

# Amazon FSx for NetApp ONTAP

Astra Trident

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# **Table of Contents**

Amazon FSx for NetApp ONTAP	1
Use Astra Trident with Amazon FSx for NetApp ONTAP	1
Integrate Amazon FSx for NetApp ONTAP	2
FSx for ONTAP configuration options and examples	6
Configure the Astra Trident EKS add-on version 23.10 on EKS cluster	. 12

# Amazon FSx for NetApp ONTAP

# Use Astra Trident with Amazon FSx for NetApp ONTAP

Amazon FSx for NetApp ONTAP is a fully managed AWS service that enables customers to launch and run file systems powered by the NetApp ONTAP storage operating system. FSx for ONTAP enables you to leverage NetApp features, performance, and administrative capabilities you are familiar with, while taking advantage of the simplicity, agility, security, and scalability of storing data on AWS. FSx for ONTAP supports ONTAP file system features and administration APIs.

# Overview

A file system is the primary resource in Amazon FSx, analogous to an ONTAP cluster on premises. Within each SVM you can create one or multiple volumes, which are data containers that store the files and folders in your file system. With Amazon FSx for NetApp ONTAP, Data ONTAP will be provided as a managed file system in the cloud. The new file system type is called **NetApp ONTAP**.

Using Astra Trident with Amazon FSx for NetApp ONTAP, you can ensure Kubernetes clusters running in Amazon Elastic Kubernetes Service (EKS) can provision block and file persistent volumes backed by ONTAP.

Amazon FSx for NetApp ONTAP uses FabricPool to manage storage tiers. It enables you to store data in a tier, based on whether the data is frequently accessed.

# Considerations

- SMB volumes:
  - SMB volumes are supported using the ontap-nas driver only.
  - · Astra Trident supports SMB volumes mounted to pods running on Windows nodes only.
- Volumes created on Amazon FSx file systems that have automatic backups enabled cannot be deleted by Trident. To delete PVCs, you need to manually delete the PV and the FSx for ONTAP volume. To prevent this issue:
  - Do not use **Quick create** to create the FSx for ONTAP file system. The quick create workflow enables automatic backups and does not provide an opt-out option.
  - When using **Standard create**, disable automatic backup. Disabling automatic backups allows Trident to successfully delete a volume without further manual intervention.



# FSx for ONTAP driver details

You can integrate Astra Trident with Amazon FSx for NetApp ONTAP using the following drivers:

- ontap-san: Each PV provisioned is a LUN within its own Amazon FSx for NetApp ONTAP volume.
- ontap-san-economy: Each PV provisioned is a LUN with a configurable number of LUNs per Amazon FSx for NetApp ONTAP volume.
- ontap-nas: Each PV provisioned is a full Amazon FSx for NetApp ONTAP volume.
- ontap-nas-economy: Each PV provisioned is a qtree, with a configurable number of qtrees per Amazon FSx for NetApp ONTAP volume.
- ontap-nas-flexgroup: Each PV provisioned is a full Amazon FSx for NetApp ONTAP FlexGroup volume.

For driver details, see NAS drivers and SAN drivers.

## Authentication

Astra Trident offers two modes of authentication.

- Certificate-based: Astra Trident will communicate with the SVM on your FSx file system using a certificate installed on your SVM.
- Credential-based: You can use the fsxadmin user for your file system or the vsadmin user configured for your SVM.



Astra Trident expects to be run as a vsadmin SVM user or as a user with a different name that has the same role. Amazon FSx for NetApp ONTAP has an fsxadmin user that is a limited replacement of the ONTAP admin cluster user. We strongly recommend using vsadmin with Astra Trident.

You can update backends to move between credential-based and certificate-based methods. However, if you attempt to provide **credentials and certificates**, backend creation will fail. To switch to a different authentication method, you must remove the existing method from the backend configuration.

For details on enabling authentication, refer to the authentication for your driver type:

- ONTAP NAS authentication
- ONTAP SAN authentication

#### Find more information

- Amazon FSx for NetApp ONTAP documentation
- Blog post on Amazon FSx for NetApp ONTAP

# Integrate Amazon FSx for NetApp ONTAP

You can integrate your Amazon FSx for NetApp ONTAP file system with Astra Trident to ensure Kubernetes clusters running in Amazon Elastic Kubernetes Service (EKS) can provision block and file persistent volumes backed by ONTAP.

# Requirements

In addition to Astra Trident requirements, to integrate FSx for ONTAP with Astra Trident, you need:

- An existing Amazon EKS cluster or self-managed Kubernetes cluster with kubectl installed.
- An existing Amazon FSx for NetApp ONTAP file system and storage virtual machine (SVM) that is reachable from your cluster's worker nodes.
- Worker nodes that are prepared for NFS or iSCSI.



Ensure you follow the node preparation steps required for Amazon Linux and Ubuntu Amazon Machine Images (AMIs) depending on your EKS AMI type.

• Astra Trident supports SMB volumes mounted to pods running on Windows nodes only. Refer to Prepare to provision SMB volumes for details.

## **ONTAP SAN and NAS driver integration**



If you are configuring for SMB volumes, you must read Prepare to provision SMB volumes before creating the backend.

#### Steps

- 1. Deploy Astra Trident using one of the deployment methods.
- 2. Collect your SVM management LIF DNS name. For example, using the AWS CLI, find the DNSName entry under Endpoints → Management after running the following command:

```
aws fsx describe-storage-virtual-machines --region <file system region>
```

3. Create and install certificates for NAS backend authentication or SAN backend authentication.



You can log in to your file system (for example to install certificates) using SSH from anywhere that can reach your file system. Use the fsxadmin user, the password you configured when you created your file system, and the management DNS name from aws fsx describe-file-systems.

4. Create a backend file using your certificates and the DNS name of your management LIF, as shown in the sample below:

#### YAML

```
----
version: 1
storageDriverName: ontap-san
backendName: customBackendName
managementLIF: svm-XXXXXXXXXXXXX.fs-XXXXXXXXXXXXXX.fsx.us-
east-2.aws.internal
svm: svm01
clientCertificate: ZXR0ZXJwYXB...ICMgJ3BhcGVyc2
clientPrivateKey: vciwKIyAgZG...0cnksIGRlc2NyaX
trustedCACertificate: zcyBbaG...b3Igb3duIGNsYXNz
```

JSON

```
{
    "version": 1,
    "storageDriverName": "ontap-san",
    "backendName": "customBackendName",
    "managementLIF": "svm-XXXXXXXXXXXXX.fs-
XXXXXXXXXXXXXXX.fsx.us-east-2.aws.internal",
    "svm": "svm01",
    "clientCertificate": "ZXR0ZXJwYXB...ICMgJ3BhcGVyc2",
    "clientPrivateKey": "vciwKIyAgZG...0cnksIGRlc2NyaX",
    "trustedCACertificate": "zcyBbaG...b3Igb3duIGNsYXNz"
}
```

For information about creating backends, see these links:

- · Configure a backend with ONTAP NAS drivers
- · Configure a backend with ONTAP SAN drivers

## Prepare to provision SMB volumes

You can provision SMB volumes using the ontap-nas driver. Before you complete ONTAP SAN and NAS driver integration complete the following steps.

#### Before you begin

Before you can provision SMB volumes using the ontap-nas driver, you must have the following.

- A Kubernetes cluster with a Linux controller node and at least one Windows worker node running Windows Server 2019. Astra Trident supports SMB volumes mounted to pods running on Windows nodes only.
- At least one Astra Trident secret containing your Active Directory credentials. To generate secret smbcreds:

```
kubectl create secret generic smbcreds --from-literal username=user
--from-literal password='password'
```

• A CSI proxy configured as a Windows service. To configure a csi-proxy, refer to GitHub: CSI Proxy or GitHub: CSI Proxy for Windows for Kubernetes nodes running on Windows.

#### Steps

- Create SMB shares. You can create the SMB admin shares in one of two ways either using the Microsoft Management Console Shared Folders snap-in or using the ONTAP CLI. To create the SMB shares using the ONTAP CLI:
  - a. If necessary, create the directory path structure for the share.

The vserver cifs share create command checks the path specified in the -path option during share creation. If the specified path does not exist, the command fails.

b. Create an SMB share associated with the specified SVM:

```
vserver cifs share create -vserver vserver_name -share-name
share_name -path path [-share-properties share_properties,...]
[other_attributes] [-comment text]
```

c. Verify that the share was created:

vserver cifs share show -share-name share name



Refer to Create an SMB share for full details.

2. When creating the backend, you must configure the following to specify SMB volumes. For all FSx for ONTAP backend configuration options, refer to FSx for ONTAP configuration options and examples.

Parameter	Description	Example
smbShare	You can specify one of the following: the name of an SMB share created using the Microsoft Management Console or ONTAP CLI or a name to allow Astra Trident to create the SMB share. This parameter is required for Amazon FSx for ONTAP backends.	smb-share
nasType	<b>Must set to smb.</b> If null, defaults to nfs.	smb

Parameter	Description	Example
securityStyle	Security style for new volumes.	<code>ntfs</code> or <code>mixed</code> for SMB volumes
	for SMB volumes.	
unixPermissions	Mode for new volumes. <b>Must be</b> left empty for SMB volumes.	

# FSx for ONTAP configuration options and examples

Learn about backend configuration options for Amazon FSx for ONTAP. This section provides backend configuration examples.

## **Backend configuration options**

See the following table for the backend configuration options:

Parameter	Description	Example
version		Always 1
storageDriverName	Name of the storage driver	ontap-nas, ontap-nas- economy, ontap-nas- flexgroup, ontap-san, ontap- san-economy
backendName	Custom name or the storage backend	Driver name + "_" + dataLIF
managementLIF	IP address of a cluster or SVM management LIF A fully-qualified domain name (FQDN) can be specified. Can be set to use IPv6 addresses if Astra Trident was installed using the IPv6 flag. IPv6 addresses must be defined in square brackets, such as [28e8:d9fb:a825:b7bf:69a8:d02f:9e 7b:3555].	"10.0.0.1", "[2001:1234:abcd::fefe]"

Parameter	Description	Example
dataLIF	IP address of protocol LIF. <b>ONTAP NAS drivers</b> : We recommend specifying dataLIF. If not provided, Astra Trident fetches data LIFs from the SVM. You can specify a fully-qualified domain name (FQDN) to be used for the NFS mount operations, allowing you to create a round-robin DNS to load-balance across multiple data LIFs. Can be changed after initial setting. Refer to Update dataLIF after initial configuration. <b>ONTAP SAN drivers</b> : Do not specify for iSCSI. Astra Trident uses ONTAP Selective LUN Map to discover the iSCI LIFs needed to establish a multi path session. A warning is generated if dataLIF is explicitly defined. Can be set to use IPv6 addresses if Astra Trident was installed using the IPv6 flag. IPv6 addresses must be defined in square brackets, such as [28e8:d9fb:a825:b7bf:69a8:d02f:9e 7b:3555].	
autoExportPolicy	Enable automatic export policy creation and updating [Boolean]. Using the autoExportPolicy and autoExportCIDRs options, Astra Trident can manage export policies automatically.	false
autoExportCIDRs	List of CIDRs to filter Kubernetes' node IPs against when autoExportPolicy is enabled. Using the autoExportPolicy and autoExportCIDRs options, Astra Trident can manage export policies automatically.	"["0.0.0.0/0", "::/0"]"
labels	Set of arbitrary JSON-formatted labels to apply on volumes	""

Parameter	Description	Example
clientCertificate	Base64-encoded value of client certificate. Used for certificate- based auth	1111
clientPrivateKey	Base64-encoded value of client private key. Used for certificate- based auth	1117
trustedCACertificate	Base64-encoded value of trusted CA certificate. Optional. Used for certificate-based authentication.	111
username	Username to connect to the cluster or SVM. Used for credential-based authentication. For example, vsadmin.	
password	Password to connect to the cluster or SVM. Used for credential-based authentication.	
svm	Storage virtual machine to use	Derived if an SVM managementLIF is specified.
storagePrefix	Prefix used when provisioning new volumes in the SVM. Cannot be modified after creation. To update this parameter, you will need to create a new backend.	trident
limitAggregateUsage	Do not specify for Amazon FSx for NetApp ONTAP. The provided fsxadmin and vsadmin do not contain the permissions required to retrieve aggregate usage and limit it using Astra Trident.	Do not use.
limitVolumeSize	Fail provisioning if requested volume size is above this value. Also restricts the maximum size of the volumes it manages for qtrees and LUNs, and the qtreesPerFlexvol option allows customizing the maximum number of qtrees per FlexVol.	"" (not enforced by default)
lunsPerFlexvol	Maximum LUNs per Flexvol, must be in range [50, 200]. SAN only.	100

Parameter	Description	Example
debugTraceFlags	Debug flags to use when troubleshooting. Example, {"api":false, "method":true} Do not use debugTraceFlags unless you are troubleshooting and require a detailed log dump.	null
nfsMountOptions	Comma-separated list of NFS mount options. The mount options for Kubernetes- persistent volumes are normally specified in storage classes, but if no mount options are specified in a storage class, Astra Trident will fall back to using the mount options specified in the storage backend's configuration file. If no mount options are specified in the storage class or the configuration file, Astra Trident will not set any mount options on an associated persistent volume.	
nasType	Configure NFS or SMB volumes creation. Options are nfs, smb, or null. Must set to smb for SMB volumes. Setting to null defaults to NFS volumes.	nfs
qtreesPerFlexvol	Maximum Qtrees per FlexVol, must be in range [50, 300]	200
smbShare	You can specify one of the following: the name of an SMB share created using the Microsoft Management Console or ONTAP CLI or a name to allow Astra Trident to create the SMB share. This parameter is required for Amazon FSx for ONTAP backends.	smb-share

Parameter	Description	Example
USEREST	Boolean parameter to use ONTAP REST APIs. <b>Tech preview</b> useREST is provided as a <b>tech</b> <b>preview</b> that is recommended for test environments and not for production workloads. When set to true, Astra Trident will use ONTAP REST APIs to communicate with the backend. This feature requires ONTAP 9.11.1 and later. In addition, the ONTAP login role used must have access to the ontap application. This is satisfied by the pre-defined vsadmin and cluster-admin roles.	false

#### Update dataLIF after initial configuration

You can change the data LIF after initial configuration by running the following command to provide the new backend JSON file with updated data LIF.

```
tridentctl update backend <backend-name> -f <path-to-backend-json-file-
with-updated-dataLIF>
```



If PVCs are attached to one or multiple pods, you must bring down all corresponding pods and then bring them back up in order to for the new data LIF to take effect.

## Backend configuration options for provisioning volumes

You can control default provisioning using these options in the defaults section of the configuration. For an example, see the configuration examples below.

Parameter	Description	Default
spaceAllocation	Space-allocation for LUNs	true
spaceReserve	Space reservation mode; "none" (thin) or "volume" (thick)	none
snapshotPolicy	Snapshot policy to use	none

Parameter	Description	Default
qosPolicy	QoS policy group to assign for volumes created. Choose one of qosPolicy or adaptiveQosPolicy per storage pool or backend.	<b>"</b> "
	Using QoS policy groups with Astra Trident requires ONTAP 9.8 or later.	
	We recommend using a non-shared QoS policy group and ensuring the policy group is applied to each constituent individually. A shared QoS policy group will enforce the ceiling for the total throughput of all workloads.	
adaptiveQosPolicy	Adaptive QoS policy group to assign for volumes created. Choose one of qosPolicy or adaptiveQosPolicy per storage pool or backend.	"
	Not supported by ontap-nas- economy.	
snapshotReserve	Percentage of volume reserved for snapshots "0"	<pre>If snapshotPolicy is none, else ""</pre>
splitOnClone	Split a clone from its parent upon creation	false
encryption	Enable NetApp Volume Encryption (NVE) on the new volume; defaults to false. NVE must be licensed and enabled on the cluster to use this option.	false
	any volume provisioned in Astra Trident will be NAE enabled.	
	For more information, refer to: How Astra Trident works with NVE and NAE.	
luksEncryption	Enable LUKS encryption. Refer to Use Linux Unified Key Setup (LUKS).	
	SAN only.	
tieringPolicy	Tiering policy to use none	<pre>snapshot-only for pre-ONTAP 9.5 SVM-DR configuration</pre>

Parameter	Description	Default
unixPermissions	Mode for new volumes.	<b>«</b> 11
	Leave empty for SMB volumes.	
securityStyle	Security style for new volumes.	NFS default is unix.
	NFS supports mixed and unix security styles.	SMB default is ntfs.
	SMB supports mixed and ntfs security styles.	

# Example

Using nasType, node-stage-secret-name, and node-stage-secret-namespace, you can specify an SMB volume and provide the required Active Directory credentials. SMB volumes are supported using the ontap-nas driver only.

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
   name: nas-smb-sc
provisioner: csi.trident.netapp.io
parameters:
   backendType: "ontap-nas"
   trident.netapp.io/nasType: "smb"
   csi.storage.k8s.io/node-stage-secret-name: "smbcreds"
   csi.storage.k8s.io/node-stage-secret-namespace: "default"
```

# Configure the Astra Trident EKS add-on version 23.10 on EKS cluster

Astra Trident streamlines Amazon FSx for NetApp ONTAP storage management in Kubernetes to enable your developers and administrators focus on application deployment. The Astra Trident EKS add-on includes the latest security patches, bug fixes, and is validated by AWS to work with Amazon EKS. The EKS add-on enables you to consistently ensure that your Amazon EKS clusters are secure and stable and reduce the amount of work that you need to do in order to install, configure, and update add-ons.

## **Prerequisites**

Ensure that you have the following before configuring the Astra Trident add-on for AWS EKS:

- An Amazon EKS cluster account with add-on subscription
- AWS permissions to the AWS marketplace:

```
"aws-marketplace:ViewSubscriptions",
"aws-marketplace:Subscribe",
"aws-marketplace:Unsubscribe
```

- AMI type: Amazon Linux 2 (AL2\_x86\_64) or Amazon Linux 2 Arm(AL2\_ARM\_64)
- Node type: AMD or ARM
- An existing Amazon FSx for NetApp ONTAP file system

## Steps

1. On your your EKS Kubernetes cluster, navigate to the Add-ons tab.

End of support for Kuberi preview ends, clusters on	etes version 1.26 is June 2024. If you don't update your cluste versions in extended support will be subject to additional fees	er to a later version before that date, it will automatically enter extended su a. Learn more 🗹	pport. After the extended support Update now
Cluster info Info			
tatus	Kubernetes version Info	Support type	Provider
Active	1.26	Standard support until June 2024	EKS
Overview Resources	Compute Networking Add-ons Authen	itication Observability Update history Tags	

2. Go to AWS Marketplace add-ons and choose the storage category.

	άn						
filtering option	15						
storage 🔻	Any vendor 🔻	Any pricing model 🔻	Clear filters				
storage X					2	1	3
	Astra Trident strea your developers ar scalability, and int containerized stors	misses Amazon F5a for NetApp nd administrators focus on apol orgration capabilities make it th age workflows. <u>Product details</u>	CNTAP storage managemen lication deployment. FSx for 0 e ideal shoke for organization	t in Kuberneles 19 let INTAP fizzibility, is seeking efficient			
	Category	Listed by	Supported versions	Pricing starting at			
	1.000.000.000.000	NetApp, Inc. E	1.27, 1.26, 1.25,	View pricing			

- 3. Locate **AstraTrident by NetApp** and select the checkbox for the Astra Trident add-on.
- 4. Choose the desired version of the add-on.

Astra Trident by Ne	tApp	Remove add-on
Listed by	Category storage	Status Ready to install
You're subscrib You can view th another offer if	ed to this software e terms and pricing details for this produ one is available.	View subscription X
v23.10.0-eksbuild.1	S-bei,	v
Select IAM role ielect an IAM role to use with	this add-on. To create a new role, follow the im	structions in the Amuzon EKS User Guide
Q Filter roles		
Mark and		4
This add-on will use the IAM	f role of the node where it runs.	

- 5. Select the IAM role option to inherit from the node.
- 6. Configure any optional settings as required and select **Next**.

Selected add-ons							
Q. Find add-an						<	1.2
Add-on name		Туре	v	Status			
netapp_trident-operator		storage		@ Ready to i	install		
ep 2: Configure selected ad	d-ons settings						Edi
Add-on name netapp_trident-operator	Version v23.10.0-eksl	build.1		IAM role Inberit fro	əm node		

- 7. Select Create.
- 8. Verify that the status of the add-on is *Active*.

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# Install/uninstall the Astra Trident EKS add-on using CLI

#### Install the Astra Trident EKS add-on using CLI:

The following example commands install the Astra Trident EKS add-on:

eksctl create addon --cluster K8s-arm --name netapp\_trident-operator --version v23.10.0-eksbuild. eksctl create addon --cluster K8s-arm --name netapp\_trident-operator --version v23.10.0-eksbuild.1 (with a dedicated version)

#### Uninstall the Astra Trident EKS add-on using CLI:

The following command uninstalls the Astra Trident EKS add-on: eksctl delete addon --cluster K8s-arm --name netapp trident-operator

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