NetApp

Amazon FSx for NetApp ONTAP documentation

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NetApp
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Amazon FSx for NetApp ONTAP documentation

Release notes

What's new

Learn what's new with Amazon FSx for NetApp ONTAP.

1 September 2024

Read mode support for storage management

Read mode is available for storage management in Workload Factory. Read mode enhances the experience of basic mode by adding read-only permissions so that the Infrastructure-as-Code templates are filled with your specific variables. The Infrastructure-as-Code templates can be executed directly from your AWS account without providing any modify permissions to Workload Factory.

Learn more about read mode

Backup before volume deletion support

You can now back up a volume before deleting it. The backup will remain in the file system until deleted.

Delete a volume

4 August 2024

Terraform support

You can now use Terraform from the Codebox to deploy file systems and storage VMs.

- Create a file system
- Create a storage VM
- Use Terraform from Codebox

Throughput and IOPS recommendations in the storage calculator

The storage calculator makes FSx for ONTAP file system configuration recommendations for throughput and IOPS based on AWS best practices, which provides you with optimal guidance for your selections.

7 July 2024

Initial release of Workload Factory for Amazon FSx for NetApp ONTAP

Amazon FSx for NetApp ONTAP is now generally available in Workload Factory.

Known limitations

Known limitations identify platforms, devices, or functions that are not supported by this release of the product in Workload Factory, or that do not interoperate correctly with it. Review these limitations carefully.

Link

A link is required to complete some operations like replication in the Workload Factory user interface.

Storage efficiency

Storage efficiency cannot be disabled or enabled after volume creation.

Throughput capacity region support

Scale-up deployments

The following regions support up to 4 GB/s maximum throughput capacity for scale-up deployments: US East (Ohio) Region, US East (N. Virginia) Region, US West (Oregon) Region, and Europe (Ireland).

Scale-out deployments

The following regions support up to 3 and 6 GB/s maximum throughput capacity for scale-out deployments: US East (N. Virginia), US East (Ohio), US West (Oregon), Europe (Ireland), and Asia Pacific (Sydney).

Capacity management

- The volume autogrow feature isn't currently supported for the iSCSI protocol.
- When the automatic capacity management feature is running, manual capacity increase isn't allowed.
- Disabling the automatic capacity management feature is only possible with the same permissions used to enable it.

Storage VMs

The number of storage VMs is limited per SKU. Creating storage VMs beyond the limitation isn't supported in Workload Factory.[1]

Refer to Managing FSx for ONTAP storage virtual machines in AWS documentation for the maximum number of SVMs per file system.

iSCSI protocol support

- The iSCSI protocol is only supported for scale-up deployments. [1]
- The iSCSI protocol is only available for FlexGroup volumes. [1]
- Only a single LUN can be configured per volume.

Region support

- Canada West (Calgary) region isn't currently supported.

Data protection

- Snapshots cannot be deleted.
- Only replication between FSx for ONTAP file systems is supported.

- When you replicate a file system, all volumes in the file system use the same replication policy.
- Only the last snapshot is available for restore.

Storage savings calculator

The Storage savings calculator doesn't calculate cost savings for the following configurations:

- FSx for Windows File Server: HDD storage type
- Elastic Block Store (EBS): st1, sc1, and standard volume types
- Elastic File System (EFS): Bursting throughput mode

Note:

1. Applies to Amazon FSx for NetApp ONTAP

Get started

Learn about Workload Factory for Amazon FSx for NetApp ONTAP

Amazon FSx for NetApp ONTAP is a fully managed, cloud-based data storage service that provides advanced data management capabilities and highly scalable performance. FSx for ONTAP allows you to create and manage file systems as the storage backend for all your workloads within BlueXP Workload Factory.

FSx for ONTAP provides the same features, performance, and administrative capabilities NetApp customers use on premises today, with the simplicity, agility, security, and scalability of a native AWS service.

FSx for ONTAP is the *Storage* component in Workload Factory.

Features

FSx for ONTAP offers the following features:

- **Fully-managed service**: provides a fully-managed service integrated with the Workload Factory console.
- **High availability**: provides high availability for each FSx for ONTAP file system, supporting Single and Multiple Availability Zones deployments.
- **Automated snapshots**: protects data with automated, efficient snapshots, which are near instantaneous, space efficient point-in-time read-only copies of the file system or volumes.
- **Volume replication**: provides disaster recovery with cross-region replication across Amazon Web Services.
- **Efficient backups**: provides an additional later of protection with a copy of the data in another region. This provides an extra layer of protection in case of emergencies.
- **Fast cloning**: accelerates application development with fast cloning.
- **Multi-protocol support**: supports Network File System (NFS), Server Message Block (SMB), and Internet Small Computer Systems Interface (iSCSI) protocols.
- **High throughput**: delivers high throughput performance to ensure low latencies for workloads running on top of FSx for ONTAP file systems.
- **In-memory cache and NVMe cache**: incorporates a unique in-memory cache and NVMe cache, which further enhances the performance of frequently accessed data.
- **Hundreds of thousands of IOPS**: provides hundreds of thousands of IOPS with SSD disks, ensuring that your storage and workloads receive timely results.
- **Thin Provisioning**: allows capacity provisioning in advance, saving costs until more capacity is needed.
- **Data deduplication and compression**: eliminates duplicate data blocks and compresses data blocks to reduce the amount of physical storage that is required for FSx for ONTAP file systems resulting in cost savings.
- **Data tiering**: allows storage cost reduction by moving less frequently accessed data from the primary, high performance SSD storage tier to the secondary capacity pool storage tier.

Additional features in Workload Factory

- **Storage cost comparison calculator**: Compares your Amazon Elastic Block Store (EBS), Elastic File System (EFS) and FSx for Windows File Server storage costs with FSx for ONTAP. From the calculator, you can view how FSx for ONTAP storage configurations offer potential savings and plan your move to FSx for ONTAP storage.

- **Workload Factory user interface**: Provides *Quick create* and *Advanced create* deployment mode options. Quick create includes AWS, NetApp, and industry standard best practices for your storage configurations.

- **Codebox**: provides developers with a code viewer for FSx for ONTAP operations, code templates for copy and download, and an automation catalog for code re-use.

Tools to use Workload Factory

You can use BlueXP Workload Factory with the following tools:

- **Workload Factory console**: the Workload Factory console provides a visual interface that gives you a holistic view of your applications and projects

- **REST API**: Workload Factory REST APIs let you deploy and manage your FSx for ONTAP file systems and other AWS resources

- **CloudFormation**: AWS CloudFormation code lets you perform the actions you defined in the Workload Factory console to model, provision, and manage AWS and third-party resources from the CloudFormation stack in your AWS account.

- **Terraform BlueXP Workload Factory Provider**: Terraform lets you build and manage infrastructure workflows generated in the Workload Factory console.

Cost

Your FSx for ONTAP account is maintained by AWS and not by Workload Factory. Refer to Pricing for Amazon FSx for NetApp ONTAP.

Supported regions

View supported Amazon regions.

Getting help

Amazon FSx for NetApp ONTAP is an AWS first-party solution. For questions or technical support issues associated with your FSx for ONTAP file system, infrastructure, or any solution using this service, use the Support Center in your AWS Management Console to open a support case with AWS. Select the "FSx for ONTAP" service and appropriate category. Provide the remaining information required to create your AWS support case.

For general questions about Workload Factory or Workload Factory applications and services, refer to Get help for FSx for ONTAP for Workload Factory.

Quick start for Workload Factory for Amazon FSx for NetApp ONTAP

With Workload Factory for Amazon FSx for NetApp ONTAP, you can get started immediately in *basic* mode.

If you'd like to use Workload Factory to create a file system, manage resources, and more, you can get started in a few steps. In this case, you need an AWS account to get started.

Follow these steps to get started.

1 **Log in to Workload Factory**

You'll need to set up an account with Workload Factory and log in

2 **Add credentials and permissions**

Choose between *basic* and *automate* operational modes

If you choose to operate in *basic* mode, you don't need to go any further. You can start using Workload Factory for FSx for ONTAP to copy partially completed code samples.

If you operate in *automate* mode, you'll need to add credentials to an account manually which includes selecting workload capabilities, such as Databases and AI, and creating the IAM policies to ensure you have the correct permissions for operating in *automate* mode.

3 **Create a file system**

You'll create an FSx file system to begin managing your storage and FSx for ONTAP resources in Workload Factory. In the Workload Factory console, in Storage, click **Create file system**. Learn how to create a file system.

You can also start with the storage savings calculator to compare the costs of your Amazon Elastic Block Store, Elastic File System, and FSx for Windows File Server storage environments to that of FSx for ONTAP. Explore savings with the storage savings calculator.

What's next

With a file system in your Storage inventory, you can create volumes, manage your FSx for ONTAP file system, and set up data protection for your resources.

Create an FSx for ONTAP file system

Using Workload Factory you can create an FSx for ONTAP file system to add and manage volumes and additional data services.

About this task

A storage VM is created when you create a file system.

Before you begin

Before creating your FSx for ONTAP file system, you will need:

- The ARN of an IAM role that gives Workload Factory the permissions needed to create an FSx for ONTAP file system. Learn how to grant permissions to an AWS account.
- The region and VPC information for where you will create the FSx for ONTAP instance.

Create an FSx for ONTAP file system

You can create an FSx for ONTAP file system using *Quick create* or *Advanced create*. You can also use the following tools available in the Codebox: REST API, CloudFormation, and Terraform. Learn how to use Codebox for automation.

> ⓘ When using Terraform from Codebox, the code you copy or download hides `fsxadmin` and `vsadmin` passwords. You'll need to re-enter the passwords when you run the code.

Quick create

Quick create enables you to use a recommended best-practice configuration. You can change most settings after you create an FSx for ONTAP file system.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Create FSx for ONTAP**.

3. On the Create FSx for ONTAP page, select **Quick create**.

   You can also load a saved configuration.

4. Under File system general configuration, provide the following:

   a. **AWS credentials**: Select to add AWS credentials in Workload Factory or continue without credentials.

   b. **File system name**: Enter a name for the file system.

   c. **Deployment topology**: Select a deployment topology.

      ▪ Scale-up topology is where one file system is used for data distribution and can increase in size to accommodate data growth.

      ▪ Scale-out topology is where more than one file system is used for data distribution.

   d. **HA pairs**: Enter the number of HA pairs.

      ▪ For scale-up deployments, you can only have one HA pair.

      ▪ For scale-out deployments, you can have between two and twelve HA pairs.

   e. **Deployment type**: Select a deployment type.

      ▪ Single Availability Zone (Single-AZ) deployment: ensures availability by monitoring for hardware failures and automatically replacing infrastructure components in the event of a failure. Achieves high durability by automatically replicating your data within an Availability Zone to protect it from component failure.

      ▪ Multiple Availability Zones (Multi-AZ) deployment: provides continuous availability to data even when an Availability Zone is unavailable. Multi-AZ file systems support all the availability and durability features of Single-AZ file systems. A Multi-AZ file system is designed for business-critical production workloads that require high availability to shared ONTAP file data and need storage with built-in replication across Availability Zones.

   f. **Tags**: Optionally, you can add up to 50 tags.

5. Under **Network & security**, in the **Region & VPC** field, select the region and VPC for the file system.

6. Under **File system details**, provide the following:

   a. **SSD storage capacity**: Enter the storage capacity and select the storage capacity unit.

   b. **ONTAP credentials**: Enter your ONTAP user name and password.

   c. **SMB/CIFS setup**: Optional. If you plan to use SMB/CIFS protocol to access volumes, you must configure the Active Directory for the storage VM during file system creation. Provide the following details for the storage VM that is created for this file system.

      i. **Active Directory domain to join**: Enter the fully qualified domain name (FQDN) for the Active Directory.

      ii. **DNS IP addresses**: Enter up to three DNS IP addresses separated by commas.

iii. **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 storage VM in the Active Directory.

iv. **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`.

v. **Password**: Enter the password for the service account.

vi. **Organization unit**: Optionally, enter the name of the Organizational Unit where you intend to create the computer account for FSx for ONTAP. The OU is the distinguished path name of the organizational unit to which you want to join the file system.

vii. **Delegated administrators group**: Optionally, enter 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 joining to a self-managed AD, use the name of the group in your AD. The default group is `Domain Admins`.

7. Open the **Summary** to review the configuration that you defined. If needed, you can change any setting at this time before saving or creating the file system.

8. Save or create the file system.

If you created the file system, you can now view the FSx for ONTAP file system in the **Inventory** page.

Advanced create

With Advanced create, you set all of the configuration options, including availability, security, backups, and maintenance.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Create FSx for ONTAP**.

3. On the Create FSx for ONTAP page, select **Advanced create**.

You can also load a saved configuration.

4. Under File system general configuration, provide the following:

   a. **AWS credentials**: Select to add AWS credentials in Workload Factory or continue without credentials.

   b. **File system name**: Enter a name for the file system.

   c. **Deployment topology**: Select a deployment topology.

      ▪ Scale-up topology is where one file system is used for data distribution and can increase in size to accommodate data growth.

      ▪ Scale-out topology is where more than one file system is used for data distribution.

   d. **HA pairs**: Enter the number of HA pairs.

      ▪ For scale-up deployments, you can only have one HA pair.

- For scale-out deployments, you can have between two and twelve HA pairs.

   e. **Deployment type**: Select a deployment type.

   - Single Availability Zone (Single-AZ) deployment: ensures availability by monitoring for hardware failures and automatically replacing infrastructure components in the event of a failure. Achieves high durability by automatically replicating your data within an Availability Zone to protect it from component failure.

   - Multiple Availability Zones (Multi-AZ) deployment: provides continuous availability to data even when an Availability Zone is unavailable. Multi-AZ file systems support all the availability and durability features of Single-AZ file systems. A Multi-AZ file system is designed for business-critical production workloads that require high availability to shared ONTAP file data and need storage with built-in replication across Availability Zones.

   f. **Tags**: Optionally, you can add up to 50 tags.

5. Under Network & security, provide the following:

   a. **Region & VPC**: Select the region and VPC for the file system.

   b. **Security group**: Create or use an existing security group.

   c. **Availability Zones**: Select availability zones and subnets.

   - For Cluster configuration node 1: Select an availability zone and subnet.

   - For Cluster configuration node 2: Select an availability zone and subnet.

   d. **VPC route tables**: Select the VPC route table to enable client access to volumes.

   e. **Endpoint IP address range**: Select **Floating IP address range outside your VPC** or **Enter an IP address range** and enter an IP address range.

   f. **Encryption**: Select the encryption key name from the dropdown.

6. Under File system details, provide the following:

   a. **SSD storage capacity**: Enter the storage capacity and select the storage capacity unit.

   b. **Provisioned IOPS**: Select **Automatic** or **User-provisioned**.

   c. **Throughput capacity per HA pair**: Select throughput capacity per HA pair.

   d. **ONTAP credentials**: Enter your ONTAP user name and password.

   e. **Storage VM Credentials**: Enter your user name. Password can be specific to this file system or you case use the same password entered for ONTAP credentials.

   f. **SMB/CIFS setup**: Optional. If you plan to use SMB/CIFS protocol to access volumes, you must configure the Active Directory for the storage VM during file system creation. Provide the following details for the storage VM that is created for this file system.

      i. **Active Directory domain to join**: Enter the fully qualified domain name (FQDN) for the Active Directory.

      ii. **DNS IP addresses**: Enter up to three DNS IP addresses separated by commas.

      iii. **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 storage VM in the Active Directory.

      iv. **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`.

      v. **Password**: Enter the password for the service account.

      vi. **Organization unit**: Optionally, enter the name of the Organizational Unit where you intend to create the computer account for FSx for ONTAP. The OU is the distinguished path name of the organizational unit to which you want to join the file system.

     vii. **Delegated administrators group**: Optionally, enter 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 joining to a self-managed AD, use the name of the group in your AD. The default group is `Domain Admins`.

7. Under Backup and maintenance, provide the following:

   a. **FSx for ONTAP Backup**: Daily automatic backups are enabled by default. Disable if desired.

      i. **Automatic backup retention period**: Enter the number of days to retain automatic backups.

     ii. **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.

    iii. **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.

8. Save or create the file system.

If you created the file system, you can now view the FSx for ONTAP file system in the **Inventory** page.

What's next

With a file system in your Storage inventory, you can create volumes, manage your FSx for ONTAP file system, and set up data protection for your resources.

Use Amazon FSx for NetApp ONTAP

Explore savings in FSx for ONTAP

Explore savings for your storage workloads which use Amazon Elastic Block Store (EBS), Elastic File System (EFS), and FSx for Windows File Server against FSx for NetApp ONTAP.

Workload Factory has a built-in storage savings calculator so that you can compare your Amazon storage environments to FSx for ONTAP. You can explore savings with or without providing your AWS credentials and customize configuration settings for your storage environment. When you provide AWS credentials, you can select one or more instances of Amazon Elastic Block Store, for example, and let Workload Factory make the comparison automatically. Whether manually or automatically, the calculator determines which storage service provides the lowest cost for your storage needs.

If the storage calculator determines that the most cost-effective storage is FSx for ONTAP, you can create or save FSx for ONTAP configurations and use the Codebox to generate Infrastructure-as-Code templates regardless of the permissions you grant to Workload Factory.

Calculator options

Two calculator options are available for making the cost comparison between your systems and FSx for ONTAP — customization and automatic detection for your Amazon storage environments.

Explore savings via customization: You provide the configuration settings for a storage environment including the use case, region, number of volumes or file systems, storage amount, snapshot frequency, amount changed per snapshot, provisioned IOPS, throughput, and more.

Explore savings for detected storage environments: Workload Factory links to your existing AWS storage environments and pulls in the details to the calculator for automatic comparison. You'll need to grant automate permissions to use automatic mode. You can change the use case, but all other details are automatically determined in the calculation.

Explore savings via customization

Follow the steps under the tab for your storage selection.

Amazon Elastic Block Store (EBS)

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Explore savings** then **Amazon Elastic Block Store (EBS)**.

3. In the Storage savings calculator, provide the following details:

   a. **Use case**: Required. Select a use case from the dropdown menu. The selected use case determines the FSx for ONTAP file system characteristics for comparison.

   b. **Region**: Optional. Select the region for your EBS configuration from the dropdown menu.

   c. **Select EBS volume type**: Optional. Select the EBS volume type used for your configuration.

   d. **Number of volumes**: Optional. Enter the number of volumes in your EBS configuration.

   e. **Storage amount per volume (TiB)**: Optional. Enter the storage amount per volume in TiB.

   f. **Snapshot frequency**: Optional. Select the snapshot frequency for your EBS configuration.

   g. **Amount changed per snapshot (GiB)**: Optional. For snapshot storage only. Enter the amount changed per snapshot in GiB.

   h. **Provisioned IOPS per volume**: Optional. For gp3, io1, and io2 volumes. Enter the provisioned IOPS per volume.

   i. **Throughput (MiB/s)**: Optional. For gp3 volumes only. Enter throughput in MiB/s per volume.

Amazon FSx for Windows File Server

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Explore savings** then **Amazon FSx for Windows File Server**.

3. In the Storage savings calculator, provide the following details:

   a. **Use case**: Required. Select a use case from the dropdown menu. The selected use case determines the FSx for ONTAP file system characteristics for comparison.

   b. **Region**: Optional. Select the region for your FSx for Windows File Server configuration from the dropdown menu.

   c. **Deployment type**: Optional. Select **Single Availability Zone** or **Multiple Availability Zones**.

   d. **Storage type**: SSD storage type is selected by default.

   e. **Storage capacity (TiB)**: Optional. Enter the storage capacity for the configuration.

   f. **Deduplication savings (%)**: Optional. Enter the capacity savings percentage you expect from deduplication.

   g. **Snapshot frequency**: Optional. Select the snapshot frequency for your configuration.

   h. **Amount changed per snapshot (GiB)**: Optional. For snapshot storage only. Enter the amount changed per snapshot in GiB.

   i. **Provisioned SSD IOPS**: Optional. Enter the provisioned SSD IOPS.

   j. **Throughput (MiB/s)**: Optional. Enter throughput in MiB/s.

Amazon Elastic File System (EFS)

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Explore savings** then **Amazon Elastic File System (EFS)**.

3. In the Storage savings calculator, provide the following details:

   a. **Use case**: Required. Select a use case from the dropdown menu. The selected use case determines the FSx for ONTAP file system characteristics for comparison.

   b. **Region**: Optional. Select the region for your FSx for Windows File Server configuration from the dropdown menu.

   c. **File System Type**: Optional. Select **Regional** or **One zone**.

   d. **Storage capacity (TiB)**: Optional. Enter the storage capacity of the EFS configuration.

   e. **Data frequently accessed (%)**: Optional. Enter the percentage of data that is frequently accessed.

   f. **Throughput mode**: Optional. Select **Provisioned throughput** or **Elastic throughput**.

   g. **Throughput (MiB/s)**: Optional. Enter the throughput in MiB/s.

After you provide details for your storage system configuration, review the calculations and recommendations provided on the page.

Additionally, scroll down to the bottom of the page to **Export PDF** or **View the calculations**.

To switch to FSx for ONTAP, follow the instructions to deploy FSx for ONTAP file systems.

Explore savings for detected storage environments

Before you begin

For Workload Factory to detect Amazon Elastic Block Store (EBS), Elastic File System (EFS), and FSx for Windows File Server storage environments in your AWS account, make sure you grant *automate* permissions in your AWS account.

> ⓘ This calculator option doesn't support calculations for EBS snapshots and FSx for Windows File Server shadow copies. When exploring savings via customization, you can provide EBS and FSx for Windows File Server snapshot details.

Follow the steps under the tab for your storage selection.

Amazon Elastic Block Store (EBS)

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the Storage inventory, select the **Elastic Block Store (EBS)** tab.

4. Select the instance(s) to compare with FSx for ONTAP and click **Explore savings**.

5. The Storage savings calculator appears. The following storage system characteristics are pre-filled based on the instance(s) you selected:

    a. **Use case**: The use case for your configuration. You can change the use case if needed.

    b. **Selected volumes**: the number of volumes in the EBS configuration

    c. **Total storage amount (TiB)**: the storage amount per volume in TiB

    d. **Total provisioned IOPS**: for gp3, io1, and io2 volumes

    e. **Total throughput (MiB/s)**: for gp3 volumes only

Amazon FSx for Windows File Server

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the Storage inventory, select the **FSx for Windows File Server** tab.

4. Select the instance(s) to compare with FSx for ONTAP and click **Explore savings**.

5. The Storage savings calculator appears. The following storage system characteristics are pre-filled based on the deployment type of the instance(s) you selected:

    a. **Use case**: The use case for your configuration. You can change the use case if needed.

    b. *Selected file systems

    c. **Total storage amount (TiB)**

    d. **Provisioned SSD IOPS**

    e. **Throughput (MiB/s)**

Amazon Elastic File System (EFS)

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the Storage inventory, select the **Elastic File System (EFS)** tab.

4. Select the instance(s) to compare with FSx for ONTAP and click **Explore savings**.

5. The Storage savings calculator appears. The following storage system characteristics are pre-filled based on the instance(s) you selected:

    a. **Use case**: The use case for your configuration. You can change the use case if needed.

    b. **Total file systems**

    c. **Total storage amount (TiB)**

    d. **Total provisioned throughput (MiB/s)**

     e. **Total elastic throughput - read (GiB)**

     f. **Total elastic throughput – write (GiB)**

After you provide details for your storage system configuration, review the calculations and recommendations provided on the page.

Additionally, scroll down to the bottom of the page to **Export PDF** or **View the calculations**.

Deploy FSx for ONTAP file systems

If you'd like to switch to FSx for ONTAP to realize cost savings, click **Create** to create the file system(s) directly from the Create an FSx for ONTAP file system wizard or click **Save** to save the recommended configuration(s) for later.

Deployment methods

In *automate* mode, you can deploy the FSx for ONTAP file system directly from Workload Factory. You can also copy the content from the Codebox window and deploy the system using one of the Codebox methods.

In *basic* mode, you can copy the content from the Codebox window and deploy the FSx for ONTAP file system using one of the Codebox methods.

Use links

Learn about Workload Factory links

A Workload Factory link creates a trust relationship and connectivity between a Workload Factory account and one or more FSx for ONTAP file systems. This enables you to monitor and manage certain file system features directly from the ONTAP REST API calls that are not available through the Amazon FSx for ONTAP API.

You don't need a link to get started with Workload Factory, but in some cases you'll need to create a link to unlock all Workload Factory features and workload capabilities.

How links work

Links leverage AWS Lambda. Lambda executes code in response to events and automatically manages the computing resources required by that code. The links that you create are part of your NetApp account and they are associated with an AWS account.

After you have created a link you can associate it with one, or many, FSx for ONTAP file systems. Each file system can be associated only to one link in the same NetApp account. If you have multiple NetApp accounts, a single file system can be associated with additional links under different NetApp accounts.

You create links from the FSx for ONTAP file system pages in Workload Factory. Learn how to create links for details.

Costs

Each transaction that Lambda performs incurs a charge. Since Lambda acts as a proxy between the two systems, there is a charge when Lambda sends a request to the ONTAP REST API on a file system, and when it sends the response back to Workload Factory.

When a link is required

Workload Factory requires a link to display some information and to perform some tasks. If you attempt to perform an operation that requires a link and you haven't associated a link with the FSx for ONTAP file system, you will see a message that the operation requires a link. You can add a new link, or associate the FSx for ONTAP file system with an existing link at that time so you can perform the operation.

The features that require a link include:

- Display the version of ONTAP that is installed on an FSx for ONTAP file system
- Manage iSCSI volumes on the system
- Enable and disable the autogrow feature for volumes
- Create and manage snapshot policies
- Configure replication relationships and replicate volumes between file systems
- Configure backup relationships and back up volume data to cloud storage
- Clone volumes within a file system
- Display additional metrics directly from ONTAP (default metrics are collected by Amazon CloudWatch)
- Management of NFS Export policies

Create a link

You can create and manage links to provide a trust relationship and connectivity between a Workload Factory account and one or more FSx for ONTAP file systems. This enables you to monitor and manage certain features directly from the FSx for ONTAP file system that are not available through the AWS FSx for ONTAP API.

Learn more about links.

About this task

Links leverage AWS Lambda to execute code in response to events and automatically manage the computing resources required by that code. The links that you create are part of your NetApp account and they are associated with an AWS account.

You can create a link in your account when defining an FSx for ONTAP file system. That link will be used for that file system, and it can be used by other FSx for ONTAP file systems.

You'll need to launch an AWS CloudFormation stack in your AWS account to create the link.

Before you begin

- You must have credentials to log in to your AWS account.
- You must have the following permissions in your AWS account when adding a link using a CloudFormation stack:

```
"cloudformation:GetTemplateSummary",
"cloudformation:CreateStack",
"cloudformation:DeleteStack",
"cloudformation:DescribeStacks",
"cloudformation:ListStacks",
"cloudformation:DescribeStackEvents",
"cloudformation:ListStackResources",
"ec2:DescribeSubnets",
"ec2:DescribeSecurityGroups",
"ec2:DescribeVpcs",
"iam:ListRoles",
"iam:GetRolePolicy",
"iam:GetRole",
"iam:DeleteRolePolicy",
"iam:CreateRole",
"iam:DetachRolePolicy",
"iam:PassRole",
"iam:PutRolePolicy",
"iam:DeleteRole",
"iam:AttachRolePolicy",
"lambda:AddPermission",
"lambda:RemovePermission",
"lambda:InvokeFunction",
"lambda:GetFunction",
"lambda:CreateFunction",
"lambda:DeleteFunction",
"lambda:TagResource",
"codestar-connections:GetSyncConfiguration",
"ecr:BatchGetImage",
"ecr:GetDownloadUrlForLayer"
```

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots menu of the file system to associate a link to and then select **Manage**.

4. In the file system overview, select **Associate link**.

5. In the Associate link dialog, select **Create a new link** and select **Continue**.

6. On the Create Link page, provide the following:

   a. **Link name**: Enter the name that you want to use for this link. The name must be unique within your account.

b. **Tags**: Optionally, add any tags that you want to associate with this link so you can more easily categorize your resources. For example, you could add a tag that identifies this link as being used by FSx for ONTAP file systems.

The AWS account and the additional information for Account, Location, and Security group are retrieved automatically based on the FSx for ONTAP file system.

7. Select **Redirect to CloudFormation**.

A dialog that explains how to create the link from the AWS CloudFormation service is displayed.

8. Select **Continue** to open the AWS Management Console, and then log in to the AWS account for this FSx for ONTAP file system.

9. On the Quick create stack page, under Capabilities, select **I acknowledge that AWS CloudFormation might create IAM resources**.

Note that three permissions are granted to Lambda when you launch the CloudFormation template. Workload Factory uses these permissions when using links.

```
"lambda:InvokeFunction",
"lambda:GetFunction",
"lambda:UpdateFunctionCode"
```

10. Select **Create stack** and then select **Continue**.

You can monitor the link creation status from the Events page. This should take no more than 5 minutes.

11. Return to the Workload Factory interface and you'll see that the link is associated with the FSx for ONTAP file system.

Result

The link you created is associated with the FSx for ONTAP file system.

Manage links

Manage links you've associated with your Workload Factory account.
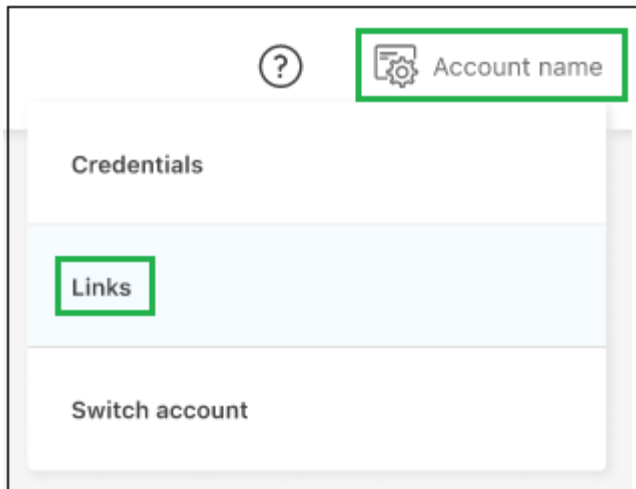
Learn more about links or create a link.

View the links associated with your account

You can view the links that are currently associated with your account.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. From the Account menu, select **Links**.

4. If any links exist, the overview page provides the information.

5. To view the FSx for ONTAP file systems that are associated with a link, select the **View** button in the Associated resources section.
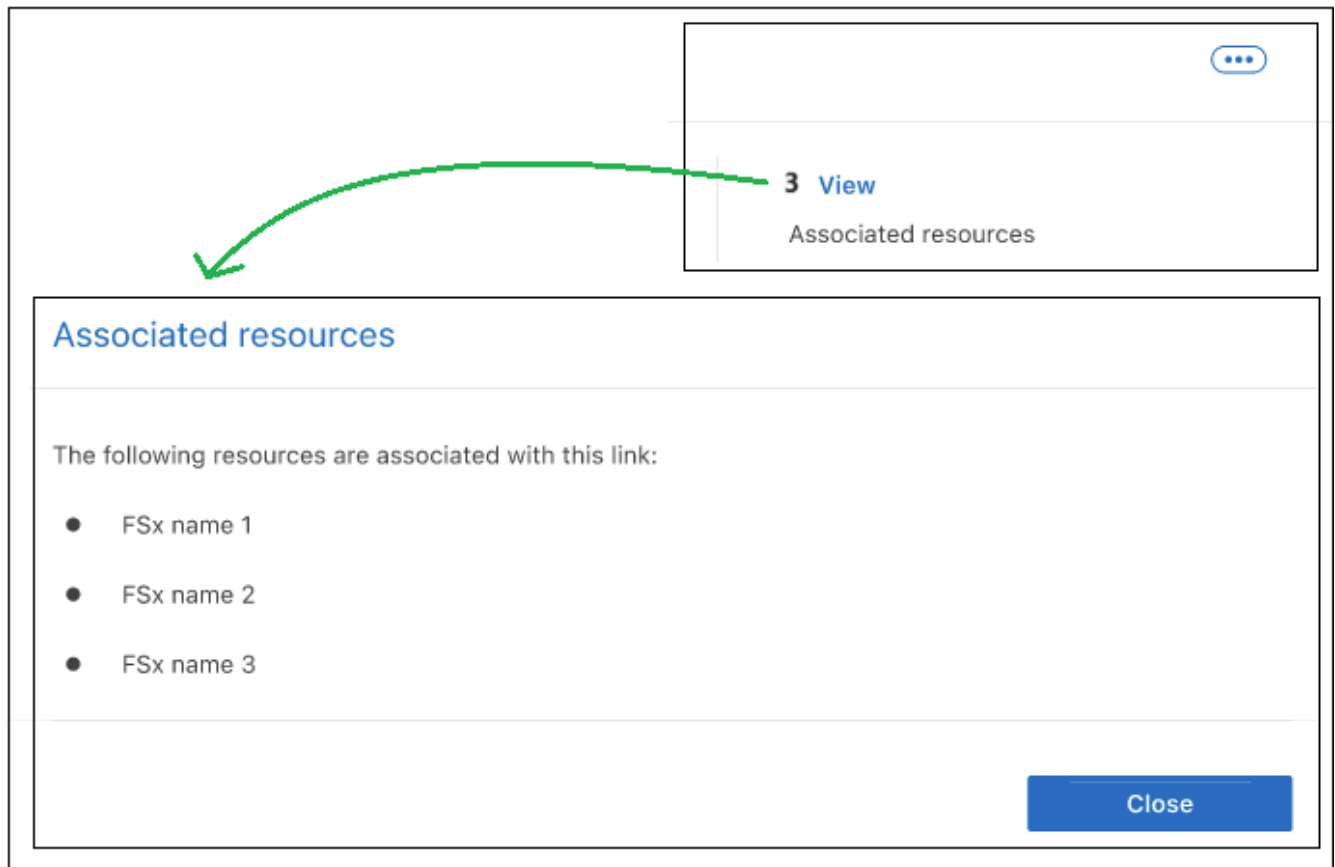
6. If you need the Amazon Resource Name (ARN) for the link, you can select the *copy* icon next to the ARN field.

Associate a link with an FSx for ONTAP file system

After you create a link, you can associate it with your FSx for ONTAP file systems. Each file system can be associated to only one link in a single NetApp account, but a link can be associated with many file systems.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots menu of the file system to associate a link to and then select **Manage**.

4. In the file system overview, select **Associate link**.

5. In the Associate link page, select **Associate an existing link**, select the link, and select **Apply**.

Result

The link is associated with the FSx for ONTAP file system and you can perform advanced ONTAP operations.

Edit a link

You can't edit a link from the Workload Factory interface. If you need to make a change to a link, you'll need to create a new link and then associate that link to your file system.

> (i) You can edit the Lambda network configuration (for example VPC, subnets, and security groups) using the AWS console and the changes will be reflected in links management UI; however, these changes can lead to connectivity issues between Lambda and ONTAP, and are not recommended.

Remove a link

You can remove a link that you're no longer using in your environment. Any FSx for ONTAP file systems or other resources that were using the link will be unable to use certain functionality after the link is removed.

Note that the link is only deleted from Workload Factory - it is not deleted from your AWS environment. You must delete the Lambda function from your AWS account after removing the link in Workload Factory.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. From the Account menu, select **Links**.

4. From the Links page, select the menu button and select **Remove**.
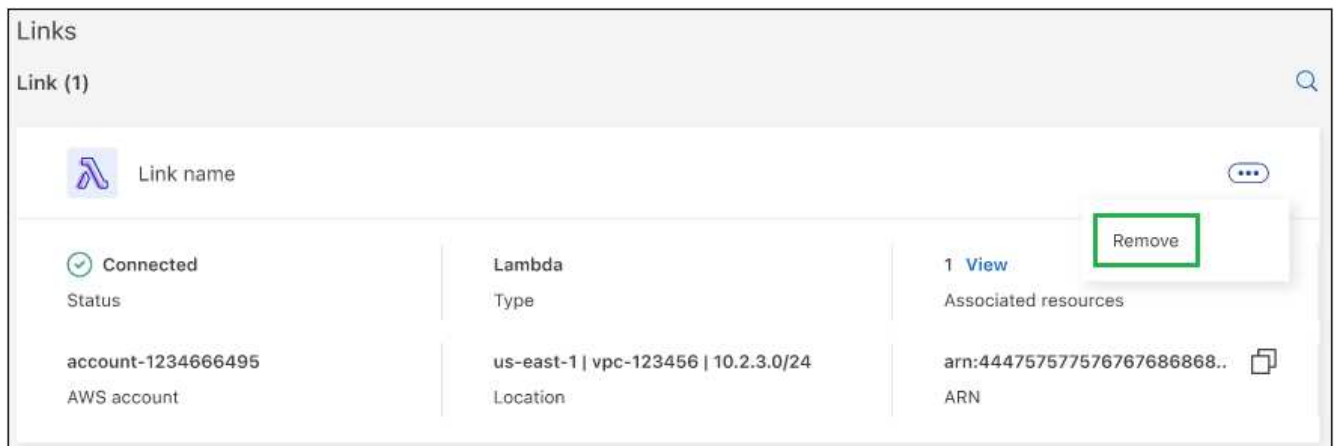
5. If you are sure, select **Remove** again.

Refer to the AWS documentation to [delete the Lambda function](#).

Manage volumes

Create an FSx for ONTAP volume

After you set up your FSx for ONTAP file system, you can create FSx for ONTAP volumes.

About this task

FSx for ONTAP volumes are virtual resources used for grouping data, determining how data is stored, and determining the type of access to your data. Volumes don't consume file system storage capacity. The data that is stored in a volume primarily consumes SSD storage. Depending on the volume's tiering policy, the data might also consume capacity pool storage. You set a volume's size when you create it, and you can change its size later.

The following protocols may be used for your volumes:

- CIFS: file storage protocol for Windows operating systems
- NFS: file storage protocol for Unix operating systems
- iSCSI: block storage protocol

Before you begin

Review the following prerequisites before you create a volume:

- You must have an FSx for ONTAP file system in Workload Factory.
- You must have a storage VM.
- For protocol access, complete the following:
  - To configure access to the 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, click **Associate link** under **Account name**. Once the link associates, return to this operation.
  - You must configure access for the protocol you select, either CIFS, NFS, or iSCSI.

Steps

1. Log in to the [Workload Factory console](#)
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, select the three dots menu of the file system you want to create a volume in, and select **Manage**.
4. From the **Overview** tab, click **Create volume**.
5. On the Create volume page under General details, provide the following details:
   a. **Volume name**: Enter a name for the volume.
   b. **Storage VM name**: Optionally, enter a storage VM name.
   c. **Volume style**: Select **FlexVol** or **FlexGroup** volume.

      FlexVol volume style is selected by default.

      FlexGroup volume size depends on the number of constituents. 100 GiB is required per constituent.

d. **Volume size**: Enter the volume size and unit.

Optionally, enable volume autogrow. This option is available when you select **File access** as the volume access type.

e. **Tags**: Optionally, you can add up to 50 tags.

6. Under Access (only for file systems with associated links), provide the following details:

a. **Access type**: Select **File access** or **Block access**. Additional fields to configure volume access differ depending on your selection.

▪ **File access**: allows multiple authorized users and devices access to the volume using SMB/CIFS, NFS, or dual (SMB/NFS) protocols.

Complete the following fields to set up file access to the volume.

i. **NFS export policy**: Provide the following details to provide NFS access:

A. **Access control**: Select a **Custom export policy**, **Existing export policy**, or **No access to the volume** from the dropdown menu.

B. **Export policy name**:

If you selected a custom export policy, select an existing policy name from the dropdown menu.

If you selected an existing export policy, enter a new policy name.

C. **Add Export Policy Rule**: Optionally, for a custom export policy, you can add export policy rules to the policy.

ii. **CIFS share**: Enter the CIFS share name to provide SMB access.

▪ **Block access**: allows hosts running critical business applications access to the volume using the iSCSI protocol.

Complete the following fields to set up block access to the volume.

i. **iSCSI configuration**: Provide the following details to configure iSCSI for block access to the volume.

A. Select **Create a new initiator group** or **Map an existing initiator group**.

B. Select the **Host operating system** from the dropdown menu.

C. Enter an **Initiator group name** for a new initiator group.

D. Under Host Initiators, add one or more iSCSI qualified name (IQN) host initiators.

7. Under Efficiency and protection, provide the following details:

a. **Storage efficiency**: Disable or enable storage efficiency.

Storage efficiency is achieved by utilizing the deduplication and compression features from ONTAP. Deduplication eliminates duplicate data blocks. Data compression compresses the data blocks to reduce the amount of physical storage that is required.

b. **Snapshot policy**: Select the snapshot policy to specify the frequency and retention of snapshots.

The following are default policies from AWS. For custom snapshot policies, you must associate a link.

default

> This policy automatically creates snapshots on the following schedule, with the oldest snapshot copies deleted to make room for newer copies:
>
> - A maximum of six hourly snapshots taken five minutes past the hour.
> - A maximum of two daily snapshots taken Monday through Saturday at 10 minutes after midnight.
> - A maximum of two weekly snapshots taken every Sunday at 15 minutes after midnight.
>
> > (i) Snapshot times are based on the file system's time zone, which defaults to Coordinated Universal Time (UTC). For information about changing the time zone, refer to Displaying and setting the system time zone in the NetApp Support documentation.

default-1weekly

> This policy works in the same way as the `default` policy, except that it only retains one snapshot from the weekly schedule.

none

> This policy doesn't take any snapshots. You can assign this policy to volumes to prevent automatic snapshots from being taken.

c. **Tiering policy**: Select the tiering policy for the data stored in the volume.

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

8. Under Advance configuration, provide the following:

   a. **Junction path**: Enter the location in the storage VM's namespace where the volume gets mounted. The default junction path is `/<volume-name>`.

   b. **Aggregates list**: Only for FlexGroup volumes. Add or remove aggregates. The minimum number of aggregates is one.

   c. **Number of constituents**: Only for FlexGroup volumes. Enter the number of constituents per aggregate. 100 GiB is required per constituent.

9. Click **Create**.

Result

Volume creation is initiated. Once created, the new volume will appear in the Volumes tab.

Create a storage VM for an FSx for ONTAP file system

Create a storage VM (SVM) for an FSx for ONTAP file system to access storage and data services virtually for your workloads in Workload Factory.

About this task

Storage VMs are isolated file servers that you can use to access the data from each workload in Workload Factory Storage. Each SVM has its own administrative credentials and endpoints for administering and

accessing data.

With SVMs, when you access data in FSx for ONTAP, your clients and workstations mount a volume, CIFS/SMB share, or iSCSI LUN hosted by an SVM using the SVM's endpoint (IP address).

Before you begin

Verify the supported number of storage VMs per file system. Refer to Managing FSx for ONTAP storage virtual machines in AWS documentation for the maximum number of SVMs per file system.

Create a storage VM

You can create a storage VM from the Workload Factory console. You can also use the following tools available in the Codebox: REST API, CloudFormation, and Terraform. Learn how to use Codebox for automation.

> ⓘ When using Terraform from Codebox, the code you copy or download hides `fsxadmin` and `vsadmin` passwords. You'll need to re-enter the passwords when you run the code.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the FSx for ONTAP tab, click the three dots menu of the file system to create a storage VM for and select **Manage**.

4. From the file system overview, select **Create a storage VM**.

5. On the Storage VM page, under Storage VM configuration, provide the following:

   a. **Name**: Enter a name for the storage VM.

   b. **Storage VM credentials**: Provide a password for this storage VM's `vsadmin` user or use the file system's `fsxadmin` user credentials.

   c. **Root volume security style**: Select the root volume security style depending on the type of clients that access your data - UNIX (Linux clients), NTFS (Windows clients), or Mixed.

   d. **Tags**: Optionally, you can add up to 50 tags.

6. Click **Create**.

Protect your data

Data protection overview

FSx for ONTAP supports snapshots to create read-only, point-in-time images of a volume, volume backups to create offline backups with long retention of your volumes, and volume replication to create asynchronous mirrors of your volume in different regions.

Types of data protection

Data protection for your workloads helps ensure that you can recover from any data loss at any time. Learn about the types of data protection before you select the features you'll use.

Snapshots

A snapshot creates a read-only, point-in-time image of a volume within the source volume as a snapshot copy. You can use the snapshot copy to recover individual files, or to restore the entire contents of a volume. Snapshots are the basis of all the backup methods. The snapshot copy that is created on your volume is used to keep the replicated volume and backup file synchronized with changes made to the source volume.

Backups

You can create backups of your data to the cloud for protection and for long-term retention purposes. If necessary, you can restore a volume, folder, or individual files from the backup to the same, or different, working file system.

Replication

Replication creates a secondary copy of your data on another FSx for ONTAP file system and continually updates the secondary data. Your data is kept current and remains available whenever you need it, such as for disaster recovery.

You can choose to create both replicated volumes on another FSx for ONTAP file system and backup files in the cloud. Or you can choose just to create replicated volumes or backup files - it's your choice.

The following diagram shows a visual representation of data protection for FSx for ONTAP storage using snapshots, replication across regions, and backup to object storage.
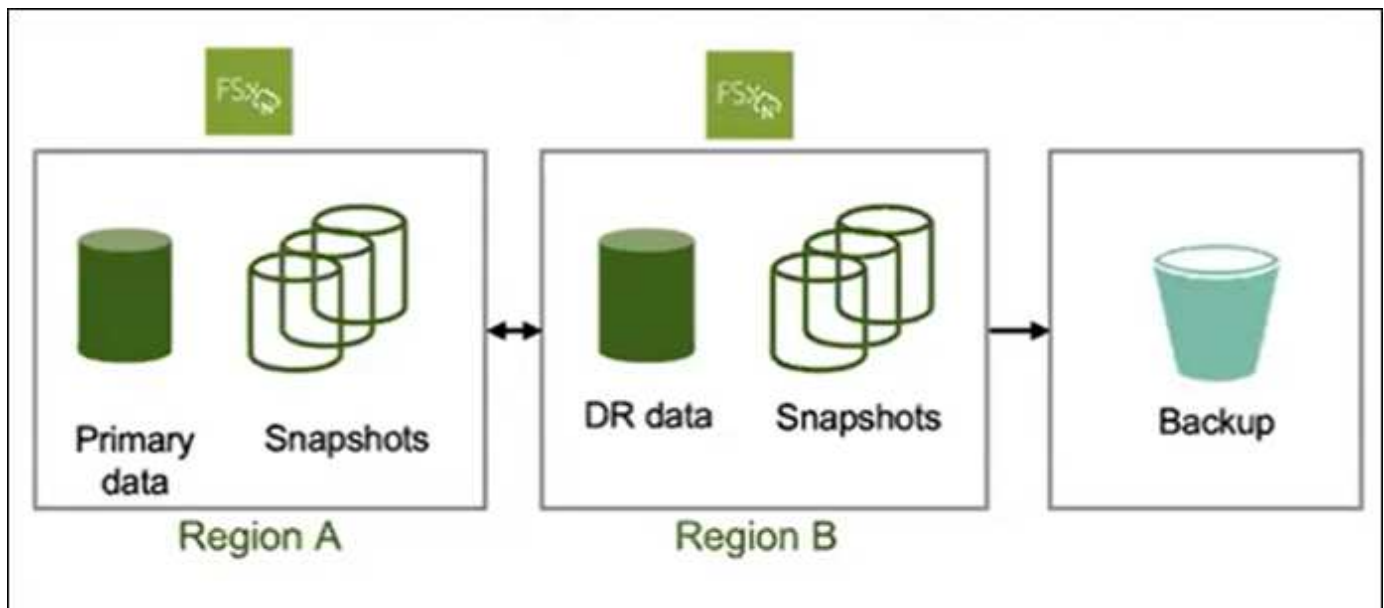
Best practices for protecting your workload data

FSx for ONTAP offers multiple data protection options which can be combined to achieve your selected recovery point and time objectives. For the best possible protection, we recommend that you use both volume snapshots and volume backups.

A recovery point objective (RPO) describes how recent the latest copy of your data is guaranteed to be, which depends on how frequently the copies are made. A recovery time objective (RTO) defines how long it takes to restore your data.

Protect your workload data with snapshots

Snapshots are virtual point-in-time versions of a volume that are taken on a scheduled basis. You can access snapshots using standard file system commands. Snapshots provide an RPO of as little as one hour. RTO depends on the amount of data to restore and is primarily limited by the volume throughput limit. Snapshots

also allow users to restore specific files and directories, which decreases RTO even further. Snapshots only consume additional volume space for changes made to the volume.

Protect your workload data with backups

Volume backups provide independent point-in-time copies of your volume. They can be used to store old backups and provide the necessary second copy of your data. Daily, weekly, and monthly backup schedules allow for RPOs starting at one day. Volume backups can only be restored as a whole. Creating a volume from a backup (RTO) can take hours to many days, depending on the size of the backup.

Protect your workload data with volume replication

Volume replication creates a copy of the latest data of a volume including all its snapshots in a different region. If you cannot afford multi-hour RTOs of a full volume restore operation from a volume backup, consider performing a volume replication. While volume replication makes sure recent data is available in a different region for you to use, you need to adjust your clients to use the volume in the other region.

Recommendations for protecting your workload data

Consider the following recommendations for protecting your workload data.

- Use volume backups in conjunction with snapshots: using the two features together ensures that you're able to restore your files from snapshots and perform full restores in case of volume loss using backups.
- Define a volume backup policy: make sure that the backup policy satisfies your company requirements for backup age and frequency. We recommend keeping a minimum of two daily backups for each volume.
- Define a snapshot schedule: older snapshots are less likely to be used to restore data. We recommend that you define a snapshot schedule that takes into consideration the diminishing returns of keeping older snapshots against the cost for additional snapshot capacity.

Manage snapshots

Create a manual snapshot of an FSx for ONTAP volume

Create a manual snapshot of an FSx for ONTAP volume. Snapshots are point-in-time versions of your volume's content.

Snapshots are resources of volumes and are instant captures of your data that consume space only for modified data. Because data changes over time, snapshots usually consume more space as they get older.

FSx for ONTAP volumes use just-in-time copy-on-write so that any unmodified files in snapshots don't consume any of the volume's capacity.

> ⓘ Snapshots aren't copies of your data. If you want to make copies of your data, consider using the FSx for ONTAP backups or volume replication features.

Before you begin

You must associate a link to create a snapshot. If you don't have an existing link, create a link. To associate a link in the file system, click **Associate link** under **Account name**. Once the link associates, return to this operation.

Steps

1. Log in to the Workload Factory console

2. In **Storage**, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system with the volume and then select **Manage**.

4. In the file system overview, select the **Volumes** tab.

5. From the **Volumes** tab, select the three dots menu for the volume to protect.

6. Select **Data protection actions**, **Snapshots**, then **Create volume from a snapshot**.

7. In the Create volume from a snapshot dialog, in the **Snapshot name** field, enter a snapshot name.

8. Click **Create**.

Create a snapshot policy for FSx for ONTAP volumes

Create a custom snapshot policy for FSx for ONTAP volumes. A snapshot policy defines how the system creates snapshots for a volume.

About this task

You can create a custom snapshot policy that differs from the three built-in snapshot policies for FSx for ONTAP:

- `default`

- `default-1weekly`

- `none`

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

Customizing a policy lets you specify when to create snapshots, how many copies to retain, and how to name them.

Before you begin

- Consider the following about snapshot capacity before you use snapshots:

  ◦ For most datasets, an additional capacity of 20% is enough to keep snapshots for up to four weeks. As data gets older, its use for restorations becomes less likely.

  ◦ Overwriting all the data in a snapshot consumes significant volume capacity, which factors into provisioning volume capacity.

- To create a custom snapshot policy, you must associate a link. If you don't have an existing link, create a link. To associate a link in the file system, click **Associate link** under **Account name**. Once the link associates, return to this operation.

Steps

1. Log in to the Workload Factory console

2. In **Storage**, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system with the volume and then select **Manage**.

4. In the file system overview, select the **Volumes** tab.

5. From the **Volumes** tab, select the three dots menu for the volume to protect with scheduled snapshots.

6. Select **Data protection actions**, **Snapshots**, then **Manage snapshot policies**.

7. On the Snapshot policy management page, select **Create a new snapshot policy**.

8. In the **Snapshot policy name** field, enter a name for the snapshot policy.

9. Optional: in the **Description** field, enter a description for the snapshot policy.

10. Under **Schedule**, select when to create snapshots. For example, every minute or hourly.

    You can select more than one frequency.

11. Under **Number of copies**, enter the number of copies to retain.

    The maximum number of copies is 1,023.

12. Optional: Under **Naming convention**, enter a **Prefix** for the policy.

13. **Retention label** is automatically populated.

    This label refers to the SnapMirror, or replication label, used to select only specified snapshots for replication from the source to the target file system.

14. Click **Apply**.

Restore a volume from a snapshot

Restore an FSx for ONTAP volume from a snapshot when the volume contains deleted or corrupted files.

About this task

This operation restores data from a snapshot to a new volume.

Before you begin

You can only restore a volume from a snapshot if you have an existing snapshot copy of the volume.

Make sure you have enough capacity to complete this operation.

Steps

1. Log in to the Workload Factory console

2. In **Storage**, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system with the volume and then select **Manage**.

4. In the file system overview, select the **Volumes** tab.

5. From the **Volumes** tab, select the three dots menu for the volume to restore from a snapshot.

6. Select **Data protection actions**, **Snapshots**, then **Restore volume from a snapshot**.

7. In the Restore volume from a snapshot dialog, in the **Snapshot name** field, select the snapshot to restore from the dropdown menu.

8. In the **Restored volume name** field, enter a unique name for the volume to restore.

9. Click **Restore**.

Create a new FSx for ONTAP volume from a snapshot

Create a new FSx for ONTAP volume from a snapshot to enable point-in-time recovery.

About this task

A snapshot is a read-only image of an FSx for ONTAP volume taken at a point in time. The creation of a new volume from a snapshot makes a copy of an entire volume within a few seconds independent of volume size. The newly created copy represents a new volume.

Before you begin

Consider the following limitations before you create a volume from a snapshot:

- Changes to permission models: If you use this operation to switch the network-attached storage (NAS) protocol type, it might also switch the permission model that the security style provides. You might experience file access permission issues, which you can only fix manually with administrator access using the NAS client tools for permissions setting.

- Increased volume consumption: After you create a volume from a snapshot, you have two independent volumes, and both consume capacity from the host file system.

Steps

1. Log in to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, click the three dots menu of the file system with the volume snapshot and then select **Manage**.
4. In the file system overview, select the **Volumes** tab.
5. In the Volumes tab, click the three dots menu for the volume that has the snapshot you want to create a volume of.
6. Select **Data protection actions**, **Snapshots**, and then **Create a volume from a snapshot**.
7. In the Create volume from a snapshot dialog, enter the snapshot name.
8. Click **Create**.

Manage backups to object storage

Create a manual backup of a volume

Create a manual backup of a volume outside regularly scheduled backups.

About this task

FSx for ONTAP backups are per volume, so each backup contains only the data in a particular volume.

FSx for ONTAP backups are incremental which means that only the data on the volume that has changed after your most recent backup is saved. This minimizes the time required to create the backup and the storage required for the backup, which saves on storage costs by not duplicating data.

Before you begin

To take backups of your volumes, both your volume and your file system must have enough available SSD storage capacity to store the backup snapshot. When taking a backup snapshot, the additional storage capacity consumed by the snapshot cannot cause the volume to exceed 98% SSD storage utilization. If this happens, the backup will fail.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system with the volume and then select **Manage**.

4. In the file system overview, select the **Volumes** tab.

5. From the **Volumes** tab, click the three dots menu for the volume to back up.

6. Select **Data protection actions**, **FSx for ONTAP backup**, and then **Manual backup**.

7. In the Manual backup dialog, enter a name for the backup.

8. Click **Back up**.

Restore a volume from a backup

Restore a volume from a backup to any FSx for ONTAP file system in your AWS account.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system with the volume and then select **Manage**.

4. In the file system overview, select the **Volumes** tab.

5. From the **Volumes** tab, click the three dots menu for the volume to restore from a backup.

6. Select **Data protection actions**, **FSx for ONTAP backup**, and then **Restore from a backup**.

7. In the Restore from a backup dialog, provide the following:

    a. **Target file system**: Select the target file system from the dropdown menu.

    b. **Target storage VM**: Select the target storage VM from the dropdown menu.

    c. **Backup name**: Select the backup name from the dropdown menu.

    d. **Restored volume name**: Enter the restored volume name.

8. Click **Restore**.

Manage replication

Create a replication relationship

Create a replication relationship for an FSx for ONTAP file system to avoid data loss in case of an unforeseen disaster.

About this task

Replication is an added layer of data protection which is essential in case the region where your data resides experiences a disaster. Data loss can be avoided if you use cross-region replication.

This operation creates a replication relationship for one or all source volumes in an FSx for ONTAP file system.

Replicated volumes in the target file system follow the naming format: `{OriginalVolumeName}_copy`.

Before you begin

Make sure you meet the following prerequisites before you begin.

- You must have two available file systems in your storage inventory to create a replication relationship.

- The two file systems you use for the replication relationship must have an associated link. If the file systems don't have existing links, first create a link. To associate a link in the file systems, click **Associate link** under **Account name**. Once the link associates in both file systems, return to this operation.

Complete the following steps to replicate a single volume or replicate all volumes in a file system.

Replicate a single volume

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots menu of the file system that contains the volume to replicate and then select **Manage**.

4. From the Volumes tab, select the three dots menu of the volume to replicate.

5. Select **Data protection actions** then **Replicate volume data**.

6. On the Create replication 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. **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 capacity in 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 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.

7. 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.

8. Click **Create**.

Replicate all volumes in a file system

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the FSx for ONTAP tab, click the three dots menu of the file system with the volumes and then select **Manage**.

4. From the file system overview, select **Create replication**.

5. On the Create replication 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 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.

6. 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.

7. Click **Create**.

Result

The replication relationship appears in the **Replication relationships** tab.

Initialize a replication relationship

Initialize a replication relationship between source and target volumes.

About this task

Initialization performs a *baseline* transfer: it makes a snapshot of the source volume, then transfers the

snapshot and all the data blocks it references to the target volume.

Before you begin

Consider when you choose to complete this operation. Initialization can be time-consuming. You might want to run the baseline transfer in off-peak hours.

Steps

1. Log in to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.
4. From the file system overview, select the **Replication relationships** tab.
5. In the Replication relationships tab, click the three dots menu of the replication relationship to initialize.
6. Select **Initialize**.
7. In the Initialize relationship dialog, click **Initialize**.

Administer and monitor

Volume administration

Enable volume autogrow

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 increase volume capacity feature.

> ℹ️   Volume autogrow isn't supported for iSCSI volumes.

Before you begin

To enable volume autogrow, you must associate a link. If you don't have an existing link, create a link. To associate a link in the file system, click **Associate link** under **Account name**. Once the link associates, return to this operation.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the FSx for ONTAP tab, select the three dots 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 three dots menu for the volume you want to modify.

6. Select **Basic actions**, then **Edit volume autogrow**.

7. In the Edit autogrow dialog, enable volume autogrow.

8. Click **Apply**.

Increase volume capacity

Manually increase the volume capacity of a volume at any time.

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

About this task

For an iSCSI LUN, this operation increases the size of the host LUN. After the capacity increases, 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.

Before you begin

To increase volume capacity, you must associate a link. If you don't have an existing link, create a link. To associate a link in the file system, click **Associate link** under **Account name**. Once the link associates, return to this operation.

Steps

1. Log in to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, select the three dots 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 three dots menu of the volume to increase capacity for.
6. Select **Basic actions**, then **Increase volume capacity**.
7. In the Increase volume capacity dialog, provide the following:
   a. Select a larger size.
   b. Change the unit if needed.
8. Click **Increase**.

Edit volume tags

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

Steps
1. Log in to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, select the three dots 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, click the three dots menu for the volume to modify tags for.
6. Select **Basic actions** then **Edit volume tags**.
7. On the Edit volume tags page, add, edit, or remove tags.

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

8. Click **Apply**.

Rebalance a volume's capacity

Rebalance the capacity of a volume to avoid imbalances that develop over time.

About this task

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.

(i) Rebalancing a volume is only supported for FlexGroup volumes.

Before you begin

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, click **Associate link** under **Account name**. Once the link associates, return to this

operation.

Steps

1. Log in to the Workload Factory console
2. In **Storage**, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, select the three dots menu of the file system that contains the volume to rebalance and then select **Manage**.
4. From the file system overview, select the **Volumes** tab.
5. From the Volumes tab, select the three dots menu of the volume to rebalance.
6. Select **Advanced actions**, then **Rebalance volume**.
7. In the Rebalance volume dialog, select **Rebalance**.

Change the tiering policy of a volume

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 four available tiering policies before you change the tiering policy.

- **Auto**: Tiers all cold data which includes user data and snapshots to the capacity pool storage tier for a specific time period.
- **Snapshot only**: Tiers only snapshot data to the capacity pool storage tier.
- **None**: Keeps all your volume's data on the primary storage tier.
- **All**: Marks all user data and snapshot data as cold and stores it in 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 to the Workload Factory console
2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots 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, click the three dots menu of the volume to change the tiering policy for.

6. Select **Advanced actions**, then **Change tiering policy**.

7. On the Change tiering policy page, select one of the following tiering policies:

   ◦ **Auto**: Enter the number of cooling days.

   ◦ **Snapshot only**: Enter the number of cooling days.

   ◦ **None**

   ◦ **All**

8. Click **Apply**.

Change the NFS export policy for a volume

Change the NFS export policy for a volume that uses NFSv3 or NFSv4.1 protocol types.

About this task

Changing a volume's export policy involves adding export policy rules which 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 to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots 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, click the three dots menu for the volume to change the NFS export policy for.

6. Select **Advanced actions**, then **Edit NFS export policy**.

7. 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**.

8. Click **Apply**.

Change the CIFS share for a volume

Changing a volume's CIFS share involves determining the users and groups to give access to and the type of access to give them.

Before you begin

Determine the users or groups to give access to and the type of access to give them.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots 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, click the three dots menu of the volume to change the SMB share for.

6. Select **Advanced actions**, then **Edit CIFS share**.

7. On the Edit CIFS share page, provide the following:

    a. **Users or groups**: Enter valid users and groups. Separate each entry by a semi-colon ";".

    b. **Permissions**: Select **Full control**, **Read/Write**, **Read**, or **No access**.

8. Click **Apply**.

Delete a volume

You can delete a volume in your FSx for ONTAP file system at any time. This operation is irreversible.

Before you begin

Consider the following before deleting a volume:

- 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.

- Replication relationships: We recommend that you delete any existing replication relationships for this volume before deleting the volume so that no broken relationships remain.

Steps

1. Log in to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, select the three dots menu of the file system with the volume to delete and then select **Manage**.
4. From the file system overview, select the **Volumes** tab.
5. From the Volumes tab, select the three dots menu of the volume to delete.
6. Select **Basic actions** then **Delete volume**.
7. In the Delete volume dialog, do the following:

   a. Optionally, click **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. Click **Continue**.
   c. Type "delete" to delete the volume.
   d. Click **Delete**.

File system administration

Increase file system capacity

Manually 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.

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

About this task

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

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

When you provision IOPS manually, you may 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 increase capacity for a file system, you must first disable automatic capacity management.

Steps
1. Log in to the the Workload Factory console.
2. In Storage, click **Go to Storage inventory**.
3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to increase capacity for.
4. Select **Manage**.
5. Under Information, click the pencil icon next to **Capacity distribution**. The pencil icon appears next to the drop down arrow when the mouse hovers over the **Capacity distribution** row.

6. In the SSD storage size dialog, enter a number for **Provisioned capacity**.

7. Select the unit for the provisioned capacity.

8. Click **Apply**.

Enable automatic capacity management for a file system

Enabling this feature lets Workload Factory automatically add incremental storage to an FSx for ONTAP file system as capacity needs change over time.

About this task

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.

Before you begin

You must have credentials with *Automate* permissions in Workload Factory to complete this task.

Steps

1. Log in to the the Workload Factory console.

2. In Storage, select **Go to Storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to enable automatic capacity management for.

4. Select **Manage**.

5. Under Information, click 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.

6. In the **Automatic capacity management** dialog, provide the following:

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

    b. Click 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. **Capacity threshold**: Enter the maximum size for the FSx for ONTAP file system.

    d. **Capacity increase increments**: Enter the percentage to increase capacity incrementally.

7. Click **Apply**.

Reset the fsxadmin password

Reset the fsxadmin password when needed.

Steps

1. Log in to the the Workload Factory console.

2. In Storage, select **Go to Storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to reset the fsxadmin password for and then select **Manage**.

4. From the file system overview, click the three dots menu.
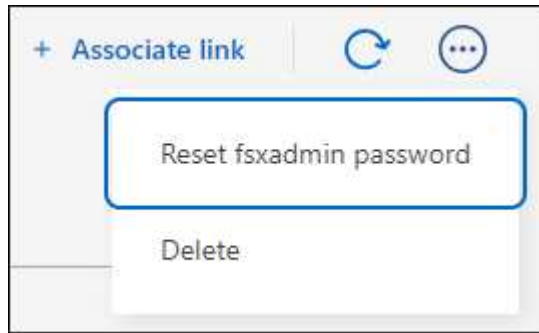
5. Select **Reset fsxadmin password**.

6. In the Reset fsxadmin password dialog, enter a new fsxadmin password and re-enter it to confirm.

7. Click **Apply**.

Delete a file system

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

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the FSx for ONTAP file system you want to delete.

4. Select **Manage**.

5. In the **Overview** tab, click the three dots menu.

6. Click **Delete**.

7. In the Delete FSx for ONTAP file system dialog, enter the name of the FSx for ONTAP file system to delete.

8. Click **Delete**.

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 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. If you don't have an existing link, create a link. To associate a link in the file system, click **Associate link** under **Account name**. Once the link associates, return to this operation.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots menu of the file system with the storage VM to replicate and then select **Manage**.

4. From the file system overview, select the **Storage VMs** tab.

5. From the Storage VMs tab, select the three dots menu of the storage VM to replicate an SVM for.

6. Select **Replicate storage VM**.

7. On the Create replication 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 capacity in 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 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.

   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. Click **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.

About this task

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

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots menu of the file system with the storage VM to update and then select **Manage**.

4. From the file system overview, select the **Storage VMs** tab.

5. From the Storage VMs tab, select the three dots menu of the storage VM to configure Active Directory for.

6. Select **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 deleted 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 joining to a self-managed AD, use the name of the group in your AD. The default group is `Domain Admins`.

8. Click **Apply**.

Edit storage VM tags

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

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, select the three dots menu of the file system with the storage VM to update and then select **Manage**.

4. From the file system overview, select the **Storage VMs** tab.

5. From the Storage VMs tab, select the three dots menu of the storage VM to edit tags for.

6. Select **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. Click **Apply**.

Delete a storage VM

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 to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.

4. From the file system overview, select the **Storage VMs** tab.

5. In the Storage VMs tab, select the three dots menu of the storage VM to configure Active Directory for.

6. Select **Delete storage VM**.

7. In the Delete storage VM dialog, type "delete" to delete the storage VM.

8. Click **Delete**.

Data protection administration

Update FSx for ONTAP backup schedule

Update the FSx for ONTAP backup schedule when needed.

Steps

1. Log in to the Workload Factory console

2. In Storage, click **Go to Storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update the backup schedule for and then select **Manage**.

4. Under Information, click 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.

5. In the **FSx for ONTAP backup** dialog, provide the following:

   a. **Daily automatic backups**: Enable or disable the feature. If you disable the feature, click **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.

6. Click **Apply**.

Enable and edit snapshots for long-term retention

Enable snapshots for long-term retention lets you replicate specific snapshots for long-term disaster recovery.

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.

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

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.

4. From the file system overview, select the **Replication relationships** tab.

5. In the Replication relationships tab, click the three dots menu of the replication relationship schedule to change.

6. Select **Edit long-term retention**.

7. In the Edit long-term retention dialog, enable or disable snapshots for long-term retention.

8. If you select to disable snapshots for long-term retention, click **Apply** to complete this operation.

9. If you select to enable snapshots for long-term retention, choose between selecting an existing policy or creating a new policy.

   a. For an existing policy, select an existing policy 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.

10. Click **Apply**.

Reverse a replication relationship

Reverse a replication relationship so that the target volume becomes the source volume.

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 to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.
4. From the file system overview, select the **Replication relationships** tab.
5. In the Replication relationships tab, click the three dots menu of the replication relationship to reverse.
6. Select **Reverse relationship**.
7. In the Reverse relationship dialog, click **Reverse**.

Change the replication schedule of a source volume

Change the replication schedule of the source volume in a replication relationship.

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

Steps

1. Log in to the Workload Factory console
2. In Storage, select **Go to storage inventory**.
3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.
4. From the file system overview, select the **Replication relationships** tab.
5. In the Replication relationships tab, click the three dots menu of the replication relationship schedule to change.
6. Select **Edit replication interval**.
7. 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

8. Click **Apply**.

Limit the max transfer rate of a replication relationship

Limit the max transfer rate of a replication relationship. 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 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.

Before you begin

Consider how much bandwidth to allocate for replication.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.

4. From the file system overview, select the **Replication relationships** tab.

5. In the Replication relationships tab, click the three dots menu of the replication relationship to limit the max transfer rate for.

6. Select **Edit max transfer rate**.

7. In the Edit max transfer rate dialog, select **Limited** and enter the max transfer limit in MB/s.

   Alternatively, select **Unlimited**.

8. Click **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 when needed.

Steps

1. Log in to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.

4. From the file system overview, select the **Replication relationships** tab.

5. In the Replication relationships tab, click the three dots menu of the replication relationship to update.

6. Select **Update now**.

7. In the Update dialog, click **Update now**.

Stop a replication relationship

When you stop a replication, 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 to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.

4. From the file system overview, select the **Replication relationships** tab.

5. In the Replication relationships tab, click the three dots menu of the replication relationship to stop.

6. Select **Break**.

7. In the Break replication dialog, select **Break**.

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

Delete a replication relationship

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 to the Workload Factory console

2. In Storage, select **Go to storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update and then select **Manage**.

4. From the file system overview, select the **Replication relationships** tab.

5. In the Replication relationships tab, click the three dots menu of the replication relationship to delete.

6. Select **Delete**.

7. In the Delete relationship dialog, click **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.

About this task

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

Automatic provisioned IOPS are calculated as 3 IOPS per GiB.

If you manually provision IOPS, you may need to increase IOPS before you can increase file system capacity.

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

Steps

1. Log in to the the Workload Factory console.

2. In Storage, click **Go to Storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to provision IOPS for and then select **Manage**.

4. Under Information, click the pencil icon next to **IOPS allocation**. The pencil icon appears next to the dropdown arrow when the mouse hovers over the **IOPS allocation** row.

5. In the Provisioned IOPS dialog, select **Automatic** or **User provisioned**.

6. If you select **User provisioned**, enter the **IOPS value**.

7. Click **Apply**.

Update throughput capacity for a file system

Update throughput capacity for an FSx for ONTAP file system as needed.

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

Steps

1. Log in to the the Workload Factory console.

2. In Storage, click **Go to Storage inventory**.

3. In the **FSx for ONTAP** tab, click the three dots menu of the file system to update throughput capacity for and then select **Manage**.

4. Under Information, click 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.

5. In the Throughput capacity dialog, select the throughput capacity you need.

6. Click **Apply**.

Reference

Performance for FSx for ONTAP

For an overview about performance, refer to Amazon FSx for NetApp ONTAP performance documentation.

Security for FSx for ONTAP

Amazon FSx for NetApp ONTAP documentation provides the following security topics for your reference.

- Data protection in Amazon FSx for NetApp ONTAP
- Identity and access management for Amazon FSx for NetApp ONTAP
- File System Access Control with Amazon VPC in Amazon FSx for NetApp ONTAP documentation

Knowledge and support

Register for support

Before you can open a support case with NetApp technical support, you need to add a NetApp Support Site account to Workload Factory and then register for support.

Support registration is required to receive technical support specific to Workload Factory and its storage solutions and services. You must register for support from the BlueXP console, which is a separate web-based console from Workload Factory.

Registering for support does not enable NetApp support for a cloud provider file service. For technical support related to a cloud provider file service, its infrastructure, or any solution using the service, refer to "Getting help" in the Workload Factory documentation for that product.

Amazon FSx for ONTAP

Support registration overview

Registering your account ID support subscription (your 20 digit 960xxxxxxxxx serial number located on the Support Resources page in BlueXP) serves as your single support subscription ID. Each BlueXP account-level support subscription must be registered.

Registering enables capabilities like opening support tickets and automatic case generation. Registration is completed by adding NetApp Support Site (NSS) accounts to BlueXP as described below.

Register your account for NetApp support

To register for support and activate support entitlement, one user in your account must associate a NetApp Support Site account with their BlueXP login. How you register for NetApp support depends on whether you already have a NetApp Support Site (NSS) account.

Existing customer with an NSS account

If you're a NetApp customer with an NSS account, you simply need to register for support through BlueXP.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

   Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. In the upper right of the BlueXP console, select the Settings icon, and select **Credentials**.
3. Select **User Credentials**.
4. Select **Add NSS credentials** and follow the NetApp Support Site (NSS) Authentication prompt.
5. To confirm that the registration process was successful, select the Help icon, and select **Support**.

   The **Resources** page should show that your account is registered for support.
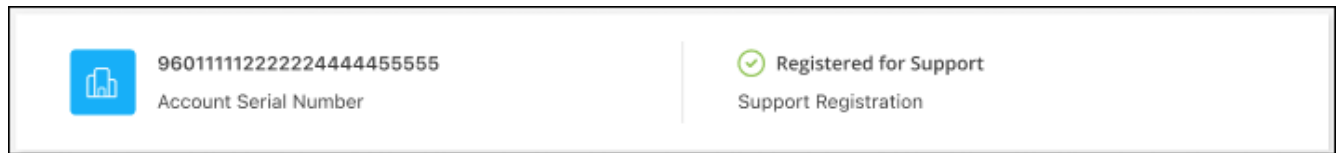
Note that other BlueXP users will not see this same support registration status if they have not associated a NetApp Support Site account with their BlueXP login. However, that doesn't mean that your BlueXP account is not registered for support. As long as one user in the account has followed these steps, then your account has been registered.

Existing customer but no NSS account

If you're an existing NetApp customer with existing licenses and serial numbers but *no* NSS account, you need to create an NSS account and associate it with your BlueXP login.

Steps

1. Create a NetApp Support Site account by completing the NetApp Support Site User Registration form

   a. Be sure to select the appropriate User Level, which is typically **NetApp Customer/End User**.

   b. Be sure to copy the BlueXP account serial number (960xxxx) used above for the serial number field. This will speed up the account processing.

2. Associate your new NSS account with your BlueXP login by completing the steps under Existing customer with an NSS account.

Brand new to NetApp

If you are brand new to NetApp and you don't have an NSS account, follow each step below.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

   Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. Locate your account ID serial number from the Support Resources page.
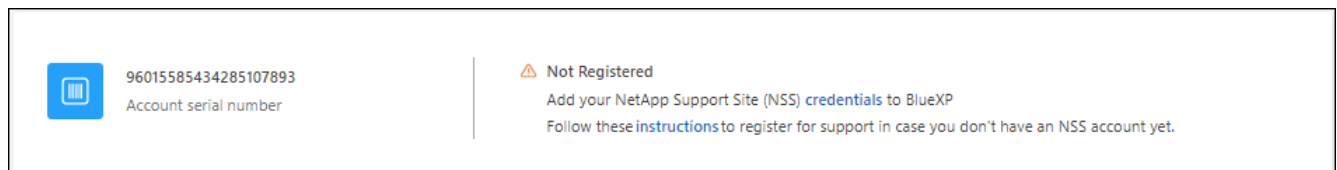
3. Navigate to NetApp's support registration site and select **I am not a registered NetApp Customer**.

4. Fill out the mandatory fields (those with red asterisks).

5. In the **Product Line** field, select **Cloud Manager** and then select your applicable billing provider.

6. Copy your account serial number from step 2 above, complete the security check, and then confirm that you read NetApp's Global Data Privacy Policy.

   An email is immediately sent to the mailbox provided to finalize this secure transaction. Be sure to check your spam folders if the validation email doesn't arrive in few minutes.

7. Confirm the action from within the email.

Confirming submits your request to NetApp and recommends that you create a NetApp Support Site account.

8. Create a NetApp Support Site account by completing the NetApp Support Site User Registration form

   a. Be sure to select the appropriate User Level, which is typically **NetApp Customer/End User**.

   b. Be sure to copy the account serial number (960xxxx) used above for the serial number field. This will speed up the account processing.

After you finish

NetApp should reach out to you during this process. This is a one-time onboarding exercise for new users.

Once you have your NetApp Support Site account, associate the account with your BlueXP login by completing the steps under Existing customer with an NSS account.

Get help for FSx for ONTAP for Workload Factory

NetApp provides support for Workload Factory and its cloud services in a variety of ways. Extensive free self-support options are available 24x7, such as knowledgebase (KB) articles and a community forum. Your support registration includes remote technical support via web ticketing.

Get support for FSx for ONTAP

For technical support related to FSx for ONTAP, its infrastructure, or any solution using the service, refer to "Getting help" in the Workload Factory documentation for that product.

Amazon FSx for ONTAP

To receive technical support specific to Workload Factory and its storage solutions and services, use the support options described below.

Use self-support options

These options are available for free, 24 hours a day, 7 days a week:

- Documentation

  The Workload Factory documentation that you're currently viewing.

- Knowledge base

  Search through the Workload Factory knowledge base to find helpful articles to troubleshoot issues.

- Communities

  Join the Workload Factory community to follow ongoing discussions or create new ones.

Create a case with NetApp support

In addition to the self-support options above, you can work with a NetApp Support specialist to resolve any issues after you activate support.

Before you get started

To use the **Create a Case** capability, you must first register for support. associate your NetApp Support Site credentials with your Workload Factory login. Learn how to register for support.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

   Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. On the **Resources** page, choose one of the available options under Technical Support:

   a. Select **Call Us** if you'd like to speak with someone on the phone. You'll be directed to a page on netapp.com that lists the phone numbers that you can call.

   b. Select **Create a Case** to open a ticket with a NetApp Support specialist:

      ▪ **Service**: Select **Workload Factory**.

      ▪ **Case Priority**: Choose the priority for the case, which can be Low, Medium, High, or Critical.

        To learn more details about these priorities, hover your mouse over the information icon next to the field name.

      ▪ **Issue Description**: Provide a detailed description of your problem, including any applicable error messages or troubleshooting steps that you performed.

      ▪ **Additional Email Addresses**: Enter additional email addresses if you'd like to make someone else aware of this issue.

      ▪ **Attachment (Optional)**: Upload up to five attachments, one at a time.

        Attachments are limited to 25 MB per file. The following file extensions are supported: txt, log, pdf, jpg/jpeg, rtf, doc/docx, xls/xlsx, and csv.

After you finish

A pop-up will appear with your support case number. A NetApp Support specialist will review your case and get back to you soon.

For a history of your support cases, you can select **Settings > Timeline** and look for actions named "create support case." A button to the far right lets you expand the action to see details.

It's possible that you might encounter the following error message when trying to create a case:

"You are not authorized to Create a Case against the selected service"

This error could mean that the NSS account and the company of record it's associated with is not the same company of record for the BlueXP account serial number (ie. 960xxxx) or the working environment serial number. You can seek assistance using one of the following options:

- Use the in-product chat
- Submit a non-technical case at https://mysupport.netapp.com/site/help

Manage your support cases (Preview)

You can view and manage active and resolved support cases directly from BlueXP. You can manage the cases associated with your NSS account and with your company.

Case management is available as a Preview. We plan to refine this experience and add enhancements in upcoming releases. Please send us feedback by using the in-product chat.

Note the following:

- The case management dashboard at the top of the page offers two views:

  ◦ The view on the left shows the total cases opened in the past 3 months by the user NSS account you provided.

  ◦ The view on the right shows the total cases opened in the past 3 months at your company level based on your user NSS account.

  The results in the table reflect the cases related to the view that you selected.

- You can add or remove columns of interest and you can filter the contents of columns like Priority and Status. Other columns provide just sorting capabilities.

  View the steps below for more details.

- At a per-case level, we offer the ability to update case notes or close a case that is not already in Closed or Pending Closed status.

Steps

1. In the upper right of the Workload Factory console, select **Help > Support**.

   Selecting this option opens the BlueXP console a new browser tab and loads the Support dashboard.

2. Select **Case Management** and if you're prompted, add your NSS account to BlueXP.

   The **Case management** page shows open cases related to the NSS account that is associated with your BlueXP user account. This is the same NSS account that appears at the top of the **NSS management** page.

3. Optionally modify the information that displays in the table:

   ◦ Under **Organization's cases**, select **View** to view all cases associated with your company.

   ◦ Modify the date range by choosing an exact date range or by choosing a different time frame.

- Filter the contents of the columns.

- Change the columns that appear in the table by selecting ➕ and then choosing the columns that you'd like to display.

4. Manage an existing case by selecting ••• and selecting one of the available options:

- **View case**: View full details about a specific case.

- **Update case notes**: Provide additional details about your problem or select **Upload files** to attach up to a maximum of five files.

  Attachments are limited to 25 MB per file. The following file extensions are supported: txt, log, pdf, jpg/jpeg, rtf, doc/docx, xls/xlsx, and csv.

- **Close case**: Provide details about why you're closing the case and select **Close case**.
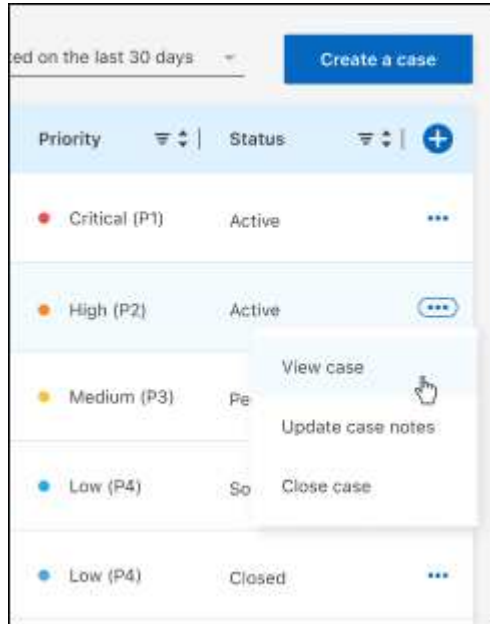
Troubleshooting for FSx for ONTAP

Amazon FSx for NetApp ONTAP documentation hosts troubleshooting topics for your reference.

Refer to Troubleshooting Amazon FSx for NetApp ONTAP for more information.

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