



# **Manage and monitor Astra Trident**

## **Astra Trident**

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# Manage and monitor Astra Trident

## Upgrade Astra Trident

### Upgrade Astra Trident

Astra Trident follows a quarterly release cadence, delivering four major releases every calendar year. Each new release builds on the previous releases and provides new features, performance enhancements, bug fixes, and improvements. We encourage you to upgrade at least once a year to take advantage of the new features in Astra Trident.

### Considerations before upgrading

When upgrading to the latest release of Astra Trident, consider the following:

- There should be only one Astra Trident instance installed across all the namespaces in a given Kubernetes cluster.
- Astra Trident 23.07 and later requires v1 volume snapshots and no longer supports alpha or beta snapshots.
- If you created Cloud Volumes Service for Google Cloud in the [CVS service type](#), you must update the backend configuration to use the `standardsw` or `zoneredundantstandardsw` service level when upgrading from Astra Trident 23.01. Failure to update the `serviceLevel` in the backend could cause volumes to fail. Refer to [CVS service type samples](#) for details.
- When upgrading, it is important you provide `parameter.fsType` in `StorageClasses` used by Astra Trident. You can delete and re-create `StorageClasses` without disrupting pre-existing volumes.
  - This is a **requirement** for enforcing [security contexts](#) for SAN volumes.
  - The [sample input](#) directory contains examples, such as `storage-class-basic.yaml.templ` and `storage-class-bronze-default.yaml`.
  - For more information, see [Known Issues](#).

### Step 1: Select a version

Astra Trident versions follow a date-based `YY.MM` naming convention, where "YY" is the last two digits of the year and "MM" is the month. Dot releases follow a `YY.MM.X` convention, where "X" is the patch level. You will select the version to upgrade to based on the version you are upgrading from.

- You can perform a direct upgrade to any target release that is within a four-release window of your installed version. For example, you can directly upgrade from 22.07 (or any 22.07 dot release) to 23.07.
- If you are upgrading from a release outside of the four-release window, perform a multi-step upgrade. Use the upgrade instructions for the [earlier version](#) you are upgrading from to upgrade to the most recent release that fits the four-release window. For example, if you are running 21.07 and want to upgrade to 23.07:
  1. First upgrade from 21.07 to 22.07.
  2. Then upgrade from 22.07 to 23.07.



When upgrading using the Trident operator on OpenShift Container Platform, you should upgrade to Trident 21.01.1 or later. The Trident operator released with 21.01.0 contains a known issue that has been fixed in 21.01.1. For more details, see the [issue details on GitHub](#).

## Step 2: Determine the original installation method

To determine which version you used to originally install Astra Trident:

1. Use `kubectl get pods -n trident` to examine the pods.
  - If there is no operator pod, Astra Trident was installed using `tridentctl`.
  - If there is an operator pod, Astra Trident was installed using the Trident operator either manually or using Helm.
2. If there is an operator pod, use `kubectl describe tproc trident` to determine if Astra Trident was installed using Helm.
  - If there is a Helm label, Astra Trident was installed using Helm.
  - If there is no Helm label, Astra Trident was installed manually using the Trident operator.

## Step 3: Select an upgrade method

Generally, you should upgrade using the same method you used for the initial installation, however you can [move between installation methods](#). There are two options to upgrade Astra Trident.

- [Upgrade using the Trident operator](#)



We suggest you review [Understand the operator upgrade workflow](#) before upgrading with the operator.

- [Upgrade using `tridentctl`](#)

## Upgrade with the operator

### Understand the operator upgrade workflow

Before using the Trident operator to upgrade Astra Trident, you should understand the background processes that occur during upgrade. This includes changes to the Trident controller, controller Pod and node Pods, and node DaemonSet that enable rolling updates.

### Trident operator upgrade handling

One of the many [benefits of using the Trident operator](#) to install and upgrade Astra Trident is the automatic handling of Astra Trident and Kubernetes objects without disrupting existing mounted volumes. In this way, Astra Trident can support upgrades with zero downtime, or [rolling updates](#). In particular, the Trident operator communicates with the Kubernetes cluster to:

- Delete and recreate the Trident Controller deployment and node DaemonSet.
- Replace the Trident Controller Pod and Trident Node Pods with new versions.
  - If a node is not updated, it does not prevent remaining nodes from being updated.

- Only nodes with a running Trident Node Pod can mount volumes.



For more information about Astra Trident architecture on the Kubernetes cluster, refer to [Astra Trident architecture](#).

### Operator upgrade workflow

When you initiate an upgrade using the Trident operator:

1. The **Trident operator**:
  - a. Detects the currently installed version of Astra Trident (version  $n$ ).
  - b. Updates all Kubernetes objects including CRDs, RBAC, and Trident SVC.
  - c. Deletes the Trident Controller deployment for version  $n$ .
  - d. Creates the Trident Controller deployment for version  $n+1$ .
2. **Kubernetes** creates Trident Controller Pod for  $n+1$ .
3. The **Trident operator**:
  - a. Deletes the Trident Node DaemonSet for  $n$ . The operator does not wait for Node Pod termination.
  - b. Creates the Trident Node Daemonset for  $n+1$ .
4. **Kubernetes** creates Trident Node Pods on nodes not running Trident Node Pod  $n$ . This ensures there is never more than one Trident Node Pod, of any version, on a node.

### Upgrade a Trident operator installation

You can upgrade Astra Trident using the Trident operator either manually or using Helm. You can upgrade from a Trident operator installation to another Trident operator installation or upgrade from a `tridentctl` installation to a Trident operator version. Review [Select an upgrade method](#) before upgrading a Trident operator installation.

### Upgrade a manual installation

You can upgrade from a cluster-scoped Trident operator installation to another cluster-scoped Trident operator installation. All Astra Trident versions 21.01 and above use a cluster-scoped operator.



To upgrade from Astra Trident that was installed using the namespace-scoped operator (versions 20.07 through 20.10), use the upgrade instructions for [your installed version](#) of Astra Trident.

### About this task

Trident provides a bundle file you can use to install the operator and create associated objects for your Kubernetes version.

- For clusters running Kubernetes 1.24 or earlier, use [bundle\\_pre\\_1\\_25.yaml](#).
- For clusters running Kubernetes 1.25 or later, use [bundle\\_post\\_1\\_25.yaml](#).

### Before you begin

Ensure you are using a Kubernetes cluster running [a supported Kubernetes version](#).

### Steps

1. Verify your Astra Trident version:

```
./tridentctl -n trident version
```

2. Delete the Trident operator that was used to install the current Astra Trident instance. For example, if you are upgrading from 23.04, run the following command:

```
kubectl delete -f 23.04/trident-installer/deploy/<bundle.yaml> -n trident
```

3. If you customized your initial installation using `TridentOrchestrator` attributes, you can edit the `TridentOrchestrator` object to modify the installation parameters. This might include changes made to specify mirrored Trident and CSI image registries for offline mode, enable debug logs, or specify image pull secrets.

4. Install Astra Trident using the correct bundle YAML file for your environment, where `<bundle.yaml>` is `bundle_pre_1_25.yaml` or `bundle_post_1_25.yaml` based on your Kubernetes version. For example, if you are installing Astra Trident 23.07, run the following command:

```
kubectl create -f 23.07.1/trident-installer/deploy/<bundle.yaml> -n trident
```

### Upgrade a Helm installation

You can upgrade an Astra Trident Helm installation.



When upgrading a Kubernetes cluster from 1.24 to 1.25 or later that has Astra Trident installed, you must update `values.yaml` to set `excludePodSecurityPolicy` to `true` or add `--set excludePodSecurityPolicy=true` to the `helm upgrade` command before you can upgrade the cluster.

### Steps

1. Download the latest Astra Trident release.
2. Use the `helm upgrade` command where `trident-operator-23.07.1.tgz` reflects the version that you want to upgrade to.

```
helm upgrade <name> trident-operator-23.07.1.tgz
```

If you set any non-default options during the initial installation (such as specifying private, mirrored registries for Trident and CSI images), use `--set` to ensure those options are included in the upgrade command, otherwise the values will reset to default.



For example, to change the default value of `tridentDebug`, run the following command:

```
helm upgrade <name> trident-operator-23.07.1-custom.tgz --set
tridentDebug=true
```

3. Run `helm list` to verify that the chart and app version have both been upgraded. Run `tridentctl logs` to review any debug messages.

### Upgrade from a `tridentctl` installation to Trident operator

You can upgrade to the latest release of the Trident operator from a `tridentctl` installation. The existing backends and PVCs will automatically be available.



Before switching between installation methods, review [Moving between installation methods](#)

### Steps

1. Download the latest Astra Trident release.

```
# Download the release required [23.07.1]
mkdir 23.07.1
cd 23.07.1
wget
https://github.com/NetApp/trident/releases/download/v22.01.1/trident-
installer-23.07.1.tar.gz
tar -xf trident-installer-23.07.1.tar.gz
cd trident-installer
```

2. Create the `tridentorchestrator` CRD from the manifest.

```
kubectl create -f
deploy/crds/trident.netapp.io_tridentorchestrators_crd_post1.16.yaml
```

3. Deploy the cluster-scoped operator in the same namespace.

```
kubectl create -f deploy/<bundle-name.yaml>

serviceaccount/trident-operator created
clusterrole.rbac.authorization.k8s.io/trident-operator created
clusterrolebinding.rbac.authorization.k8s.io/trident-operator created
deployment.apps/trident-operator created
podsecuritypolicy.policy/tridentoperatorpods created

#Examine the pods in the Trident namespace
```

NAME	READY	STATUS	RESTARTS	AGE
trident-controller-79df798bdc-m79dc	6/6	Running	0	150d
trident-node-linux-xrst8	2/2	Running	0	150d
trident-operator-5574dbbc68-nthjv	1/1	Running	0	1m30s

#### 4. Create a TridentOrchestrator CR for installing Astra Trident.

```
cat deploy/crds/tridentorchestrator_cr.yaml
apiVersion: trident.netapp.io/v1
kind: TridentOrchestrator
metadata:
  name: trident
spec:
  debug: true
  namespace: trident

kubectl create -f deploy/crds/tridentorchestrator_cr.yaml

#Examine the pods in the Trident namespace
```

NAME	READY	STATUS	RESTARTS	AGE
trident-csi-79df798bdc-m79dc	6/6	Running	0	1m
trident-csi-xrst8	2/2	Running	0	1m
trident-operator-5574dbbc68-nthjv	1/1	Running	0	5m41s

#### 5. Confirm Trident was upgraded to the intended version.

```
kubectl describe torc trident | grep Message -A 3

Message:          Trident installed
Namespace:        trident
Status:           Installed
Version:          v23.07.1
```



## Upgrade with tridentctl

You can easily upgrade an existing Astra Trident installation using `tridentctl`.

### About this task

Uninstalling and reinstalling Astra Trident acts as an upgrade. When you uninstall Trident, the Persistent Volume Claim (PVC) and Persistent Volume (PV) used by the Astra Trident deployment are not deleted. PVs that have already been provisioned will remain available while Astra Trident is offline, and Astra Trident will provision volumes for any PVCs that are created in the interim once it is back online.

### Before you begin

Review [Select an upgrade method](#) before upgrading using `tridentctl`.

### Steps

1. Run the uninstall command in `tridentctl` to remove all of the resources associated with Astra Trident except for the CRDs and related objects.

```
./tridentctl uninstall -n <namespace>
```

2. Reinstall Astra Trident. Refer to [Install Astra Trident using tridentctl](#).



Do not interrupt the upgrade process. Ensure the installer runs to completion.

## Monitor Astra Trident

Astra Trident provides a set of Prometheus metrics endpoints that you can use to monitor Astra Trident performance.

### Overview

The metrics provided by Astra Trident enable you to do the following:

- Keep tabs on Astra Trident's health and configuration. You can examine how successful operations are and if it can communicate with the backends as expected.
- Examine backend usage information and understand how many volumes are provisioned on a backend and the amount of space consumed, and so on.
- Maintain a mapping of the amount of volumes provisioned on available backends.
- Track performance. You can take a look at how long it takes for Astra Trident to communicate to backends and perform operations.



By default, Trident's metrics are exposed on the target port 8001 at the `/metrics` endpoint. These metrics are **enabled by default** when Trident is installed.

### What you'll need

- A Kubernetes cluster with Astra Trident installed.
- A Prometheus instance. This can be a [containerized Prometheus deployment](#) or you can choose to run Prometheus as a [native application](#).

## Step 1: Define a Prometheus target

You should define a Prometheus target to gather the metrics and obtain information about the backends Astra Trident manages, the volumes it creates, and so on. This [blog](#) explains how you can use Prometheus and Grafana with Astra Trident to retrieve metrics. The blog explains how you can run Prometheus as an operator in your Kubernetes cluster and the creation of a ServiceMonitor to obtain Astra Trident metrics.

## Step 2: Create a Prometheus ServiceMonitor

To consume the Trident metrics, you should create a Prometheus ServiceMonitor that watches the `trident-csi` service and listens on the `metrics` port. A sample ServiceMonitor looks like this:

```
apiVersion: monitoring.coreos.com/v1
kind: ServiceMonitor
metadata:
  name: trident-sm
  namespace: monitoring
  labels:
    release: prom-operator
spec:
  jobLabel: trident
  selector:
    matchLabels:
      app: controller.csi.trident.netapp.io
  namespaceSelector:
    matchNames:
      - trident
  endpoints:
    - port: metrics
      interval: 15s
```

This ServiceMonitor definition retrieves metrics returned by the `trident-csi` service and specifically looks for the `metrics` endpoint of the service. As a result, Prometheus is now configured to understand Astra Trident's metrics.

In addition to metrics available directly from Astra Trident, kubelet exposes many `kubelet_volume_*` metrics via its own metrics endpoint. Kubelet can provide information about the volumes that are attached, and pods and other internal operations it handles. See [here](#).

## Step 3: Query Trident metrics with PromQL

PromQL is good for creating expressions that return time-series or tabular data.

Here are some PromQL queries that you can use:

## Get Trident health information

- **Percentage of HTTP 2XX responses from Astra Trident**

```
(sum (trident_rest_ops_seconds_total_count{status_code=~"2.."} OR on()  
vector(0)) / sum (trident_rest_ops_seconds_total_count)) * 100
```

- **Percentage of REST responses from Astra Trident via status code**

```
(sum (trident_rest_ops_seconds_total_count) by (status_code) / scalar  
(sum (trident_rest_ops_seconds_total_count))) * 100
```

- **Average duration in ms of operations performed by Astra Trident**

```
sum by (operation)  
(trident_operation_duration_milliseconds_sum{success="true"}) / sum by  
(operation)  
(trident_operation_duration_milliseconds_count{success="true"})
```

## Get Astra Trident usage information

- **Average volume size**

```
trident_volume_allocated_bytes/trident_volume_count
```

- **Total volume space provisioned by each backend**

```
sum (trident_volume_allocated_bytes) by (backend_uuid)
```

## Get individual volume usage



This is enabled only if kubelet metrics are also gathered.

- **Percentage of used space for each volume**

```
kubelet_volume_stats_used_bytes / kubelet_volume_stats_capacity_bytes *  
100
```

## Learn about Astra Trident AutoSupport telemetry

By default, Astra Trident sends Prometheus metrics and basic backend information to NetApp on a daily cadence.

- To stop Astra Trident from sending Prometheus metrics and basic backend information to NetApp, pass the `--silence-autosupport` flag during Astra Trident installation.
- Astra Trident can also send container logs to NetApp Support on-demand via `tridentctl send autosupport`. You will need to trigger Astra Trident to upload its logs. Before you submit logs, you should accept NetApp's [privacy policy](#).
- Unless specified, Astra Trident fetches the logs from the past 24 hours.
- You can specify the log retention time frame with the `--since` flag. For example: `tridentctl send autosupport --since=1h`. This information is collected and sent via a `trident-autosupport` container that is installed alongside Astra Trident. You can obtain the container image at [Trident AutoSupport](#).
- Trident AutoSupport does not gather or transmit Personally Identifiable Information (PII) or Personal Information. It comes with a [EULA](#) that is not applicable to the Trident container image itself. You can learn more about NetApp's commitment to data security and trust [here](#).

An example payload sent by Astra Trident looks like this:

```
---
items:
- backendUUID: ff3852e1-18a5-4df4-b2d3-f59f829627ed
  protocol: file
  config:
    version: 1
    storageDriverName: ontap-nas
    debug: false
    debugTraceFlags:
    disableDelete: false
    serialNumbers:
    - nwkvzfanek_SN
    limitVolumeSize: ''
  state: online
  online: true
```

- The AutoSupport messages are sent to NetApp's AutoSupport endpoint. If you are using a private registry to store container images, you can use the `--image-registry` flag.
- You can also configure proxy URLs by generating the installation YAML files. This can be done by using `tridentctl install --generate-custom-yaml` to create the YAML files and adding the `--proxy-url` argument for the `trident-autosupport` container in `trident-deployment.yaml`.

## Disable Astra Trident metrics

To **disable** metrics from being reported, you should generate custom YAMLS (using the `--generate-custom-yaml` flag) and edit them to remove the `--metrics` flag from being invoked for the `trident-main` container.

# Uninstall Astra Trident

You should use the same method to uninstall Astra Trident that you used to install Astra Trident.

## About this task

- If you need a fix for bugs observed after an upgrade, dependency issues, or an unsuccessful or incomplete upgrade, you should uninstall Astra Trident and reinstall the earlier version using the specific instructions for that [version](#). This is the only recommended way to *downgrade* to an earlier version.
- For easy upgrade and reinstallation, uninstalling Astra Trident does not remove the CRDs or related objects created by Astra Trident. If you need to completely remove Astra Trident and all of its data, see [Completely remove Astra Trident and CRDs](#).

## Before you begin

If you are decommissioning Kubernetes clusters, you must delete all applications that use volumes created by Astra Trident prior to uninstalling. This ensures that PVCs are unpublished on Kubernetes nodes before they are deleted.

## Determine the original installation method

You should use the same method to uninstall Astra Trident that you used to install it. Before uninstalling, verify which version you used to originally install Astra Trident.

1. Use `kubectl get pods -n trident` to examine the pods.
  - If there is no operator pod, Astra Trident was installed using `tridentctl`.
  - If there is an operator pod, Astra Trident was installed using the Trident operator either manually or using Helm.
2. If there is an operator pod, use `kubectl describe tproc trident` to determine if Astra Trident was installed using Helm.
  - If there is a Helm label, Astra Trident was installed using Helm.
  - If there is no Helm label, Astra Trident was installed manually using the Trident operator.

## Uninstall a Trident operator installation

You can uninstall a trident operator installation manually or using Helm.

### Uninstall manual installation

If you installed Astra Trident using the operator, you can uninstall it by doing one of the following:

1. **Edit `TridentOrchestrator` CR and set the uninstall flag:**

```
kubectl patch torc <trident-orchestrator-name> --type=merge -p
'{"spec":{"uninstall":true}}'
```

When the `uninstall` flag is set to `true`, the Trident operator uninstalls Trident, but does not remove the `TridentOrchestrator` itself. You should clean up the `TridentOrchestrator` and create a new one if you want to

install Trident again.

2. **Delete TridentOrchestrator:** By removing the `TridentOrchestrator` CR that was used to deploy Astra Trident, you instruct the operator to uninstall Trident. The operator processes the removal of `TridentOrchestrator` and proceeds to remove the Astra Trident deployment and daemonset, deleting the Trident pods it had created as part of the installation.

```
kubectl delete -f deploy/<bundle.yaml> -n <namespace>
```

## Uninstall Helm installation

If you installed Astra Trident by using Helm, you can uninstall it by using `helm uninstall`.

```
#List the Helm release corresponding to the Astra Trident install.
helm ls -n trident
NAME                NAMESPACE      REVISION      UPDATED
STATUS             CHART          APP VERSION
trident            trident         1             2021-04-20
00:26:42.417764794 +0000 UTC deployed      trident-operator-21.07.1
21.07.1

#Uninstall Helm release to remove Trident
helm uninstall trident -n trident
release "trident" uninstalled
```

## Uninstall a tridentctl installation

Use the `uninstall` command in `tridentctl` to remove all of the resources associated with Astra Trident except for the CRDs and related objects:

```
./tridentctl uninstall -n <namespace>
```

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