write mode, optimize cache volume size, and volume logical capacity reporting
- Cost optimization: storage efficiencies, data tiering, unnecessary snapshot and backup deletion, and orphaned block devices

Before you begin

- You must grant *operations and remediation* permissions in your AWS account.
- The remediation process may cause instance downtimes or service interruptions. Make sure you review each recommendation carefully before selecting to fix a configuration issue.
- Connect to an FSx for ONTAP file system using a link for the most comprehensive analysis of your file system resources.

Fix a configuration issue

You can fix configuration issues for an FSx for ONTAP file system or for selected volumes in a file system. You can select one or more configurations to fix.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Well-architected**.
4. Select **View issues** for any configuration. Make sure you review the recommendation carefully.

   The recommendation explains best practices and potential pitfalls of unoptimized configurations.

5. Select to **Fix**.

   When **View and fix** is an option, select the impacted volumes to fix.

6. Review the summary and action items that appear in the dialog to learn what will happen if you choose to fix the issue. Some operations may cause instance downtimes or service interruptions.
7. Select **Continue** to fix the configuration issue.

Result

The process to fix the issue initiates. Select the account settings menu and then select **Tracker** to view the status of the operation.

Dismiss a configuration analysis

Dismiss to stop a configuration analysis indefinitely for an FSx for ONTAP file system or for selected volumes in a file system. You can restart the analysis when needed.

Dismiss a configuration analysis for a file system

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Well-architected**.
4. Select **View issues** for any configuration. Make sure you review the recommendation carefully.

   The recommendation explains best practices and potential pitfalls of unoptimized configurations.
5. Under Configurations, identify the configuration that doesn't apply to your environment and then select **Dismiss**.
6. In the Dismiss configuration dialog, select **Dismiss** to stop the analysis for the configuration.

Dismiss a configuration analysis for a volume

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Well-architected**.
4. Under Configurations, identify the configuration to dismiss for selected volumes and then select **View and fix**.
5. Identify the volume(s) to dismiss from the configuration analysis.
   - For one volume: select the actions menu and then select **Dismiss volume**.
   - For multiple volumes: select the volumes and then select **Dismiss** next to Bulk action.
6. Select **Dismiss** to stop the analysis for the configuration.
7. In the Dismiss volumes dialog, select **Dismiss** to confirm.

Result

The configuration analysis stops for the file system or selected volumes.

You can reactivate the analysis at any time. The configuration is no longer included in the total optimization score.

Reactivate a dismissed configuration analysis

Reactivate a dismissed configuration analysis at any time. You can select one or more configurations to reactivate.

Reactivate a configuration analysis for a file system

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Well-architected**.
4. Select **Dismissed configurations**.
5. Identify the configuration you want to reactivate and select **Reactivate**.

Reactivate a configuration analysis for a volume

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Well-architected**.
4. Select **Dismissed configurations**.
5. Identify the volume(s) to reactivate from the configuration analysis.
   - For one volume: select the actions menu and then select **Reactivate volume**.
   - For multiple volumes: select the volumes and then select **Reactivate** next to Bulk action.

Result

The configuration analysis is reactivated. A new analysis occurs daily moving forward.

Analyze FSx for ONTAP EMS events in NetApp Workload Factory

Quickly identify and resolve FSx for ONTAP file system issues with the smart event analyzer in NetApp Workload Factory. The event analyzer automatically extracts and analyzes FSx for ONTAP Event Management System (EMS) events, leveraging Agentic AI with Amazon Bedrock integration.

About this task

Storage administrators often respond to FSx for ONTAP EMS events only after customer complaints, or by maintaining custom scripts and alarms. This reactive approach can reduce efficiency, delay issue resolution, and increase downtime.

The event analyzer automatically extracts error, alerts, and emergency EMS events from FSx for ONTAP file systems. You can view these events by connecting to the file system using a link and by granting *view, planning, and analysis* permissions in your AWS account. Events are displayed for 72 hours before removal.

With Amazon Bedrock integration, Workload Factory uses AI to analyze events and provide actionable insights to maintain the health and performance of your FSx for ONTAP file systems.

Key benefits include:

- Advanced troubleshooting: AI automatically identifies, analyzes, and provides insights to fix FSx for ONTAP EMS events, reducing manual investigation time.
- Best-practice remediation: The event analyzer gives clear, actionable steps to resolve FSx for ONTAP EMS events.

When using the event analyzer, you have full control of your environment while benefiting from advanced AI analysis.

To allow Workload Factory to analyze events, you must activate Amazon Bedrock, select the model Workload Factory uses, create a private endpoint to connect to Amazon Bedrock, add permissions, and create an enterprise license.

Amazon Bedrock pricing

Data privacy and security

Your data privacy and security are protected through:

- **Data sovereignty**: All data and aggregations stay within your AWS account and are communicated via private VPC endpoint (Amazon Bedrock), with no public internet exposure.
- **No AI Training**: Customer data is not used to train or improve models. Amazon Bedrock processes events in real time but does not train on your data. Results are stored only in your environment.

For more details, refer to the Amazon Bedrock data protection documentation.

Before you begin

To use the event analyzer, ensure the following:

- You have *operations and remediation* permissions in your AWS account to analyze events for FSx for ONTAP file systems.
- Port 22 (SSH) is open in the security group associated with your FSx for ONTAP file system.

Additional requirements (the system will prompt you during log error analysis):

- **Amazon Bedrock model**

  Configure Amazon Bedrock APIs for each AWS account. Amazon BedRock APIs are used to provide insights for FSx for ONTAP events.

  Recommended model: `anthropic.claude-sonnet-4-20250514-v1:0`. Provide the Inference profile ARN for your selected region.

- **Workload Factory link**

  Create and associate a link with an FSx for ONTAP file system to enable AI-powered events analysis. A link establishes a trust relationship between Workload Factory and one or more FSx for ONTAP file systems and leverages AWS Lambda.

  Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

- **AWS IAM permissions**

Add the following permissions to the Workload Factory IAM role associated policy.

- `bedrock:InvokeModel`
- `bedrock:InvokeModelWithResponseStream`

  These permissions allow Workload Factory to invoke Bedrock models for error investigation and remediation guidance. This profile also ensures secure AI access for tailored insights.

  Also add the following permissions for AWS credentials associated with Workload Factory:

- `bedrock:GetInferenceProfile`
- `bedrock:ListInferenceProfiles`

  These permissions verify model availability.

View and analyze EMS events for FSx for ONTAP

Use the Workload Factory console to view and analyze EMS events for FSx for ONTAP file systems.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **Analysis**.
4. From the Analysis screen, select the AWS accounts, credentials, and regions that contain the FSx for ONTAP file systems you want to analyze.

   Only FSx for ONTAP file systems with events display on the screen.
5. If needed, complete the AI analysis setup requirements by following the on-screen prompts to meet any missing prerequisites.
6. Find the FSx for ONTAP file system you want to analyze and then select **View events**.
7. Review the detailed event information.

Volume administration

Enable volume autogrow in Workload Factory

Enable volume autogrow to let Workload Factory manage volume capacity for you. You can disable it at any time.

Optionally, you can manually increase the volume capacity of a volume at any time using the adjust volume capacity feature.

Volume autogrow isn't supported for iSCSI volumes.

Before you begin

To enable volume autogrow, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume you want to modify.
7. Select **Basic actions**, then **Set volume autogrow**.
8. In the Set autogrow dialog, enable volume autogrow to automatically expand the volume capacity until the volume reaches the maximum size. This feature accommodates increasing data usage, ensuring uninterrupted operations.

   Specify the maximum volume growth size and unit. The maximum growth size cannot be smaller than the current volume size.

9. Select **Apply**.

Adjust volume capacity in NetApp Workload Factory

Manually adjust the volume capacity of a volume at any time from the NetApp Workload Factory console.

Optionally, you can enable the autogrow feature to let Workload Factory manage volume capacity for you.

About this task

You can adjust volume capacity by increasing or decreasing the provisioned size of a volume. The following table shows the minimum and maximum volume sizes by volume type:

Volume type	Minimum size	Maximum size
FlexVol volume	20 MiB	300 TiB
FlexGroup volume	800 GiB	2 PiB

For an iSCSI LUN, increasing the size of the volume also increases the size of the host LUN. After you increase volume capacity, follow the procedure provided by your host operating system to discover the new size of the LUN and expand the file system of the LUN.

Decreasing volume size is supported only for NFS and SMB/CIFS volumes.

Before you begin

To adjust volume capacity, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.

4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu of the volume to adjust capacity for.
7. Select **Basic actions**, then **Adjust volume capacity**.
8. In the Adjust volume capacity dialog, set the **Provisioned capacity** and unit.
9. Select **Adjust** to apply the changes.

Related information

- Enable volume autogrow in Workload Factory
- Rebalance a volume in Workload Factory

Check and rebalance volume capacity

Check the balance of FlexVol or FlexGroup volume capacity and rebalance volume capacity to spread files evenly across all FlexVol volumes in a node or across all constituents so that all nodes participate in the workload of a single FlexGroup volume.

About this task

Rebalancing volume capacity is supported for FlexVol volumes and FlexGroup volumes. Rebalancing a volume redistributes the capacity when imbalances develop over time due to the addition of new files and file growth. After you manually start the rebalance operation, we select the files and move them automatically and non-disruptively. Volume transfer operations consume file system resources.

Each volume type and rebalancing operations differ as follows.

FlexVol volumes

FlexVol volumes are logical containers that offer flexibility in managing data, allowing for expansion, contraction, movement, and efficient copying. They can be used with NAS and SAN environments.

A FlexVol volume can be balanced in relation to other FlexVol volumes within one node in an FSx for ONTAP file system. If the file system has only a single FlexVol volume, then rebalancing isn't possible. When the file system has more then one FlexVol volume per node and a single FlexVol volume is selected, the FlexVol volume is balanced in the context of all FlexVols but only the selected volume is allowed to move.

FlexGroup volumes

FlexGroup volumes, on the other hand, are scalable NAS containers designed for high performance and automatic load distribution. They consist of multiple member volumes (constituents) that share traffic transparently. FlexGroup volumes provide massive capacity, exceeding FlexVol limits, with up to 60PB capacity and 400 billion files. They simplify management by offering a single namespace container.

Capacity is spread across a number of constituents in a scale-out FSx for ONTAP file system with two or more high availability (HA) pairs. Each constituent is a container that dictates the maximum single file size. FSx for ONTAP spreads files across all constituents in an even way so all nodes participate in the workload of a single FlexGroup volume.

When the constituents aren't distributed evenly across all nodes, FlexGroup volume performance decreases.

Checking the balance of FlexGroup volume capacity includes assessing the current layout of constituents.

When you rebalance the volume's capacity, NetApp Workload Factory designs a new constituent layout with an even number of constituents to spread the data evenly across all HA pairs. The service executes the rebalance plan which in turn improves read and write operations.

Rebalancing isn't supported for SAN volumes like iSCSI and NVMe.

Check the balance of your volumes

Check the balance of FlexVol or FlexGroup volumes in an FSx for ONTAP file system.

Before you begin

- FlexGroup volume balance is available only for FSx for ONTAP file systems using a scale-out deployment with at least two HA pairs.
- To check the balance of a volume, you must associate a link. If you don't have an existing link, create a link. To associate a link in the file system, select **Associate link** under **Account name**. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system that contains volumes to rebalance and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select **Check volume balance** at the top of the table.
7. In the Volume balance window, review the balance status of:
    - FlexGroup volumes
    - FlexVol volumes

    When a volume is unbalanced, consider rebalancing it.

Rebalance volume capacity

Rebalance one or more unbalanced volumes.

A Workload Factory admin can stop rebalancing during the operation.

Before you begin

- Check the balance of a volume before rebalancing volumes.
- To rebalance a volume, you must associate a link. If you don't have an existing link, create a link. To associate a link in the file system, select **Associate link** under **Account name**. After the link associates, return to this operation.
- Note that existing snapshots on volumes you rebalance become partial and cannot be used to restore volume data, but new snapshots taken after rebalancing can be used to restore volume data.
- FlexVol volumes are best rebalanced altogether to balance all volume resources evenly. Deselected volumes don't actively participate in the balancing procedure.

FlexVol volume

A FlexVol volume can be balanced in relation to other FlexVol volumes within one node in an FSx for ONTAP file system. When the file system has more then one FlexVol volume per node and a single FlexVol volume is selected, then the FlexVol volume is balanced in the context of all FlexVols but only the selected volume is allowed to move.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system that contains the volume to rebalance and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select **Check volume balance** at the top of the table.
7. In the Volumes balance window, optionally select **Data distribution** in the FlexVol balance summary to view used capacity per aggregate.
8. Select **Rebalance** to rebalance one or more unbalanced volumes.
9. In the Rebalance wizard, follow the steps.
    a. **Max transfer rate**: Optional. Disabled by default. Enable throttling to limit the bandwidth of a volume move on your file system and to slow outgoing volume replication traffic.

       Enter the throttle value in MB/s.

       Select **Next**.

    b. Review the current and proposed layouts of all FlexVol volumes, and then select **Next**.
    c. Carefully review what will happen and the note before beginning the rebalance operation.
10. Select **Rebalance**.

Result

The FlexVol volume is rebalanced. When the operation completes, the file system will be throttled back to the original value.

FlexGroup volume

Data redistributes across member volumes to rebalance the FlexGroup volume. Based on your chosen layout, the rebalance operation might add FlexGroup member volumes and increase the size of provisioned volumes.

Steps

1. Log in using one of the console experiences.
2. In **Storage**, select **Go to Storage**
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system that contains the volume to rebalance and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.

6. From the Volumes tab, select **Check FlexGroup balance** at the top of the table.
7. In the FlexGroup balance window, select **Rebalance** to rebalance one or more unbalanced volumes.
8. In the Rebalance wizard, select the data distribution layout that you prefer.
    - **Performance-optimized** (recommended): increases the number of FlexGroup member volumes and the provisioned size of the volume. Follows NetApp best practice.
    - **Restricted**: supports volumes in a replication relationship. The number of FlexGroup member volumes and the size of provisioned volumes remains the same. Selected by default if all selected volumes participate in a replication relationship.
    - **Manual**: Select the desired number of FlexGroup member volumes per HA pair. Depending on your selection, the number of FlexGroup member volumes and the provisioned size of the volume might increase.
9. **Throttling**: Optional. Disabled by default. Enable throttling to limit the bandwidth of a volume move on your file system and to slow outgoing volume replication traffic.

    Enter the throttle value in MB/s.
10. Select a layout comparison view and then select **Next**.
    - Volume layout comparison
    - FSx for ONTAP layout comparison
11. Optionally, download a list of volume moves before rebalancing.
12. Select **Rebalance**.

Result

FlexGroup member volumes are moved one at a time during rebalancing. When the operation completes, the file system will be throttled back to the original value.

Stop a volume rebalance operation

Stop a rebalance operation at any time; it isn't disruptive. Stopping the operation aborts active volume moves.

You can start another rebalance operation later.

Steps

1. After you begin the rebalance operation, from the Volume balance page, select **Stop rebalancing**.
2. In the Stop rebalancing dialog, select **Stop**.

Result

The volume rebalance operation stops and active volume moves abort.

Manage immutable files for a volume in NetApp Workload Factory

You can update certain immutable files settings for a volume when the feature is enabled, such as the retention policy and periods, the autocommit period, and volume append mode.

Note that enabling immutable files is only possible during volume creation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. In the Volumes tab, select the actions menu of the volume to clone.
6. Select **Data protection actions**, then **Manage immutable files**.
7. On the Manage Immutable files page, you can update the following:
    - **Retention period**: select **Unspecified** or **Specify period**.
        - **Unspecified**: The default minimum period is "0" years and the default maximum period is "30 years".
        - **Specify period**: Option to define the retention policy, minimum and maximum periods, the autocommit feature, and the volume append mode feature. Provide the following details:
            - **Retention policy**: This period must be greater than or equal to the minimum retention period and less than or equal to the maximum retention period.
            - **Minimum and maximum periods**: Set the minimum and maximum periods to commit files in this volume to an immutable WORM state.
    - **Autocommit**: enable or disable the feature to automatically commit files to WORM that haven't been modified during the Autocommit period.
    - **Privileged delete**: Enable or disable the feature. Enabling the feature allows a SnapLock administrator to delete an unexpired WORM volume. This feature is only supported in Enterprise retention mode.
    - **Volume append mode**: enable or disable the feature. Enabling volume append mode enables you to add new content to WORM files.
8. Click **Apply**.

Result

The updates now apply to the volume.

Manage volume tags in NetApp Workload Factory

Tags can help you categorize your resources. You can add, edit, and remove volume tags at any time for FSx for ONTAP volumes in NetApp Workload Factory.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to modify tags for.
7. Select **Basic actions** then **Edit volume tags**.

8. On the Edit volume tags page, add, edit, or remove tags.

   The maximum number of tags you can apply to a volume is 50.

9. Select **Apply**.

Manage FSx for ONTAP cache volumes with NetApp Workload Factory

Use the NetApp Workload Factory console to manage cache volumes for FSx for ONTAP file systems. Caching, a method for temporarily storing data, improves data access performance by reducing retrieval time. You can edit the cache name, adjust capacity, change the export policy, select a caching method, pre-populate the cache, or delete cache volumes.

About this task

You can manage cache volumes that are associated with cache relationships in the NetApp Workload Factory console.

Before you begin

- You must associate a link to manage cache volumes and relationships. Learn how to associate an existing link or to create and associate a new link. After you associate the link, return to this operation.
- You must have an existing cache volume to edit.

Edit the cache volume name

Change the name of an existing cache volume at any time.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select FSx for ONTAP.
4. From FSx for ONTAP, select the actions menu of the file system with the cache volume and then select **Manage**.
5. From the file system overview, select the **Cache relationships** tab.
6. Select the actions menu for the cache volume you want to modify and then select **Edit cache name**.
7. In the **Edit cache name** dialog, enter the new name for the cache volume and then select **Apply**.

Adjust the capacity of a cache volume

You can adjust the capacity of an existing cache volume at any time.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select FSx for ONTAP.
4. From FSx for ONTAP, select the actions menu of the file system with the cache volume and then select **Manage**.

5. From the file system overview, select the **Cache relationships** tab.
6. Select the actions menu for the cache volume you want to modify and then select **Adjust cache capacity**.
7. In the **Adjust cache capacity** dialog, enter the new capacity for the cache volume by percentage or by unit and then select **Apply**.

Edit the cache volume export policy

Change the mount path or the export policy assigned to an existing cache volume.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select FSx for ONTAP.
4. From FSx for ONTAP, select the actions menu of the file system with the cache volume and then select **Manage**.
5. From the file system overview, select the **Cache relationships** tab.
6. Select the actions menu for the cache volume you want to modify and then select **Edit export policy**.
7. In the **Edit export policy** dialog, change the mount path or select a different export policy to assign to the cache volume.
8. Select **Apply**.

Change the caching method for a cache volume

You can change how the cache works for an existing cache volume to write-around or write-back.

Learn more about write modes.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select FSx for ONTAP.
4. From FSx for ONTAP, select the actions menu of the file system with the cache volume and then select **Manage**.
5. From the file system overview, select the **Cache relationships** tab.
6. Select the actions menu for the cache volume you want to modify and then select **Change caching method**.
7. In the **Change caching method** dialog, select the new caching method and then select **Apply**.

Prepopulate a cache volume

Fill the cache volume with data from the origin volume before you use it to make cached data available faster.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select FSx for ONTAP.

4. From FSx for ONTAP, select the actions menu of the file system with the cache volume and then select **Manage**.
5. From the file system overview, select the **Cache relationships** tab.
6. Select the actions menu for the cache volume you want to modify and then select **Prepopulate cache**.
7. In the **Prepopulate cache** dialog, specify the path to the data set to use for prepopulation and then select **Apply**.

Delete a cache volume

When you delete a cache volume, you remove its cache relationship. Cached data is no longer available.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select FSx for ONTAP.
4. From FSx for ONTAP, select the actions menu of the file system with the cache volume and then select **Manage**.
5. From the file system overview, select the **Cache relationships** tab.
6. Select the actions menu for the cache volume you want to delete and then select **Delete cache volume**.
7. In the **Delete cache volume** dialog, confirm the deletion and then select **Delete**.

Change the tiering policy of a volume in NetApp Workload Factory

In NetApp Workload Factory, you can change the tiering policy to automatically re-allocate data from the high-performance primary storage tier to the secondary capacity pool storage tier.

About this task

You can change the tiering policy of a volume at any time. The tiering policy is defined per volume.

Deciding where your data is stored has implications for your cost savings.

FSx for ONTAP has two tiers for storing volume data:

- **SSD storage tier**: This primary storage tier is for the data you access most frequently, also known as *hot* data. Storing data in the primary storage tier is more expensive than in the secondary storage tier.
- **Capacity pool storage tier**: This secondary storage tier is for archived data or infrequently accessed data, also known as *cold* data.

Refer to Managing storage capacity in AWS for FSx for NetApp ONTAP documentation for more information about storage tiers.

Before you begin

Review the available tiering policies before you change the tiering policy.

- **Balanced (Auto)**: default tiering policy when creating a volume using the user interface. Keeps frequently accessed data in the SSD storage tier and tiers infrequently accessed data and snapshots to the capacity pool storage tier after the cooling period ends. Recommended for general primary workloads.

- **Cost-optimized (All)**: Tiers all snapshots and data to the capacity pool storage tier. Recommended for secondary targets.
- **Performance optimized (Snapshots only)**: Tiers only snapshot data to the capacity pool storage tier. Recommended for low-latency workloads such as mission-critical databases.
- **None**: Keeps volume data in the SSD storage tier, preventing it from being moved to the capacity pool storage tier.

Note that some tiering policies have an associated minimum cooling period which sets the time, or *cooling days*, that user data in a volume must remain inactive for the data to be considered "cold" and moved to the capacity pool storage tier. The cooling period starts when data is written to the disk.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu of the volume to change the tiering policy for.
7. Select **Advanced actions**, then **Change tiering policy**.
8. On the Change tiering policy page, select to copy the tiering policy of the source volume or select one of the following tiering policies:
   - **Balanced (Auto)**: Enter the number of cooling days.
   - **Cost-optimized (All)**
   - **Performance-optimized (Snapshots only)**: Enter the number of cooling days.
   - **None**
9. Select **Apply**.

Update storage efficiency setting of a volume

In NetApp Workload Factory, you can update the storage efficiency setting after volume creation.

About this task

The storage efficiency feature includes deduplication, data compression, and data compaction to achieve optimal space savings on a FlexVol volume. Deduplication eliminates duplicate data blocks. Data compression compresses the data blocks to reduce the amount of physical storage that is required. Data compaction stores more data in less space to increase storage efficiency.

If you chose not to enable storage efficiency when you created a volume, you can enable the setting for potential space and cost savings at any time.

Volumes use thin provisioning whether you enable or disable storage efficiency.

Steps

1. Log in using one of the console experiences.

2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu of the volume to change the tiering policy for.
7. Select **Advanced actions**, then **Set storage efficiency**.
8. Choose to enable or disable volume storage efficiency.
9. Select **Apply** to save the change.

Manage the NFS export policy for a volume in NetApp Workload Factory

Manage the NFS export policy for a volume that uses NFSv3 or NFSv4.1 protocol types in NetApp Workload Factory.

About this task

Managing a volume's export policy involves adding export policy rules that detail client specifications, access control, super user access, and NFS version. You can add more than one export policy and prioritize them.

Before you begin

Determine the client specifications for the export policy rules. Valid values for the client specification are as follows:

- IP addresses
- IP addresses with subnet masks
- IP addresses with a network mask
- A netgroup name preceded by the "@" character
- A domain name preceded by a period "."
- Host names

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to change the NFS export policy for.
7. Select **Advanced actions**, then **Edit NFS export policy**.
8. On the Edit NFS export policy page, provide the following:
   a. **Access control**: Select **Custom export policy** or **Existing export policy**.

      Alternatively, you can select **No access to the volume**.

b. **Export policy name**: Optionally, enter a name for the export policy.

c. **Add export policy rule**: Provide the following details and rank the policies starting with #1 as the priority rule:

   i. **Client specification**: Separate multiple values with commas.

   ii. **Access control**: Select **Read/Write**, **Read only**, or **No access** from the dropdown menu.

   iii. **Super user access**: Select **Yes** or **No**.

   iv. **NFS version**: Select **All**, **NFSv3**, or **NFSv4**.

9. Select **Apply**.

Manage the SMB/CIFS share for a volume in Workload Factory

Managing a volume's SMB/CIFS share in Workload Factory includes SMB/CIFS share creation, determining the users and groups to give access to and the level of permissions to give them, and SMB/CIFS share deletion.

Before you begin

Before you begin, do the following:

- To manage SMB/CIFS shares, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.
- Determine the users or groups to give access to and the level of permissions to give them.

Create an SMB/CIFS share for a volume

Follow the steps to create an SMB/CIFS share for a volume.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu of the volume to change the SMB share for.
7. Select **Advanced actions**, then **Manage SMB/CIFS shares**.
8. On the Manage SMB/CIFS shares page, select **Create SMB/CIFS share**.
9. In the Create SMB/CIFS share dialog, provide the following:
   a. **Name**: Enter the name of the SMB/CIFS share.
   b. **Path**: Either define the path using the default volume name or provide a share to an internal directory.

      Valid path inputs for volume name, for example "avocado", are as follows:

      - /avocado
      - /avocado/folder

- /avocado/folder/subfolder
- /avocado/file-name

  Valid path inputs for share name, for example "Server", are as follows:

- \\Server
- \\Server\Projects
- \\Server\Projects\Shared resources

c. **Permissions**: Select Full control, Read/Write, Read, or No access, and then enter the users or groups separated by a semicolon (;). Users or groups are case sensitive and the user's domain must be included using the format "domain\username".

10. Select **Create**.

Change an SMB/CIFS share for a volume

Follow the steps to change the SMB/CIFS share settings for a volume.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. In the **FSx for ONTAP** tab, select the actions menu of the file system with the volume to update and then select **Manage**.
4. From the file system overview, select the **Volumes** tab.
5. From the Volumes tab, select the actions menu of the volume to change the SMB share for.
6. Select **Advanced actions**, then **Manage SMB/CIFS shares**.
7. On the Manage SMB/CIFS shares page, select **View and edit**.
8. Change the SMB/CIFS access permissions, or the users or groups to give permissions to.

   Changes might cause current users or groups to lose access to the SMB/CIFS share.

9. Select **Apply** to save the changes.

Delete an SMB/CIFS share for a volume

Follow the steps to delete an SMB/CIFS share for a volume.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. In the **FSx for ONTAP** tab, select the actions menu of the file system with the volume to update and then select **Manage**.
4. From the file system overview, select the **Volumes** tab.
5. From the Volumes tab, select the actions menu of the volume to change the SMB share for.
6. Select **Advanced actions**, then **Manage SMB/CIFS shares**.
7. On the Manage SMB/CIFS shares page, select the actions menu of the SMB/CIFS share and then select **Delete**.

Deleting the SMB/CIFS share makes it unavailable and inaccessible to any users who want to mount it.

8. In the Delete SMB/CIFS share dialog, select **Delete** to confirm deletion.

Manage the S3 access points for a volume in NetApp Workload Factory

Manage the S3 access points for a volume in NetApp Workload Factory. You can use the Workload Factory console to assign S3 access points to existing volumes, view details for your S3 buckets, make changes to existing access points, or delete S3 access points.

About this task

Amazon FSx for NetApp ONTAP supports S3 data access to NFS and SMB file systems, enabling their integration with dozens of S3-based AWS services such as Amazon Bedrock, SageMaker, Athena, AWS Glue, and more. You can connect AWS services to all of your object storage data.

By attaching S3 access points to NFS and SMB volumes in an FSx for ONTAP file system, files stored in these volumes can be accessed by any AWS services as if they were in an S3 bucket. When attaching the access point, you define its unique id, specify the file access type (UNIX or Windows) and add a username for authorizing file access requests by the access point.

After the S3 access point is attached, it appears in the AWS Management Console and has a unique access point alias. This alias is used as the S3 bucket name provided to the AWS services to which you want to connect. For example, you can provide the alias to an Amazon Bedrock knowledge base, and it will then use the files in the FSx for ONTAP volume to provide contextual answers to queries.

You can attach multiple S3 access points to a single FSx for ONTAP volume, each with its own unique access level, allowing you to connect to as many AWS services as required.

Before you begin

Ensure that you meet the following requirements:

- You must have an existing volume with an S3 access point.
- You must grant credentials with the *operations and remediation* permission policy in Workload Factory to complete this task.

Create and attach S3 access points to an existing volume

Create and attach S3 access points to an existing volume in NetApp Workload Factory.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the file system with the volume to update.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to manage the S3 access points for and then select **Advanced actions**, then **Manage S3 access points**.
7. Select **Create and attach S3 access point**.
8. In the **Create and attach S3 access point** dialog, provide the following information:

- **S3 access point name**: Enter the name of the S3 access point.
- **User**: Select an existing user with access to the volume or create a new user.
- **User type**: Select **UNIX** or **Windows** as the user type.
- **Enable metadata catalog**: Select to enable metadata on the volume to generate metadata inventory for all objects accessible to the S3 access point. This feature incurs AWS costs for S3 requests.

9. Select **Create and attach**.

View details

Alias, ARN, and S3 URI are available access point details without metadata enabled.

With metadata enabled on the volume, you can view access point, inventory table, and table bucket details of existing S3 access points attached to the volume. A link to the inventory table in the AWS Management Console is also provided.

Access point details are copiable for use in other applications.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update, then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to manage the S3 access points for and then select **Advanced actions**, then **Manage S3 access points**.
7. From the **Manage S3 access points** screen, select the actions menu and then select **View details**.

Edit access point

Change the user and user type for an existing S3 access point attached to a volume. You can also enable or disable metadata for the access point.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update, then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to manage the S3 access points for and then select **Advanced actions**, then **Manage S3 access points**.
7. From the **Manage S3 access points** screen, select the actions menu and then select **Edit access point**.
8. Make updates and then select **Apply**.

Manage S3 access point tags

Add or remove tags for an existing S3 access point attached to a volume.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update, then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to manage the S3 access points for and then select **Advanced actions**, then **Manage S3 access points**.
7. From the **Manage S3 access points** screen, select the actions menu and then select **Manage tags**.
8. In the Manage S3 access point tags dialog, you can add up to 50 tags or remove tags for the S3 access point.
9. Select **Apply**.

Delete existing S3 access points from a volume

Delete existing S3 access points from a volume in NetApp Workload Factory.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume to update, then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu for the volume to manage the S3 access points for and then select **Advanced actions**, then **Manage S3 access points**.
7. Select the actions menu for the S3 access point to delete and then select **Detach**.
8. In the **Detach and remove an S3 access point** dialog, select **Detach and remove** to delete the S3 access point from the volume.

Split a cloned volume in NetApp Workload Factory

Split a cloned FlexVol volume from its parent volume to make the clone a normal read/write FlexVol volume in NetApp Workload Factory.

Data is accessible on the clone and the parent during the split. The split process only updates metadata and requires minimal IO. No data blocks are copied.

About this task

The clone splitting operation involves the following:

- New snapshot copies of the FlexClone volume cannot be created during the split operation.
- A FlexClone volume cannot be split from the parent volume if it belongs to a data protection relationship.
- If you take the FlexClone volume offline while splitting is in progress, the split operation is suspended; when you bring the FlexClone volume back online, the splitting operation resumes.
- After the split, both the parent FlexVol volume and the clone require the full space allocation determined by their volume guarantees.
- After a FlexClone volume is split from its parent the two cannot be rejoined.

Before you begin

Consider the following before you split a cloned volume:

- To split a cloned volume, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.
- The FlexClone volume must be online when the split operation begins.
- The parent volume must be online for the split to succeed.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume clone to split and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. In the Volumes tab, select the actions menu of the volume with the cloned volume to split.
7. Select **Data protection actions**, then **Split cloned volume**.
8. In the Split volume dialog, select **Delete**.

Result

The volume clone is split and appears in the Volumes tab.

Delete a volume in NetApp Workload Factory

Delete a volume in your FSx for ONTAP file system that is no longer required and to free up space. This operation is irreversible.

Before you begin

Consider the following before deleting a volume:

- Replication relationships: You must delete all existing replication relationships for this volume before deleting the volume so that no broken relationships remain.
- Local snapshots: All snapshots associated with this FSx for ONTAP file system will be permanently deleted.
- FSx for ONTAP backup: FSx for ONTAP backup copies will remain and you can still use them.
- Immutable files and snapshots: Volumes containing immutable files and snapshots cannot be deleted until the retention period ends.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actionsenu of the file system with the volume to delete and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. From the Volumes tab, select the actions menu of the volume to delete.
7. Select **Basic actions** then **Delete volume**.
8. In the Delete volume dialog, do the following:
   a. Optionally, select **Back up the volume** to back up the volume before deletion.

      The backup will remain in the file system until you manually delete it.

   b. Select **Continue**.
   c. Type “delete” to delete the volume.
   d. Select **Delete** to confirm.

Block storage administration

Manage the igroups for a file system in NetApp Workload Factory

Use the NetApp Workload Factory console to manage igroups and control client access for FSx for ONTAP block devices. You can view igroup details, manage client access, and delete igroups.

Before you begin

- You must associate a link to manage igroups. Learn how to associate an existing link or to create and associate a new link. After you associate the link, return to this operation.
- You must have an existing igroup to view and manage.

Manage client access for an igroup

You can manage client access for an existing igroup at any time.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Select the resource type **Initiator groups (igroups)** to view existing igroups.
6. Go to the actions menu for the block device and select **Manage client access**.
7. Review the client access details displayed for the igroup.
8. To make changes to client access, select **Edit client access**.

9. In the **Edit client access** dialog, you can edit the following:
    - **igroup name**
    - **igroup description**
    - **Storage VM name**
    - **Block device name**
    - **Operating system type**
    - **Host initiators**
10. Select **Apply**.

Delete an igroup

You can delete an existing igroup when it is no longer needed.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Select the resource type **Initiator groups (igroups)** to view existing igroups.
6. Navigate to the actions menu for the block device and then select **Delete initiator group**.
7. In the Delete initiator group (igroup) dialog, type "delete" to confirm that you want to delete the igroup, and then select **Delete**.

Related information

Create an igroup for an FSx for ONTAP file system

Manage the block devices for a file system in NetApp Workload Factory

From the NetApp Workload Factory console, you can manage the block devices for your FSx for ONTAP file systems. Management tasks include viewing block device details, increasing capacity, managing client access, archiving block device data, and deleting block devices.

About this task

Block devices, or LUNs (logical unit numbers), are volumes that contain file systems in a SAN environment and can be accessed by hosts over a network.

You can manage block devices for FSx for ONTAP file systems that use the iSCSI protocol.

Before you begin

- You must associate a link to manage block devices. Learn how to associate an existing link or to create and associate a new link. After you associate the link, return to this operation.
- You must have an existing block device to view and manage.

View block device details

View details for an existing block device at any time.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Navigate to the actions menu for block device and then select **View details**.

   General details, consumption, access, and protection information for the block device are displayed.

Increase the capacity of a block device

Increase the capacity of an existing block device at any time.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Navigate to the actions menu for the block device and then select **Increase capacity**.
6. Enter the new capacity for the block device and select the unit.
7. Select **Increase** to apply the changes.

> After you increase the size of the block device, follow the procedure provided by your host operating system to discover the new size of the block device and expand the file system on it.

Manage client access for a block device

You can manage client access for an existing block device at any time by creating igroups, and adding or removing block devices and host initiators.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Navigate to the actions menu for the block device and then select **Manage client access**.
6. If no igroup exists, create a new igroup by selecting **Create igroup**, and then do the following:
   a. **Block device name**: Enter a block device name. You can select multiple block devices to associate with the igroup.
   b. **Operating system type**: Select the operating system type.

c. **igroup name**: Enter an igroup name.

d. **igroup description**: Optionally, enter an igroup description.

e. **Host initiators**: Enter one or more host initiators. These initiators must follow iSCSI qualified (IQN) format.

f. Select **Create**.

7. If an igroup already exists, select **Edit client access** to add or remove block devices and host initiators from the igroup and then select **Apply**.

Archive the data of an orphaned block device

Block devices that are no longer mapped to a client or unused for seven consecutive days are classified as orphaned block devices. You can archive the data of an orphaned block device to the capacity pool tier to reclaim SSD capacity.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Under Orphan devices, select **View and reclaim capacity**.
6. On the Reclaim space for unused block devices screen, select one or more block devices to archive the data and reclaim the capacity.
7. Select **Archive**.

Delete a block device

Block devices that are no longer mapped to a client or unused for seven consecutive days are classified as orphaned block devices. This operation unmaps and deletes the selected block device. If the host FlexVol volume doesn't contain any block devices, Workload Factory also deletes it.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the **Block devices** tab.
5. Under Orphan devices, select **View and reclaim capacity**.
6. On the Reclaim space for unused block devices screen, select one or more block devices to archive the data and reclaim the capacity.
7. Select **Delete**.

Related information

Create a block device for an FSx for ONTAP file system

File system administration

Adjust file system capacity in Workload Factory

Manually adjust the solid-state drive (SSD) storage capacity of an FSx for ONTAP file system to meet the needs of your project-based workloads with varying active working sets.

Increase the SSD storage capacity of an FSx for ONTAP file system when the amount of used SSD storage capacity exceeds a threshold that you specify or decrease the SSD storage capacity when working sets are inactive to improve cost efficiency.

Alternatively, you can enable the automatic capacity management feature so Workload Factory manages file system capacity for you.

Decreasing SSD storage capacity is only supported for second-generation file systems.

About this task

With elastic file system capacity, you can dynamically adjust the capacity of your file systems to match the needs of your workloads.

Adjusting file system capacity impacts IOPS for your FSx for ONTAP file system.

When you automatically provision IOPS for a file system, IOPS increases or decreases by 3 IOPS with every 1 GiB increase or decrease in SSD capacity.

When you provision IOPS manually, you might need to increase your IOPS allocation to support the increased file system capacity.

For SSD storage capacity limits, refer to Quotas in AWS FSx for NetApp ONTAP documentation.

Before you begin

To adjust capacity for a file system, you must first disable automatic capacity management.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Dashboard, select **Adjust SSD capacity**.
4. Select the file system you want to adjust capacity for and then select **Continue**.
5. In the Adjust SSD capacity dialog, enter a number for **Provisioned capacity**.
6. Select the unit for the provisioned capacity.
7. Select **Apply**.

Enable automatic capacity and inode management for a file system

Enabling automatic capacity and inode management lets NetApp Workload Factory automatically add incremental storage or inodes to an FSx for ONTAP file system as capacity needs change over time. Additionally, enabling this feature removes the need to

monitor capacity and inodes manually.

About this task

A scan of the FSx for ONTAP file system occurs every 30 minutes to determine whether incremental storage needs to be added and to check for available volume inodes, the maximum number of files and folders in a volume, so that their count increases according to the configured automatic capacity management thresholds.

Only one account can manage this feature.

The maximum amount of SSD storage capacity for all FSx for ONTAP file systems is 524,288 GiB. To request a quota increase, refer to Quotas in AWS FSx for NetApp ONTAP documentation.

Enable automatic capacity management

Enable automatic capacity management to automatically add incremental storage up to the maximum size limit for an FSx for ONTAP file system.

Before you begin

Consider the following before you begin:

- You must grant credentials with the *view, planning, and analysis* permission policy in Workload Factory to complete this task.
- To make sure volume inodes increase along with storage capacity, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.
- You shouldn't enable this feature during data migration because AWS imposes a minimum six-hour cool down period between SSD capacity increases. This restriction might delay adjustments, so plan accordingly.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to enable automatic capacity management for.
5. Select **Manage**.
6. Under Information, select the pencil icon next to **Automatic capacity management**. The pencil icon appears next to the drop down arrow when the mouse hovers over the **Automatic capacity management** row.
7. In the **Automatic capacity management** dialog, provide the following:
   a. **Credentials**: Select credentials with *Automate* permissions from the dropdown menu.
   b. Select the enable button to **Enable automatic capacity management**.

      Alternatively, disable the feature. If you need to increase file system capacity, you must first disable automatic capacity management.

   c. **Warning threshold**: Set the warning threshold lower than the threshold increase to trigger a notification from the Workload Factory notification service. The default is 70%.

The warning threshold setting is available only if you enabled the Workload Factory notification service.

d. **Threshold increase**: Enter the maximum percentage increase for the FSx for ONTAP file system. The default is 80%.

This is the threshold at which Workload Factory triggers a job to increase the capacity. For example, if the file system reaches 80% of capacity, then Workload Factory will increase capacity.

e. **Incremental increase**: Enter the percentage to increase capacity incrementally. The default is 10%.

This is the percentage we increase capacity each time the threshold is reached. For example, if the file system is 80% full and the incremental increase is set to 10%, then Workload Factory increases the capacity by 10%.

8. Select **Apply**.

Result

A file system scan occurs every 30 minutes to determine if the file system needs additional capacity.

Enable automatic inode management

Enable automatic inode management to make sure that the file capacity per volume scales up by increasing the number of inodes (files) up to the allowable limit.

Terraform users: Terraform has a limitation that requires that all operations are completed within Terraform. Inode management isn't supported in Terraform, but you can enable automatic inode management in the Workload Factory console.

Before you begin

Consider the following before you begin:

- To manage volume inodes automatically, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.
- Automatic inode management can be set up with a *warning threshold* that triggers a notification from the Workload Factory notification service. To use this feature, you must enable the Workload Factory notification service first.
- You must grant credentials with the *view, planning, and analysis* permission policy in Workload Factory to complete this task.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to enable automatic inodes management for.
5. Select **Manage**.
6. Under Information, select the pencil icon next to **Automatic inodes management**. The pencil icon appears next to the drop down arrow when the mouse hovers over the **Automatic inodes management** row.
7. In the **Automatic inodes management** dialog, provide the following:

a. **Credentials**: Select credentials with *Automate* permissions from the dropdown menu.

b. Select the enable button to **Enable automatic inodes management**.

   Alternatively, disable the feature. If you need to increase the number of inodes, you must first disable automatic inodes management.

c. **Warning threshold**: Set the warning threshold lower than the threshold increase to trigger a notification from the Workload Factory notification service. The default is 70%.

   The warning threshold setting is available only if you enabled the Workload Factory notification service.

d. **Threshold increase**: Enter the maximum percentage increase for the number of inodes (files) per volume. The default is 80%.

e. **Incremental increase**: Enter the percentage to increase the number of inodes (files) incrementally. The default is 10%.

8. Select **Apply**.

Result

A file system scan occurs every 30 minutes to determine if the volumes need additional inodes (files) per volume.

Manage FSx for ONTAP file system tags in NetApp Workload Factory

Tags can help you categorize your resources. You can add, edit, and remove tags for a file system at any time in NetApp Workload Factory.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage file system tags**.
5. In the **Manage file system tags** dialog, add, edit, or remove tags as needed.

   The maximum number of tags you can apply to a file system is 50.

6. Select **Apply**.

Reset the fsxadmin password in NetApp Workload Factory

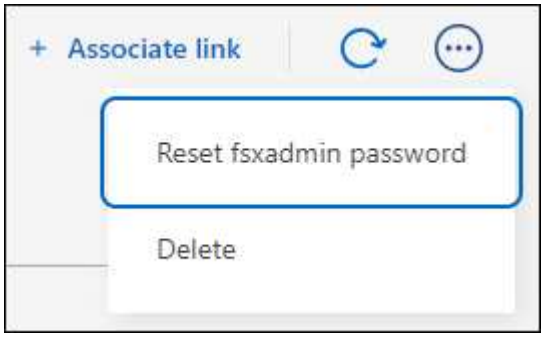
Reset the fsxadmin password in NetApp Workload Factory when necessary.

If you provided an alternate user during file system creation, you can only reset the fsxadmin password in the AWS console.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.

4. From **FSx for ONTAP**, select the actions menu of the file system to reset the fsxadmin password for and then select **Manage**.
5. From the file system overview, select the actions menu.



6. Select **Reset fsxadmin password**.
7. In the Reset fsxadmin password dialog, enter a new fsxadmin password and re-enter it to confirm.
8. Select **Apply**.

Delete a file system in NetApp Workload Factory

To delete a file system in NetApp Workload Factory, you must first delete any volumes, storage VMs, or replication relationships associated with the file system.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the FSx for ONTAP file system you want to delete.
5. Select **Manage**.
6. In the **Overview** tab, select the actions menu.
7. Select **Delete**.
8. In the Delete FSx for ONTAP file system dialog, enter the name of the FSx for ONTAP file system to delete.
9. Select **Delete** to confirm.

Storage VM administration

Replicate a storage VM to another FSx for ONTAP file system

Replicating a storage VM to another FSx for ONTAP file system in NetApp Workload Factory provides a protective layer of data access in case of data loss. This operation replicates all volumes in one storage VM to another FSx for ONTAP file system.

Before you begin

To replicate a storage VM to another FSx for ONTAP file system, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the storage VM to replicate and then select **Manage**.
5. In the file system overview under Storage VMs, select **Manage**.
6. On the Manage storage VMs screen, select the actions menu of the storage VM to replicate an SVM for, then select **Advanced actions** > **Replicate storage VM**.
7. On the Replicate data page, under Replication target, provide the following:
   a. **FSx for ONTAP file system**: Select credentials, region, and FSx for ONTAP file system name for the target FSx for ONTAP file system.
   b. **Storage VM name**: Select the storage VM from the dropdown menu.
   c. **Volume name**: The target volume name is generated automatically with the following format `{OriginalVolumeName}_copy`.
   d. **Tiering policy**: Select the tiering policy for the data stored in the target volume.

      Auto is the default tiering policy when creating a volume using the Workload Factory FSx for ONTAP user interface. For more information about volume tiering policies, refer to Volume storage capacityin AWS FSx for NetApp ONTAP documentation.

   e. **Max transfer rate**: Select **Limited** and enter the max transfer limit in MB/s. Alternatively, select **Unlimited**.

      Without a limit, network and application performance might decline. Alternatively, we recommend an unlimited transfer rate for FSx for ONTAP file systems for critical workloads, for example, those that are used primarily for disaster recovery.

8. Under Replication settings, provide the following:
   a. **Replication interval**: Select the frequency that snapshots are transferred from the source volume to the target volume.
   b. **Long-term retention**: Optionally, enable snapshots for long-term retention.

      If you enable long-term retention, then select an existing policy or create a new policy to define the snapshots to replicate and the number to retain.

      i. For **Choose an existing policy**, select an existing policy from the dropdown menu.
      ii. For **Create a new policy**, provide the following:
         A. **Policy name**: Enter a policy name.
         B. **Snapshot policies**: In the table, select the snapshot policy frequency and the number of copies to retain. You can select more than one snapshot policy.
9. Select **Create**.

Result

All volumes within the storage VM are replicated to the target file system.

Configure and update Active Directory for a storage VM

Configure and update Active Directory for a storage VM in an FSx for ONTAP file system in NetApp Workload Factory.

About this task

The same steps apply for configuring and updating Active Directory for a storage VM.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the storage VM to update and then select **Manage**.
5. In the file system overview under Storage VMs, select **Manage**.
6. From the Manage storage VMs screen, select the actions menu of the storage VM to configure Active Directory for, then select **Basic actions** > **Manage AD configuration**.
7. On the Manage AD configuration page, provide the following:
   a. **Active Directory domain to join**: Enter the fully qualified domain name (FQDN) of your Active Directory.
   b. **DNS IP addresses**: Enter up to three IP addresses separated by commas.
   c. **SMB server NetBIOS name**: Enter the SMB server NetBIOS name of the Active Directory computer object to create for your storage VM. This is the name of this SVM in Active Directory.
   d. **User name**: Enter the user name of the service account in your existing Active Directory.

      Do not include a domain prefix or suffix. For `EXAMPLE\ADMIN`, use `ADMIN`.

   e. **Password**: Enter the password for the service account.
   f. **Organization unit (OU)**: Enter the organization unit.

      The OU is the distinguished path name of the organizational unit to which you want to join your file system.

   g. **Delegated administrators group**: Optionally, enter the delegated file system administrators group.

      The delegated administrators group is the name of the group in your Active Directory that can administer your file system.

      If you are using AWS Managed Microsoft AD, you must specify a group such as AWS Delegated FSx Administrators, AWS Delegated Administrators, or a custom group with delegated permissions to the OU.

      If you are connecting to a self-managed AD, use the name of the group in your AD. The default group is `Domain Admins`.

8. Select **Apply**.

Manage storage VM tags in NetApp Workload Factory

Tags can help you categorize your resources. You can add, edit, and remove tags for a storage VM at any time in NetApp Workload Factory.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the storage VM to update and then select **Manage**.
5. In the file system overview under Storage VMs, select **Manage**.
6. From the Manage storage VMs screen, select the actions menu of the storage VM to edit tags for, then select **Basic actions** > **Edit storage VM tags**.
7. On the Edit storage VM tags page, add, edit, or remove tags.

   The maximum number of tags you can apply to a storage VM is 50.

8. Select **Apply**.

Reset the storage VM password in NetApp Workload Factory

Reset the password for a storage VM in NetApp Workload Factory when necessary.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the storage VM password to reset and then select **Manage**.
5. In the file system overview under Storage VMs, select **Manage**.
6. From the Manage storage VMs screen, select the actions menu of the storage VM to reset the password for, then select **Basic actions** > **Reset password**.
7. In the Reset password dialog, provide the following:
   a. **New password**: Enter a new password for the storage VM.
   b. **Confirm password**: Enter the new password again to confirm.
8. Select **Apply**.

Delete a storage VM in NetApp Workload Factory

Delete a storage VM (SVM) that you no longer require from an FSx for ONTAP file system configuration.

Before you begin

Review the following before you delete a storage VM:

- Make sure that no applications are accessing the data in the SVM.
- Delete all non-root volumes attached to the SVM.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. In the file system overview under Storage VMs, select **Manage**.
6. On the Manage storage VMs screen, select the actions menu of the storage VM to delete.
7. Select **Delete storage VM**.
8. In the Delete storage VM dialog, type “delete” to delete the storage VM.
9. Select **Delete** to confirm.

Data protection administration

Snapshots

Manage snapshot policies

Manage snapshot policies for FSx for ONTAP volumes in Workload Factory. A snapshot policy defines how the system creates snapshots for a volume.

About this task

Snapshot management operations like assigning, changing, and deleting snapshot policies for volumes in an FSx for ONTAP file system are managed at the storage VM level. Snapshot policies can be shared with a single storage VM or with all storage VMs.

Some management tasks require you to associate a link with the FSx for ONTAP file system. Learn about Workload Factory links.

By default, every volume is associated with the file system’s `default` snapshot policy. We recommend using this policy for most workloads.

Change a snapshot policy

You can change the snapshot policy name, schedule, and number of copies to retain, and enable or disable immutable snapshots. It isn’t possible to enable or disable policy sharing across storage VMs. This option is available only during snapshot policy creation.

Before you begin

To display existing snapshot policies, you must associate a link. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.

3. In the **FSx for ONTAP** tab, select the actions menu of the file system and then select **Manage**.
4. In the file system overview, select the **Storage VMs** tab.
5. From the **Storage VMs** tab, select the actions menu for the storage VM containing the volume to protect with scheduled snapshots, then **Advanced actions**, and then **Manage snapshot policies**.
6. On the Snapshot policy management page, select the actions menu for the snapshot policy to change and then select **Edit**.
7. In the Edit snapshot policy dialog, make the necessary changes to the snapshot policy.
8. Select **Apply**.

Result

The snapshot policy is updated.

Enable immutable snapshots

Lock snapshots to prevent them from being deleted during the retention period.

Before you begin

You must associate a link to enable immutable snapshots. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. In the **FSx for ONTAP** tab, select the actions menu of the file system that contains the volume to lock snapshots for and then select **Manage**.
4. In the file system overview, select the **Volumes** tab.
5. From the **Volumes** tab, select the actionsenu for the volume to protect.
6. Select **Data protection actions**, **Snapshots**, then **Make a snapshot immutable**.
7. In the Make a snapshot immutable dialog, do the following:
   a. **Snapshot name**: Select the snapshot to lock.
   b. Set the **Retention period** in number of hours, days, months, or years.
   c. Accept the statement.
8. Select **Apply**.

Result

The volume snapshot is now locked.

Assign a snapshot policy to a volume

You can assign a snapshot policy to a single volume to create scheduled snapshots for the volume.

Before you begin

You must associate a link to assign a snapshot policy. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. In the **FSx for ONTAP** tab, select the actions menu of the file system that contains the volume to assign a snapshot policy to and then select **Manage**.
4. In the file system overview, select the **Storage VMs** tab.
5. From the **Storage VMs** tab, select the actions menu for the storage VM containing the volume to protect with scheduled snapshots, then **Advanced actions**, and then **Manage snapshot policies**.
6. On the Snapshot policy management page, select the actions menu of the snapshot policy and then select **Assign policy to volume**.
7. In the Assign snapshot policy dialog, select a snapshot policy to assign to the volume and review the policy schedule.

   If the policy contains immutable snapshots, and you want use it, accept the statement.
8. Select **Assign**.

Result

The snapshot policy is assigned to the volume.

Remove a snapshot policy from a volume

Remove a snapshot policy from a volume because you no longer want snapshots of the volume or because you want to delete a snapshot policy that is assigned to multiple volumes. To delete a snapshot policy that is assigned to more than one volume, you must manually remove it from all volumes.

Before you begin

You must associate a link to remove a snapshot policy. Learn how to associate an existing link or to create and associate a new link. After the link associates, return to this operation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. In the **FSx for ONTAP** tab, select the actions menu of the file system that contains the volume to assign a snapshot policy to and then select **Manage**.
4. In the file system overview, select the **Storage VMs** tab.
5. From the **Storage VMs** tab, select the actions menu for the storage VM containing the volume to protect with scheduled snapshots, then **Advanced actions**, and then **Manage snapshot policies**.
6. On the Snapshot policy management page, select the actions menu of the snapshot policy and then select **Assign policy to volume**.
7. In the Assign snapshot policy dialog, select **None** to remove the snapshot policy.
8. Select **Assign**.

Result

The snapshot policy is removed from the volume.

Delete a snapshot policy

Delete a snapshot policy when you no longer need it.

When a snapshot policy is assigned to more than one volume, you must manually remove it from all volumes to delete the snapshot policy. Alternatively, you can assign a different snapshot policy to the volumes.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume and then select **Manage**.
5. In the file system overview, select the **Storage VMs** tab.
6. From the **Storage VMs** tab, select the actions menu of the storage VM with the snapshot policy to delete, then **Advanced actions**, and then **Manage snapshot policies**.
7. On the Snapshot policy management page, select the actions menu for the snapshot policy to delete and then select **Delete**.
8. In the Delete dialog, select **Delete** to delete the policy.

Enable and edit snapshots for long-term retention

In NetApp Workload Factory, you can enable snapshots for long-term retention, which lets you replicate specific snapshots for long-term disaster recovery.

Long-term retention enables business services to continue operating even in the event of a complete site failure, supporting transparent failover of applications using a secondary copy.

The same steps apply for enabling and editing snapshots for long-term retention.

When an on-premises ONTAP cluster is the target for the replication relationship, changing snapshots for long-term retention isn't supported.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actionsenu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship schedule to change.
7. Select **Edit long-term retention**.
8. In the Edit long-term retention dialog, enable or disable snapshots for long-term retention.
9. If you select to disable snapshots for long-term retention, select **Apply** to complete this operation.
10. If you select to enable snapshots for long-term retention, choose between selecting an existing policy or creating a new policy.
    a. To use an existing policy, select it from the dropdown menu.

b. To create a new policy, provide the following:
   i. **Policy name**: Enter a policy name.
   ii. **Snapshot policies**: Select one or more snapshot policies.
   iii. **Copies to retain**: Enter the number of snapshot copies to retain on the target file system.
11. Select **Apply**.

Manage snapshots of an FSx for ONTAP volume

Edit snapshot settings, enable directory access, and delete snapshots to manage your snapshots and data protection in Workload Factory.

Edit a snapshot

Edit the name, label, and retention period of a snapshot. If the snapshot isn't already immutable, you can make the snapshot immutable.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume and then select **Manage**.
5. In the file system overview, select the **Volumes** tab.
6. From the **Volumes** tab, select the actions menu for the volume with the snapshot to edit.
7. Select **Data protection actions** and then **Manage snapshots**.
8. From the Manage snapshots page, select the actions menu for the snapshot to edit, and then select **Edit**.
9. In the Edit a snapshot dialog, you may edit the following:
   a. Change the name.
   b. Change the label.
   c. Change the retention period.
   d. Optional: **Make this snapshot immutable** to prevent the snapshot from being deleted during the retention period.

      If the snapshot is already immutable, you can't edit this setting.

      Accept the statement regarding immutable snapshots.
10. Select **Apply**.

Access a snapshot

Enable snapshot directory access to give users the ability access snapshots autonomously.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.

3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume and then select **Manage**.
5. In the file system overview, select the **Volumes** tab.
6. From the **Volumes** tab, select the actions menu for the volume with the snapshot to access.
7. Select **Data protection actions** and then **Manage snapshots**.
8. From the Manage snapshots page, select the actions menu for the snapshot to access, and then select **Access**.
9. In the Access snapshot dialog, select to **Enable snapshot directory access** to access this volume snapshot and all snapshots of the volume.
    - For NFS volumes: Select **NFS access path** to view the NFS path for the snapshot.
    - For SMB/CIFS volumes: Select **SMB access path** to view the SMB path for the snapshot.
10. Copy the access path.
11. Select **Apply**.

Restore data from a snapshot

You have the option to restore data from a snapshot to an existing volume or to a new volume.

Restore a volume from a snapshot

Delete a snapshot

Delete a snapshot to free up space.

Immutable snapshots cannot be deleted until the retention period ends.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system with the volume and then select **Manage**.
5. In the file system overview, select the **Volumes** tab.
6. From the **Volumes** tab, select the actions menu for the volume with the snapshot to delete.
7. Select **Data protection actions** and then **Manage snapshots**.
8. From the Manage snapshots page, select the actions menu for the snapshot to delete, and then select **Delete**.
9. In the Delete snapshot dialog, type "delete".
10. Select **Delete** to confirm deletion.

Related information

- Create a snapshot
- Create a snapshot policy
- Restore a volume from a snapshot

Backups

Manage the backup schedule for an FSx for ONTAP file system

Manage the backup schedule for an FSx for ONTAP file system in NetApp Workload Factory.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update the backup schedule for and then select **Manage**.
5. Under Information, select the pencil icon next to **FSx for ONTAP backup**. The pencil icon appears next to the dropdown arrow when the mouse hovers over the **FSx for ONTAP backup** row.
6. In the **FSx for ONTAP backup** dialog, provide the following:
   a. **Daily automatic backups**: Enable or disable the feature. If you disable the feature, select **Apply**. If you enable the feature, complete the following steps.
   b. **Automatic backup retention period**: Enter the number of days to retain automatic backups.
   c. **Daily automatic backup window**: Select either **No preference** (a daily backup start time is Selected for you) or **Select start time for daily backups** and specify a start time.
   d. **Weekly maintenance window**: Select either **No preference** (a weekly maintenance window start time is selected for you) or **Select start time for 30-minute weekly maintenance window** and specify a start time.
7. Select **Apply**.

Replication

Replicate data protection volumes in NetApp Workload Factory

Replicate data protection volumes, or cascade the replication of volume data, to extend data protection to tertiary systems or migrate your data.

About this task

NetApp Workload Factory supports replicating data protection volumes, also called *cascade deployments*. A *cascade deployment* consists of a chain of relationships in which a source volume is mirrored to a secondary volume (first hop), and the secondary volume is mirrored to a tertiary volume (second hop). If the secondary volume becomes unavailable, you can synchronize the relationship between the primary and tertiary volumes without performing a new baseline transfer.

This feature is supported for FSx for ONTAP file systems with ONTAP version 9.6 and higher. Refer to ONTAP documentation for compatible ONTAP versions.

Learn more about how cascade deployments work.

Before you begin

Consider the following before you begin:

- Be aware that volumes that are part of a cascade configuration can take longer to resynchronize.
- If the source volume of the relationship is a data protection volume and is a target of another relationship, reversing the replication relationship isn't supported.
- One replica of a data protection volume (or a second hop) is supported. It isn't considered best practice to create a second replica of a data protection volume (or a third hop).

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system that contains the volume(s) to replicate and then select **Manage**.
5. From the file system overview, select the **Volumes** tab.
6. In the Volumes table, select one or more data protection volumes (DP/replicated volumes), and then select **Replicate data**.
7. On the Replicate data page, under Replication target, provide the following:
   a. **FSx for ONTAP file system**: Select credentials, region, and FSx for ONTAP file system name for the target FSx for ONTAP file system.
   b. **Storage VM name**: Select the storage VM from the dropdown menu.
   c. **Volume name**: The target volume name is generated automatically with the following format `{OriginalVolumeName}_copy`. You can use the auto-generated volume name or enter another volume name.
   d. **Use case**: Select one of the following use cases for the replication. Depending on the selected use case, Workload Factory fills in the form with recommended values in accordance with best practices. You can accept the recommended values or make changes as you complete the form.
      - Migration: transfers your data to the target FSx for ONTAP file system
      - Hot disaster recovery: ensures high availability and rapid disaster recovery for critical workloads
      - Cold or archive disaster recovery:
        - Cold disaster recovery: uses longer recovery time objectives (RTO) and recovery point objects (RPO) to lower costs
        - Archive: replicates data for long-term storage and compliance
      - Other
   e. **Tiering policy**: Select the tiering policy for the data stored in the target volume. The tiering policy defaults to the recommended tiering policy for the use case you selected.

      Balanced (Auto) is the default tiering policy when creating a volume using the Workload Factory console. For more information about volume tiering policies, refer to Volume storage capacity in AWS FSx for NetApp ONTAP documentation. Note that Workload factory uses use-case based names in the Workload Factory console for tiering policies and includes FSx for ONTAP tiering policy names in parentheses.

      If you selected the migration use case, Workload Factory automatically selects to copy the tiering policy of source volume to the target volume. You can deselect to copy the tiering policy and select a tiering policy which applies to the volume selected for replication.

f. **Max transfer rate**: Select **Limited** and enter the max transfer limit in MB/s. Alternatively, select **Unlimited**.

   Without a limit, network and application performance may decline. Alternatively, we recommend an unlimited transfer rate for FSx for ONTAP file systems for critical workloads, for example, those that are used primarily for disaster recovery.

8. Under Replication settings, provide the following:
   a. **Replication interval**: Select the frequency that snapshots are transferred from the source volume to the target volume.
   b. **Long-term retention**: Optionally, enable snapshots for long-term retention. Long-term retention enables business services to continue operating even through a complete site failure, supporting applications to fail over transparently using a secondary copy.

      Replications without long-term retention use the *MirrorAllSnapshots* policy. Enabling long-term retention assigns the *MirrorAndVault* policy to the replication.

      If you enable long-term retention, then select an existing policy or create a new policy to define the snapshots to replicate and the number to retain.

      Matching source and target labels are required for long-term retention. If desired, Workload factory can create missing labels for you.

      - **Choose an existing policy**: select an existing policy from the dropdown menu.
      - **Create a new policy**: provide the following:
        - **Policy name**: Enter a policy name.
        - Optional: Enable immutable snapshots.
          - Select **Enable immutable snapshots** to prevent snapshots taken in this policy from being deleted during the retention period.
          - Set the **Retention period** in number of hours, days, months, or years.
        - **Snapshot policies**: In the table, select the snapshot policy frequency and the number of copies to retain. You can select more than one snapshot policy.
9. Select **Create**.

Result

The replicated volume or volumes replicate and appear in the **Replication relationships** tab in the target FSx for ONTAP file system.

Reverse a replication relationship in NetApp Workload Factory

Reverse a replication relationship in NetApp Workload Factory so that the target volume becomes the source volume.

Reverse operations are supported for the following:

- Two FSx for ONTAP file systems
- One FSx for ONTAP file system and one on-premises ONTAP cluster

After you stop replication and make changes to the target volume, you can replicate those changes back to the

source volume. This process is common in a disaster recovery scenario in which you operate on the target volume for a while and want to switch roles of the volumes.

About this task

When you reverse and resume a replication, it switches the source and target roles of your volumes; the target volume becomes the new source volume, and the source volume becomes the new target volume. The reverse operation also overwrites the contents of the new target volume with the contents of the new source volume. If you reverse a replication twice, the original replication direction re-establishes.

Any data written to the original source volume between the last data replication and the time that the source volume is disabled is not preserved.

Before you begin

Make sure that you know the current and future roles of your source and target volumes because changes on the new target volume are overwritten with the new source volume. If used incorrectly, you can experience unintended data loss.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship to reverse.
7. Select **Reverse relationship**.
8. In the Reverse relationship dialog, select **Reverse**.

Change the replication schedule of a source volume

Change the replication schedule of the source volume in a replication relationship in NetApp Workload Factory.

Choose how frequently snapshots from the source volume are transferred to the replicated volume to match your required point objectives (RPOs).

When an on-premises ONTAP cluster is the target for the replication relationship, changing the replication schedule isn't supported.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actionsenu of the replication relationship schedule to change.
7. Select **Edit replication interval**.

8. In the Edit replication interval dialog, select the frequency of snapshot transfer from the source volume. You may select between the following frequencies:
    - Every 5 minutes
    - Hourly
    - Every 8 hours
    - Daily
    - Weekly
9. Select **Apply**.

Limit the max transfer rate of a replication relationship

Limit the max transfer rate of a replication relationship in NetApp Workload Factory. An unlimited transfer rate might negatively impact the performance of other applications and your network.

About this task

Limiting the max transfer rate is optional but recommended. Without a limit, network and application performance might decline.

Alternatively, we recommend an unlimited transfer rate for FSx for ONTAP file systems for critical workloads, for example, those that are used primarily for disaster recovery.

Before you begin

Consider how much bandwidth to allocate for replication.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actionsenu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actionsenu of the replication relationship to limit the max transfer rate for.
7. Select **Edit max transfer rate**.
8. In the Edit max transfer rate dialog, select **Limited** and enter the max transfer limit in MB/s.

    Alternatively, select **Unlimited**.

9. Select **Apply**.

Update snapshot data in a replication relationship

A replication relationship has a set replication schedule, but you can manually update snapshot data transferred between source and target volumes in NetApp Workload Factory at any time.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship to update.
7. Select **Update now**.
8. In the Update dialog, select **Update now**.

Pause and resume a replication relationship in NetApp Workload Factory

Pause a replication relationship to stop scheduled replication updates from the source volume to the target volume. The target volume transitions from read-only to read/write. Both volumes continue to share the latest replication snapshot as a new baseline for later resynchronization.

About this task

When paused, the replication relationship between source and target volume continues to exist. Data transfers pause and the volumes become independent. To re-enable the transfer of changes from source volume to destination volume, resume the replication.

When you resume a replication, all the changes to the target volume are undone and NetApp Workload Factory re-enables the replication. The target volume transitions from read/write to read-only, and receives updates from the source volume at the scheduled replication interval again. When you resume a replication relationship, the target volume reverts back to the latest initial replication snapshot, at which point, the volume replication process starts over.

Before you begin

If you pause when a transfer is in progress, the transfer is not affected, and the relationship becomes "Quiescing" until the transfer completes. If the current transfer aborts, it is now a future transfer and will not restart.

Pause a replication relationship

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship to pause.
7. Select **Pause (Quiesce)**.
8. In the **Quiesce relationship** dialog, select **Quiesce**.

Result

The relationship pauses and its status shows as "Paused".

Resume a paused replication relationship

When you resume a replication relationship, any changes to the destination volume while the replication was stopped are deleted.

> Any data written to the original source volume between the last data replication and the time that the source volume is disabled is not preserved.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship to resume.
7. Select **Resume**.
8. In the Resume relationship dialog, select **Resume**.

Result

The relationship resumes and its status shows as "Replicated".

Stop a replication relationship in NetApp Workload Factory

Stop a replication relationship in NetApp Workload Factory. When you stop a replication relationship, scheduled replication updates from the source volume to the target volume pause. The target volume transitions from read-only to read/write.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship to stop.
7. Select **Break**.
8. In the Break replication dialog, select **Break**.

Result

The replication status of the volume changes to **Broken**. The target volume becomes writable.

Delete a replication relationship in NetApp Workload Factory

Delete a replication relationship in NetApp Workload Factory. When you delete a replication relationship, it removes the replication relationship between the source and target volume. After the replication relationship deletes, both volumes continue to exist

independently with the current data they contain.

When you delete a replication relationship, FSx for ONTAP also deletes the common replication snapshots of the source and target volume.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update and then select **Manage**.
5. From the file system overview, select the **Replication relationships** tab.
6. In the Replication relationships tab, select the actions menu of the replication relationship to delete.
7. Select **Delete**.
8. In the Delete relationship dialog, select **Delete**.

Performance administration

Provision SSD IOPS for an FSx for ONTAP file system

Automatically provision or manually provision SSD IOPS for an FSx for ONTAP file system in NetApp Workload Factory.

About this task

You can enable automatic SSD IOPS provisioning for an FSx file system or manually provision IOPS.

Automatically provisioned IOPS are calculated as three IOPS per GiB.

If you manually provision IOPS, you might need to increase IOPS before increasing file system capacity.

For information about IOPS limits, refer to Quotas in AWS FSx for NetApp ONTAP documentation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to provision IOPS for and then select **Manage**.
5. Under Information, select the pencil icon that appears next to the dropdown arrow when the mouse hovers over the **IOPS allocation** row.
6. In the Provisioned IOPS dialog, select **Automatic** or **User provisioned**.
7. If you select **User provisioned**, enter the desired **IOPS value**.
8. Select **Apply**.

Update throughput capacity for a file system

Update throughput capacity for an FSx for ONTAP file system in NetApp Workload Factory as needed.

For throughput capacity limits, refer to Quotas in AWS FSx for NetApp ONTAP documentation.

Steps

1. Log in using one of the console experiences.
2. Select the menu and then select **Storage**.
3. From the Storage menu, select **FSx for ONTAP**.
4. From **FSx for ONTAP**, select the actions menu of the file system to update throughput capacity for and then select **Manage**.
5. Under Information, select the pencil icon next to **Throughput capacity**. The pencil icon appears next to the drop down arrow when the mouse hovers over the **Throughput capacity** row.
6. In the Throughput capacity dialog, select the throughput capacity you need.
7. Select **Apply** to save the changes.

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