



## **Knowledge and support**

### **Astra Trident**

NetApp  
October 22, 2024

# Table of Contents

- Knowledge and support ..... 1
- Frequently asked questions ..... 1
- Troubleshooting ..... 8
- Support ..... 12

# Knowledge and support

## Frequently asked questions

Find answers to the frequently asked questions about installing, configuring, upgrading, and troubleshooting Astra Trident.

### General questions

#### How frequently is Astra Trident released?

Astra Trident is released every three months: January, April, July, and October. This is one month after a Kubernetes release.

#### Does Astra Trident support all the features that are released in a particular version of Kubernetes?

Astra Trident usually does not support alpha features in Kubernetes. Trident might support beta features within the two Trident releases that follow the Kubernetes beta release.

#### Does Astra Trident have any dependencies on other NetApp products for its functioning?

Astra Trident does not have any dependencies on other NetApp software products and it works as a standalone application. However, you should have a NetApp backend storage device.

#### How can I obtain complete Astra Trident configuration details?

Use the `tridentctl get` command to obtain more information about your Astra Trident configuration.

#### Can I obtain metrics on how storage is provisioned by Astra Trident?

Yes. Prometheus endpoints that can be used to gather information about Astra Trident operation, such as the number of backends managed, the number of volumes provisioned, bytes consumed, and so on. You can also use [Cloud Insights](#) for monitoring and analysis.

#### Does the user experience change when using Astra Trident as a CSI Provisioner?

No. There are no changes as far as the user experience and functionalities are concerned. The provisioner name used is `csi.trident.netapp.io`. This method of installing Astra Trident is recommended if you want to use all the new features provided by current and future releases.

## Install and use Astra Trident on a Kubernetes cluster

#### Does Astra Trident support an offline install from a private registry?

Yes, Astra Trident can be installed offline. See [here](#).

#### Can I install Astra Trident be remotely?

Yes. Astra Trident 18.10 and later support remote installation capability from any machine that has `kubectl` access to the cluster. After `kubectl` access is verified (for example, initiate a `kubectl get nodes` command from the remote machine to verify), follow the installation instructions.

## **Can I configure High Availability with Astra Trident?**

Astra Trident is installed as a Kubernetes Deployment (ReplicaSet) with one instance, and so it has HA built in. You should not increase the number of replicas in the deployment. If the node where Astra Trident is installed is lost or the pod is otherwise inaccessible, Kubernetes automatically re-deploys the pod to a healthy node in your cluster. Astra Trident is control-plane only, so currently mounted pods are not affected if Astra Trident is re-deployed.

## **Does Astra Trident need access to the kube-system namespace?**

Astra Trident reads from the Kubernetes API Server to determine when applications request new PVCs, so it needs access to kube-system.

## **What are the roles and privileges used by Astra Trident?**

The Trident installer creates a Kubernetes ClusterRole, which has specific access to the cluster's PersistentVolume, PersistentVolumeClaim, StorageClass, and Secret resources of the Kubernetes cluster. See [here](#).

## **Can I locally generate the exact manifest files Astra Trident uses for installation?**

You can locally generate and modify the exact manifest files Astra Trident uses for installation, if needed. See [here](#).

## **Can I share the same ONTAP backend SVM for two separate Astra Trident instances for two separate Kubernetes clusters?**

Although it is not advised, you can use the same backend SVM for two Astra Trident instances. Specify a unique volume name for each instance during installation and/or specify a unique `StoragePrefix` parameter in the `setup/backend.json` file. This is to ensure the same FlexVol is not used for both instances.

## **Is it possible to install Astra Trident under ContainerLinux (formerly CoreOS)?**

Astra Trident is simply a Kubernetes pod and can be installed wherever Kubernetes is running.

## **Can I use Astra Trident with NetApp Cloud Volumes ONTAP?**

Yes, Astra Trident is supported on AWS, Google Cloud, and Azure.

## **Does Astra Trident work with Cloud Volumes Services?**

Yes, Astra Trident supports the Azure NetApp Files service in Azure as well as the Cloud Volumes Service in GCP.

## **Troubleshooting and support**

### **Does NetApp support Astra Trident?**

Although Astra Trident is open source and provided for free, NetApp fully supports it provided your NetApp backend is supported.

### **How do I raise a support case?**

To raise a support case, do one of the following:

1. Contact your Support Account Manager and get help to raise a ticket.
2. Raise a support case by contacting [NetApp Support](#).

### **How do I generate a support log bundle?**

You can create a support bundle by running `tridentctl logs -a`. In addition to the logs captured in the bundle, capture the kubelet log to diagnose the mount problems on the Kubernetes side. The instructions to get the kubelet log varies based on how Kubernetes is installed.

### **What do I do if I need to raise a request for a new feature?**

Create an issue on [Astra Trident Github](#) and mention **RFE** in the subject and description of the issue.

### **Where do I raise a defect?**

Create an issue on [Astra Trident Github](#). Make sure to include all the necessary information and logs pertaining to the issue.

### **What happens if I have quick question on Astra Trident that I need clarification on? Is there a community or a forum?**

If you have any questions, issues, or requests, reach out to us through our Astra [Discord channel](#) or GitHub.

### **My storage system's password has changed and Astra Trident no longer works, how do I recover?**

Update the backend's password with `tridentctl update backend myBackend -f </path/to_new_backend.json> -n trident`. Replace `myBackend` in the example with your backend name, and `</path/to_new_backend.json` with the path to the correct `backend.json` file.

### **Astra Trident cannot find my Kubernetes node. How do I fix this?**

There are two likely scenarios why Astra Trident cannot find a Kubernetes node. It can be because of a networking issue within Kubernetes or a DNS issue. The Trident node daemonset that runs on each Kubernetes node must be able to communicate with the Trident controller to register the node with Trident. If networking changes occurred after Astra Trident was installed, you encounter this problem only with new Kubernetes nodes that are added to the cluster.

### **If the Trident pod is destroyed, will I lose the data?**

Data will not be lost if the Trident pod is destroyed. Trident metadata is stored in CRD objects. All PVs that have been provisioned by Trident will function normally.

## **Upgrade Astra Trident**

### **Can I upgrade from a older version directly to a newer version (skipping a few versions)?**

NetApp supports upgrading Astra Trident from one major release to the next immediate major release. You can upgrade from version 18.xx to 19.xx, 19.xx to 20.xx, and so on. You should test upgrading in a lab before production deployment.

### **Is it possible to downgrade Trident to a previous release?**

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.

## Manage backends and volumes

### Do I need to define both Management and Data LIFs in an ONTAP backend definition file?

The management LIF is mandatory. Data LIF varies:

- ONTAP SAN: Do not specify for iSCSI. Astra Trident uses [ONTAP Selective LUN Map](#) to discover the iSCSI LIFs needed to establish a multi path session. A warning is generated if `dataLIF` is explicitly defined. Refer to [ONTAP SAN configuration options and examples](#) for details.
- ONTAP NAS: 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. Refer to [ONTAP NAS configuration options and examples](#) for details

### Can Astra Trident configure CHAP for ONTAP backends?

Yes. Astra Trident supports bidirectional CHAP for ONTAP backends. This requires setting `useCHAP=true` in your backend configuration.

### How do I manage export policies with Astra Trident?

Astra Trident can dynamically create and manage export policies from version 20.04 onwards. This enables the storage administrator to provide one or more CIDR blocks in their backend configuration and have Trident add node IPs that fall within these ranges to an export policy it creates. In this manner, Astra Trident automatically manages the addition and deletion of rules for nodes with IPs within the given CIDRs.

### Can IPv6 addresses be used for the Management and Data LIFs?

Astra Trident supports defining IPv6 addresses for:

- `managementLIF` and `dataLIF` for ONTAP NAS backends.
- `managementLIF` for ONTAP SAN backends. You cannot specify `dataLIF` on an ONTAP SAN backend.

Astra Trident must be installed using the flag `--use-ipv6` (for `tridentctl` installation), `IPv6` (for Trident operator), or `tridentTPv6` (for Helm installation) for it to function over IPv6.

### Is it possible to update the Management LIF on the backend?

Yes, it is possible to update the backend Management LIF using the `tridentctl update backend` command.

### Is it possible to update the Data LIF on the backend?

You can update the Data LIF on `ontap-nas` and `ontap-nas-economy` only.

### Can I create multiple backends in Astra Trident for Kubernetes?

Astra Trident can support many backends simultaneously, either with the same driver or different drivers.

## How does Astra Trident store backend credentials?

Astra Trident stores the backend credentials as Kubernetes Secrets.

## How does Astra Trident select a specific backend?

If the backend attributes cannot be used to automatically select the right pools for a class, the `storagePools` and `additionalStoragePools` parameters are used to select a specific set of pools.

## How do I ensure that Astra Trident will not provision from a specific backend?

The `excludeStoragePools` parameter is used to filter the set of pools that Astra Trident will use for provisioning and will remove any pools that match.

## If there are multiple backends of the same kind, how does Astra Trident select which backend to use?

If there are multiple configured backends of the same type, Astra Trident selects the appropriate backend based on the parameters present in `StorageClass` and `PersistentVolumeClaim`. For example, if there are multiple `ontap-nas` driver backends, Astra Trident tries to match parameters in the `StorageClass` and `PersistentVolumeClaim` combined and match a backend which can deliver the requirements listed in `StorageClass` and `PersistentVolumeClaim`. If there are multiple backends that match the request, Astra Trident selects from one of them at random.

## Does Astra Trident support bi-directional CHAP with Element/SolidFire?

Yes.

## How does Astra Trident deploy Qtrees on an ONTAP volume? How many Qtrees can be deployed on a single volume?

The `ontap-nas-economy` driver creates up to 200 Qtrees in the same FlexVol (configurable between 50 and 300), 100,000 Qtrees per cluster node, and 2.4M per cluster. When you enter a new `PersistentVolumeClaim` that is serviced by the economy driver, the driver looks to see if a FlexVol already exists that can service the new Qtree. If the FlexVol does not exist that can service the Qtree, a new FlexVol is created.

## How can I set Unix permissions for volumes provisioned on ONTAP NAS?

You can set Unix permissions on the volume provisioned by Astra Trident by setting a parameter in the backend definition file.

## How can I configure an explicit set of ONTAP NFS mount options while provisioning a volume?

By default, Astra Trident does not set mount options to any value with Kubernetes. To specify the mount options in the Kubernetes Storage Class, follow the example given [here](#).

## How do I set the provisioned volumes to a specific export policy?

To allow the appropriate hosts access to a volume, use the `exportPolicy` parameter configured in the backend definition file.

## How do I set volume encryption through Astra Trident with ONTAP?

You can set encryption on the volume provisioned by Trident by using the encryption parameter in the backend definition file. For more information, refer to: [How Astra Trident works with NVE and NAE](#)

## What is the best way to implement QoS for ONTAP through Astra Trident?

Use `StorageClasses` to implement QoS for ONTAP.

## How do I specify thin or thick provisioning through Astra Trident?

The ONTAP drivers support either thin or thick provisioning. The ONTAP drivers default to thin provisioning. If thick provisioning is desired, you should configure either the backend definition file or the `StorageClass`. If both are configured, `StorageClass` takes precedence. Configure the following for ONTAP:

1. On `StorageClass`, set the `provisioningType` attribute as thick.
2. In the backend definition file, enable thick volumes by setting `backend spaceReserve` parameter as volume.

## How do I make sure that the volumes being used are not deleted even if I accidentally delete the PVC?

PVC protection is automatically enabled on Kubernetes starting from version 1.10.

## Can I grow NFS PVCs that were created by Astra Trident?

Yes. You can expand a PVC that has been created by Astra Trident. Note that volume autogrow is an ONTAP feature that is not applicable to Trident.

## Can I import a volume while it is in SnapMirror Data Protection (DP) or offline mode?

The volume import fails if the external volume is in DP mode or is offline. You receive the following error message:

```
Error: could not import volume: volume import failed to get size of
volume: volume <name> was not found (400 Bad Request) command terminated
with exit code 1.
Make sure to remove the DP mode or put the volume online before importing
the volume.
```

## How is resource quota translated to a NetApp cluster?

Kubernetes Storage Resource Quota should work as long as NetApp storage has capacity. When the NetApp storage cannot honor the Kubernetes quota settings due to lack of capacity, Astra Trident tries to provision but errors out.

## Can I create Volume Snapshots using Astra Trident?

Yes. Creating on-demand volume snapshots and Persistent Volumes from Snapshots are supported by Astra Trident. To create PVs from snapshots, ensure that the `VolumeSnapshotDataSource` feature gate has been enabled.



## What are the drivers that support Astra Trident volume snapshots?

As of today, on-demand snapshot support is available for our `ontap-nas`, `ontap-nas-flexgroup`, `ontap-san`, `ontap-san-economy`, `solidfire-san`, `gcp-cvs`, and `azure-netapp-files` backend drivers.

## How do I take a snapshot backup of a volume provisioned by Astra Trident with ONTAP?

This is available on `ontap-nas`, `ontap-san`, and `ontap-nas-flexgroup` drivers. You can also specify a `snapshotPolicy` for the `ontap-san-economy` driver at the FlexVol level.

This is also available on the `ontap-nas-economy` drivers but on the FlexVol level granularity and not on the qtree level granularity. To enable the ability to snapshot volumes provisioned by Astra Trident, set the backend parameter option `snapshotPolicy` to the desired snapshot policy as defined on the ONTAP backend. Any snapshots taken by the storage controller are not known by Astra Trident.

## Can I set a snapshot reserve percentage for a volume provisioned through Astra Trident?

Yes, you can reserve a specific percentage of disk space for storing the snapshot copies through Astra Trident by setting the `snapshotReserve` attribute in the backend definition file. If you have configured `snapshotPolicy` and `snapshotReserve` in the backend definition file, snapshot reserve percentage is set according to the `snapshotReserve` percentage mentioned in the backend file. If the `snapshotReserve` percentage number is not mentioned, ONTAP by default takes the snapshot reserve percentage as 5. If the `snapshotPolicy` option is set to none, the snapshot reserve percentage is set to 0.

## Can I directly access the volume snapshot directory and copy files?

Yes, you can access the snapshot directory on the volume provisioned by Trident by setting the `snapshotDir` parameter in the backend definition file.

## Can I set up SnapMirror for volumes through Astra Trident?

Currently, SnapMirror has to be set externally by using ONTAP CLI or OnCommand System Manager.

## How do I restore Persistent Volumes to a specific ONTAP snapshot?

To restore a volume to an ONTAP snapshot, perform the following steps:

1. Quiesce the application pod which is using the Persistent volume.
2. Revert to the required snapshot through ONTAP CLI or OnCommand System Manager.
3. Restart the application pod.

## Can Trident provision volumes on SVMs that have a Load-Sharing Mirror configured?

Load-sharing mirrors can be created for root volumes of SVMs that serve data over NFS. ONTAP automatically updates load-sharing mirrors for volumes that have been created by Trident. This may result in delays in mounting volumes. When multiple volumes are created using Trident, provisioning a volume is dependent on ONTAP updating the load-sharing mirror.

## How can I separate out storage class usage for each customer/tenant?

Kubernetes does not allow storage classes in namespaces. However, you can use Kubernetes to limit usage of a specific storage class per namespace by using Storage Resource Quotas, which are per namespace. To deny a specific namespace access to specific storage, set the resource quota to 0 for that storage class.

# Troubleshooting

Use the pointers provided here for troubleshooting issues you might encounter while installing and using Astra Trident.

## General troubleshooting

- If the Trident pod fails to come up properly (for example, when the Trident pod is stuck in the ContainerCreating phase with fewer than two ready containers), running `kubectl -n trident describe deployment trident` and `kubectl -n trident describe pod trident` can provide additional insights. Obtaining kubelet logs (for example, via `journalctl -xeu kubelet`) can also be helpful.
- If there is not enough information in the Trident logs, you can try enabling the debug mode for Trident by passing the `-d` flag to the install parameter based on your installation option.

Then confirm debug is set using `./tridentctl logs -n trident` and searching for `level=debug msg` in the log.

### Installed with Operator

```
kubectl patch torc trident -n <namespace> --type=merge -p
'{"spec":{"debug":true}}'
```

This will restart all Trident pods, which can take several seconds. You can check this by observing the 'AGE' column in the output of `kubectl get pod -n trident`.

For Astra Trident 20.07 and 20.10 use `tprov` in place of `torc`.

### Installed with Helm

```
helm upgrade <name> trident-operator-21.07.1-custom.tgz --set
tridentDebug=true`
```

### Installed with tridentctl

```
./tridentctl uninstall -n trident
./tridentctl install -d -n trident
```

- You can also obtain debug logs for each backend by including `debugTraceFlags` in your backend definition. For example, include `debugTraceFlags: {"api":true, "method":true,}` to obtain API calls and method traversals in the Trident logs. Existing backends can have `debugTraceFlags` configured with a `tridentctl` backend update.
- When using RedHat CoreOS, ensure that `iscsid` is enabled on the worker nodes and started by default. This can be done using OpenShift MachineConfigs or by modifying the ignition templates.
- A common problem you could encounter when using Trident with [Azure NetApp Files](#) is when the tenant and client secrets come from an app registration with insufficient permissions. For a complete list of Trident requirements, see [Azure NetApp Files](#) configuration.

- If there are problems with mounting a PV to a container, ensure that `rpcbind` is installed and running. Use the required package manager for the host OS and check if `rpcbind` is running. You can check the status of the `rpcbind` service by running `systemctl status rpcbind` or its equivalent.
- If a Trident backend reports that it is in the `failed` state despite having worked before, it is likely caused by changing the SVM/admin credentials associated with the backend. Updating the backend information using `tridentctl update backend` or bouncing the Trident pod will fix this issue.
- If you encounter permission issues when installing Trident with Docker as the container runtime, attempt the installation of Trident with the `--in cluster=false` flag. This will not use an installer pod and avoid permission troubles seen due to the `trident-installer` user.
- Use the `uninstall` parameter `<Uninstalling Trident>` for cleaning up after a failed run. By default, the script does not remove the CRDs that have been created by Trident, making it safe to uninstall and install again even in a running deployment.
- If you want to downgrade to an earlier version of Trident, first run the `tridentctl uninstall` command to remove Trident. Download the desired [Trident version](#) and install using the `tridentctl install` command.
- After a successful install, if a PVC is stuck in the `Pending` phase, running `kubectl describe pvc` can provide additional information about why Trident failed to provision a PV for this PVC.

## Troubleshooting an unsuccessful Trident deployment using the operator

If you are deploying Trident using the operator, the status of `TridentOrchestrator` changes from `Installing` to `Installed`. If you observe the `Failed` status, and the operator is unable to recover by itself, you should check the logs of the operator by running following command:

```
tridentctl logs -l trident-operator
```

Trailing the logs of the `trident-operator` container can point to where the problem lies. For example, one such issue could be the inability to pull the required container images from upstream registries in an airgapped environment.

To understand why the installation of Trident was unsuccessful, you should take a look at the `TridentOrchestrator` status.

```

kubect1 describe torc trident-2
Name:          trident-2
Namespace:
Labels:        <none>
Annotations:   <none>
API Version:   trident.netapp.io/v1
Kind:          TridentOrchestrator
...
Status:
  Current Installation Params:
    IPv6:
    Autosupport Hostname:
    Autosupport Image:
    Autosupport Proxy:
    Autosupport Serial Number:
    Debug:
    Image Pull Secrets:          <nil>
    Image Registry:
    k8sTimeout:
    Kubelet Dir:
    Log Format:
    Silence Autosupport:
    Trident Image:
  Message:          Trident is bound to another CR 'trident'
  Namespace:       trident-2
  Status:          Error
  Version:
Events:
  Type          Reason  Age          From          Message
  ----          -
  Warning      Error   16s (x2 over 16s)  trident-operator.netapp.io  Trident
is bound to another CR 'trident'

```

This error indicates that there already exists a `TridentOrchestrator` that was used to install Trident. Since each Kubernetes cluster can only have one instance of Trident, the operator ensures that at any given time there only exists one active `TridentOrchestrator` that it can create.

In addition, observing the status of the Trident pods can often indicate if something is not right.

```
kubectl get pods -n trident
```

NAME	READY	STATUS	RESTARTS
trident-csi-4p5kq 5m18s	1/2	ImagePullBackOff	0
trident-csi-6f45bfd8b6-vfrkw 5m19s	4/5	ImagePullBackOff	0
trident-csi-9q5xc 5m18s	1/2	ImagePullBackOff	0
trident-csi-9v95z 5m18s	1/2	ImagePullBackOff	0
trident-operator-766f7b8658-ldzsv 8m17s	1/1	Running	0

You can clearly see that the pods are not able to initialize completely because one or more container images were not fetched.

To address the problem, you should edit the `TridentOrchestrator` CR. Alternatively, you can delete `TridentOrchestrator`, and create a new one with the modified and accurate definition.

## Troubleshooting an unsuccessful Trident deployment using `tridentctl`

To help figure out what went wrong, you could run the installer again using the `-d` argument, which will turn on debug mode and help you understand what the problem is:

```
./tridentctl install -n trident -d
```

After addressing the problem, you can clean up the installation as follows, and then run the `tridentctl install` command again:

```
./tridentctl uninstall -n trident
INFO Deleted Trident deployment.
INFO Deleted cluster role binding.
INFO Deleted cluster role.
INFO Deleted service account.
INFO Removed Trident user from security context constraint.
INFO Trident uninstallation succeeded.
```

## Completely remove Astra Trident and CRDs

You can completely remove Astra Trident and all created CRDs and associated custom resources.



This cannot be undone. Do not do this unless you want a completely fresh installation of Astra Trident. To uninstall Astra Trident without removing CRDs, see [Uninstall Astra Trident](#).

### Trident operator

To uninstall Astra Trident and completely remove CRDs using the Trident operator:

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

### Helm

To uninstall Astra Trident and completely remove CRDs using Helm:

```
kubectl patch torc trident --type=merge -p
'{"spec":{"wipeout":["crds"],"uninstall":true}}'
```

`tridentctl`

To completely remove CRDs after uninstalling Astra Trident using `tridentctl`

```
tridentctl obliviate crd
```

## Support

NetApp provides support for Astra Trident in a variety of ways. Extensive free self-support options are available 24x7, such as knowledgebase (KB) articles and a Discord channel.

### Astra Trident support lifecycle

Astra Trident provides three levels of support based on your version. Refer to [NetApp software version support for definitions](#).

#### Full support

Astra Trident provides full support for twelve months from the release date.

#### Limited support

Astra Trident provides limited support for months 13 - 24 from the release date.

#### Self-support

Astra Trident documentation is available for months 25 - 36 from the release date.

### Table 1. Astra Trident version support schedule

Version	Full support	Limited support	Self-support
<a href="#">23.07</a>	July 2024	July 2025	July 2026
<a href="#">23.04</a>	April 2024	April 2025	April 2026
<a href="#">23.01</a>	January 2024	January 2025	January 2026
<a href="#">22.10</a>	October 2023	October 2024	October 2025
<a href="#">22.07</a>	—	July 2024	July 2025
<a href="#">22.04</a>	—	April 2024	April 2025
<a href="#">22.01</a>	—	January 2024	January 2025
<a href="#">21.10</a>	—	October 2023	October 2024



Releases prior to 21.07, redirect to the legacy documentation site.

## Self-support

For a comprehensive list of troubleshooting articles, see the [NetApp Knowledgebase \(login required\)](#). You can also find information about troubleshooting issues related to Astra [here](#).

## Community support

There is a vibrant public community of container users (including Astra Trident developers) on our Astra [Discord channel](#). This is a great place to ask general questions about the project and discuss related topics with like-minded peers.

## NetApp technical support

For help with Astra Trident, create a support bundle using `tridentctl logs -a -n trident` and send it to NetApp Support `<Getting Help>`.

## For more information

- [Astra blogs](#)
- [Astra Trident blogs](#)
- [Kubernetes Hub](#)
- [NetApp.io](#)

## Copyright information

Copyright © 2024 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

LIMITED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (b)(3) of the Rights in Technical Data -Noncommercial Items at DFARS 252.227-7013 (FEB 2014) and FAR 52.227-19 (DEC 2007).

Data contained herein pertains to a commercial product and/or commercial service (as defined in FAR 2.101) and is proprietary to NetApp, Inc. All NetApp technical data and computer software provided under this Agreement is commercial in nature and developed solely at private expense. The U.S. Government has a non-exclusive, non-transferrable, nonsublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b) (FEB 2014).

## Trademark information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.