



# **Configure an ANF backend**

## **Astra Trident**

NetApp

November 02, 2022

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# Configure an Azure NetApp Files backend

You can configure Azure NetApp Files (ANF) as the backend for Astra Trident. You can attach NAS and SMB volumes using an ANF backend.

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## Considerations

- The Azure NetApp Files service does not support volumes smaller than 100 GB. Astra Trident automatically creates 100-GB volumes if a smaller volume is requested.
- Astra Trident supports SMB volumes mounted to pods running on Windows nodes only.
- Astra Trident does not support Windows ARM architecture.

## Prepare to configure an Azure NetApp Files backend

Before you can configure your ANF backend, you need to ensure the following requirements are met.

If you are using Azure NetApp Files for the first time or in a new location, some initial configuration is required.

- To set up Azure NetApp files and create an NFS volume, refer to [Azure: Set up Azure NetApp Files and create an NFS volume](#).
- To configure Azure NetApp Files and add an SMB volume, refer to: [Azure: Create an SMB volume for Azure NetApp Files](#).

## Requirements

To configure and use an [Azure NetApp Files](#) backend, you need the following:

- subscriptionID from an Azure subscription with Azure NetApp Files enabled.
- tenantID, clientID, and clientSecret from an [App Registration](#) in Azure Active Directory with sufficient permissions to the Azure NetApp Files service. The App Registration should use either:
  - The Owner or Contributor role [predefined by Azure](#)
  - A [custom Contributor role](#) at the subscription level (assignableScopes) with the following permissions that are limited to only what Astra Trident requires. After creating the custom role, [assign the role using the Azure portal](#).

```
{
  "id": "/subscriptions/<subscription-id>/providers/Microsoft.Authorization/roleDefinitions/<role-definition-id>",
  "properties": {
    "roleName": "custom-role-with-limited-perms",
    "description": "custom role providing limited permissions",
    "assignableScopes": [
```

```

        "/subscriptions/<subscription-id>"
    ],
    "permissions": [
        {
            "actions": [

"Microsoft.NetApp/netAppAccounts/capacityPools/read",

"Microsoft.NetApp/netAppAccounts/capacityPools/write",

"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/read",

"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/write",

"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/delete",

"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/snapshots/read",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/snapshots/write",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/snapshots/delete",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/subvolumes/read",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/subvolumes/write",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/subvolumes/delete",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/subvolumes/GetMetadata/action",
",
"Microsoft.NetApp/netAppAccounts/capacityPools/volumes/MountTargets/read",
",
                "Microsoft.Network/virtualNetworks/read",
                "Microsoft.Network/virtualNetworks/subnets/read",

"Microsoft.Features/featureProviders/subscriptionFeatureRegistrations/read",

"Microsoft.Features/featureProviders/subscriptionFeatureRegistrations

```

```

/write",

"Microsoft.Features/featureProviders/subscriptionFeatureRegistrations
/delete",

        "Microsoft.Features/features/read",
        "Microsoft.Features/operations/read",
        "Microsoft.Features/providers/features/read",

"Microsoft.Features/providers/features/register/action",

"Microsoft.Features/providers/features/unregister/action",

"Microsoft.Features/subscriptionFeatureRegistrations/read"
    ],
    "notActions": [],
    "dataActions": [],
    "notDataActions": []
  }
]
}
}

```

- The Azure location that contains at least one [delegated subnet](#). As of Trident 22.01, the location parameter is a required field at the top level of the backend configuration file. Location values specified in virtual pools are ignored.

## Additional requirements for SMB volumes

- 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 so ANF can authenticate to Active Directory. To generate secret `smbcreds`:

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

- 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.

## Azure NetApp Files backend configuration options and examples

Learn about NFS and SMB backend configuration options for ANF and review configuration examples.

Astra Trident uses your backend configuration (subnet, virtual network, service level, and location), to create ANF volumes on capacity pools that are available in the requested location and match the requested service

level and subnet.



Astra Trident does not support Manual QoS capacity pools.

## Backend configuration options

ANF backends provide these configuration options.

| Parameter         | Description  | Default                               |
|-------------------|--|---------------------------------------|
| version           |  | Always 1                              |
| storageDriverName | Name of the storage driver                                       | "azure-netapp-files"                  |
| backendName       | Custom name of the storage backend                               | Driver name + "_" + random characters |
| subscriptionID    | The subscription ID from your Azure subscription                 |                                       |
| tenantID          | The tenant ID from an App Registration                           |                                       |
| clientID          | The client ID from an App Registration                           |                                       |
| clientSecret      | The client secret from an App Registration                       |                                       |
| serviceLevel      | One of Standard, Premium, or Ultra                               | "" (random)                           |
| location          | Name of the Azure location where the new volumes will be created |                                       |
| resourceGroups    | List of resource groups for filtering discovered resources       | [] (no filter)                        |
| netappAccounts    | List of NetApp accounts for filtering discovered resources       | [] (no filter)                        |
| capacityPools     | List of capacity pools for filtering discovered resources        | [] (no filter, random)                |
| virtualNetwork    | Name of a virtual network with a delegated subnet                | ""                                    |
| subnet            | Name of a subnet delegated to Microsoft.Netapp/volumes           | ""                                    |

| Parameter                    | Description   | Default                      |
|------------------------------|---|------------------------------|
| <code>networkFeatures</code> | <p>Set of VNet features for a volume, may be <code>Basic</code> or <code>Standard</code>.</p> <p>Network Features is not available in all regions and might have to be enabled in a subscription. Specifying <code>networkFeatures</code> when the functionality is not enabled causes volume provisioning to fail.</p>                   | ""                           |
| <code>nfsMountOptions</code> | <p>Fine-grained control of NFS mount options.</p> <p>Ignored for SMB volumes.</p> <p>To mount volumes using NFS version 4.1, include <code>nfsvers=4</code> in the comma-delimited mount options list to choose NFS v4.1.</p> <p>Mount options set in a storage class definition override mount options set in backend configuration.</p> | "nfsvers=3"                  |
| <code>limitVolumeSize</code> | Fail provisioning if the requested volume size is above this value  | "" (not enforced by default) |
| <code>debugTraceFlags</code> | <p>Debug flags to use when troubleshooting. Example, <code>\{"api": false, "method": true, "discovery": true\}</code>. Do not use this unless you are troubleshooting and require a detailed log dump.</p>  | null                         |
| <code>nasType</code>         | <p>Configure NFS or SMB volumes creation.</p> <p>Options are <code>nfs</code>, <code>smb</code> or <code>null</code>. Setting to null defaults to NFS volumes.</p>  | <code>nfs</code>             |



For more information on Network Features, refer to [Configure network features for an Azure NetApp Files volume](#).

## Required permissions and resources

If you receive a “No capacity pools found” error when creating a PVC, it is likely your app registration doesn’t have the required permissions and resources (subnet, virtual network, capacity pool) associated. If debug is enabled, Astra Trident will log the Azure resources discovered when the backend is created. Verify an appropriate role is being used.

The values for `resourceGroups`, `netappAccounts`, `capacityPools`, `virtualNetwork`, and `subnet` can be specified using short or fully-qualified names. Fully-qualified names are recommended in most situations as short names can match multiple resources with the same name.

The `resourceGroups`, `netappAccounts`, and `capacityPools` values are filters that restrict the set of discovered resources to those available to this storage backend and may be specified in any combination. Fully-qualified names follow this format:

| Type            | Format  |
|-----------------|---|
| Resource group  | <resource group>                                  |
| NetApp account  | <resource group>/<netapp account>                 |
| Capacity pool   | <resource group>/<netapp account>/<capacity pool> |
| Virtual network | <resource group>/<virtual network>                |
| Subnet          | <resource group>/<virtual network>/<subnet>       |

## Volume provisioning

You can control default volume provisioning by specifying the following options in a special section of the configuration file. Refer to [Example configurations](#) for details.

| Parameter                    | Description  | Default   |
|------------------------------|--|---|
| <code>exportRule</code>      | Export rules for new volumes.<br><br><code>exportRule</code> must be a comma-separated list of any combination of IPv4 addresses or IPv4 subnets in CIDR notation.<br><br>Ignored for SMB volumes. | "0.0.0.0/0"   |
| <code>snapshotDir</code>     | Controls visibility of the <code>.snapshot</code> directory  | "false"   |
| <code>size</code>            | The default size of new volumes  | "100G"  |
| <code>unixPermissions</code> | The unix permissions of new volumes (4 octal digits).<br><br>Ignored for SMB volumes.  | "" (preview feature, requires whitelisting in subscription) |



For all volumes created on an ANF backend, Astra Trident copies the labels present on a storage pool to the storage volume at the time it is provisioned. Storage administrators can define labels per storage pool and group all volumes created in a storage pool. This is a convenient way to differentiate volumes based on a set of customizable labels that are provided in the backend configuration.

## Example configurations



### Example 1: Minimal configuration

This is the absolute minimum backend configuration. With this configuration, Astra Trident discovers all of your NetApp accounts, capacity pools, and subnets delegated to ANF in the configured location, and places new volumes on one of those pools and subnets randomly. Because `nasType` is omitted, the `nfs` default applies and the backend will provision for NFS volumes.

This configuration is ideal when you are just getting started with ANF and trying things out, but in practice you are going to want to provide additional scoping for the volumes you provision.

```
{
  "version": 1,
  "storageDriverName": "azure-netapp-files",
  "subscriptionID": "9f87c765-4774-fake-ae98-a721add45451",
  "tenantID": "68e4f836-edc1-fake-bff9-b2d865ee56cf",
  "clientID": "dd043f63-bf8e-fake-8076-8de91e5713aa",
  "clientSecret": "SECRET",
  "location": "eastus"
}
```

### Example 2: Specific service level configuration with capacity pool filters

This backend configuration places volumes in Azure's `eastus` location in an `Ultra` capacity pool. Astra Trident automatically discovers all of the subnets delegated to ANF in that location and places a new volume on one of them randomly.

```
{
  "version": 1,
  "storageDriverName": "azure-netapp-files",
  "subscriptionID": "9f87c765-4774-fake-ae98-a721add45451",
  "tenantID": "68e4f836-edc1-fake-bff9-b2d865ee56cf",
  "clientID": "dd043f63-bf8e-fake-8076-8de91e5713aa",
  "clientSecret": "SECRET",
  "location": "eastus",
  "serviceLevel": "Ultra",
  "capacityPools": [
    "application-group-1/account-1/ultra-1",
    "application-group-1/account-1/ultra-2"
  ],
}
```

### Example 3: Advanced configuration

This backend configuration further reduces the scope of volume placement to a single subnet, and also modifies some volume provisioning defaults.

```
{
  "version": 1,
  "storageDriverName": "azure-netapp-files",
  "subscriptionID": "9f87c765-4774-fake-ae98-a721add45451",
  "tenantID": "68e4f836-edc1-fake-bff9-b2d865ee56cf",
  "clientID": "dd043f63-bf8e-fake-8076-8de91e5713aa",
  "clientSecret": "SECRET",
  "location": "eastus",
  "serviceLevel": "Ultra",
  "capacityPools": [
    "application-group-1/account-1/ultra-1",
    "application-group-1/account-1/ultra-2"
  ],
  "virtualNetwork": "my-virtual-network",
  "subnet": "my-subnet",
  "networkFeatures": "Standard",
  "nfsMountOptions": "vers=3,proto=tcp,timeo=600",
  "limitVolumeSize": "500Gi",
  "defaults": {
    "exportRule": "10.0.0.0/24,10.0.1.0/24,10.0.2.100",
    "snapshotDir": "true",
    "size": "200Gi",
    "unixPermissions": "0777"
  }
}
```

#### Example 4: Virtual storage pool configuration

This backend configuration defines multiple storage pools in a single file. This is useful when you have multiple capacity pools supporting different service levels and you want to create storage classes in Kubernetes that represent those.

```

{
  "version": 1,
  "storageDriverName": "azure-netapp-files",
  "subscriptionID": "9f87c765-4774-fake-ae98-a721add45451",
  "tenantID": "68e4f836-edc1-fake-bff9-b2d865ee56cf",
  "clientID": "dd043f63-bf8e-fake-8076-8de91e5713aa",
  "clientSecret": "SECRET",
  "location": "eastus",
  "resourceGroups": ["application-group-1"],
  "networkFeatures": "Basic",
  "nfsMountOptions": "vers=3,proto=tcp,timeo=600",
  "labels": {
    "cloud": "azure"
  },
  "location": "eastus",

  "storage": [
    {
      "labels": {
        "performance": "gold"
      },
      "serviceLevel": "Ultra",
      "capacityPools": ["ultra-1", "ultra-2"],
      "networkFeatures": "Standard"
    },
    {
      "labels": {
        "performance": "silver"
      },
      "serviceLevel": "Premium",
      "capacityPools": ["premium-1"]
    },
    {
      "labels": {
        "performance": "bronze"
      },
      "serviceLevel": "Standard",
      "capacityPools": ["standard-1", "standard-2"]
    }
  ]
}

```

## Storage Class definitions

The following `StorageClass` definitions refer to the storage pools above.

### Example definitions using `parameter.selector` field

Using `parameter.selector` you can specify for each `StorageClass` the virtual pool that is used to host a volume. The volume will have the aspects defined in the chosen pool.

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: gold
provisioner: csi.trident.netapp.io
parameters:
  selector: "performance=gold"
allowVolumeExpansion: true
---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: silver
provisioner: csi.trident.netapp.io
parameters:
  selector: "performance=silver"
allowVolumeExpansion: true
---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: bronze
provisioner: csi.trident.netapp.io
parameters:
  selector: "performance=bronze"
allowVolumeExpansion: true
```

### Example definitions for SMB volumes

Using `nasType`, `node-stage-secret-name`, and `node-stage-secret-namespace`, you can specify an SMB volume and provide the required Active Directory credentials.

### Example 1: Basic configuration on default namespace

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

### Example 2: Using different secrets per namespace

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: anf-sc-smb
provisioner: csi.trident.netapp.io
parameters:
  backendType: "azure-netapp-files"
  trident.netapp.io/nasType: "smb"
  csi.storage.k8s.io/node-stage-secret-name: "smbcreds"
  csi.storage.k8s.io/node-stage-secret-namespace: ${pvc.namespace}
```

### Example 3: Using different secrets per volume

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: anf-sc-smb
provisioner: csi.trident.netapp.io
parameters:
  backendType: "azure-netapp-files"
  trident.netapp.io/nasType: "smb"
  csi.storage.k8s.io/node-stage-secret-name: ${pvc.name}
  csi.storage.k8s.io/node-stage-secret-namespace: ${pvc.namespace}
```



`nasType: "smb"` filters for pools which support SMB volumes. `nasType: "nfs"` or `nasType: "null"` filters for NFS pools.

## Create the backend

After you create the backend configuration file, run the following command:

```
tridentctl create backend -f <backend-file>
```

If the backend creation fails, something is wrong with the backend configuration. You can view the logs to determine the cause by running the following command:

```
tridentctl logs
```

After you identify and correct the problem with the configuration file, you can run the create command again.

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