



# Using Red Hat Enterprise Linux 8.1 with NetApp ONTAP

## ONTAP SAN Host

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# Table of Contents

- Using Red Hat Enterprise Linux 8.1 with NetApp ONTAP..... 1
  - Installing the Linux Unified Host Utilities ..... 1
  - SAN Toolkit..... 1
  - SAN Booting..... 2
  - Multipathing ..... 2
  - Recommended Settings..... 3
  - Known Problems and Limitations ..... 6
  - Release Notes..... 9

# Using Red Hat Enterprise Linux 8.1 with NetApp ONTAP

## Installing the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the [NetApp Support Site](#) in a 64-bit .rpm file.

Installing the Linux Unified Host Utilities is strongly recommended, but not mandatory. The utilities do not change any settings on your Linux host. The utilities improve management and assist NetApp customer support in gathering information about your configuration.

### *Before you begin*

If you have a version of Linux Unified Host Utilities currently installed you should upgrade it or, you should remove it and use the following steps to install the latest version.

1. Download the 64-bit Linux Unified Host Utilities software package from the [NetApp Support Site](#) to your host.
2. Use the following command to install the software package:

```
rpm -ivh netapp_linux_unified_host_utilities-7-1.x86_64
```

## SAN Toolkit

The toolkit is installed automatically when you install the NetApp Host Utilities package. This kit provides the **sanlun** utility, which helps you manage LUNs and HBAs. The **sanlun** command returns information about the LUNs mapped to your host, multipathing, and information necessary to create initiator groups.

### *Example*

In the following example, the **sanlun lun show command** returns LUN information.

```
# sanlun lun show all
controller(7mode/E-Series)/
vserver(cDOT/FlashRay)  lun-pathname  device
                        filename    host
                        adapter      protocol  lun
                        size          Product
-----
data_vserver            /vol/vol1/lun1  /dev/sdb  host16  FCP      120.0g  cDOT
data_vserver            /vol/vol1/lun1  /dev/sdc  host15  FCP      120.0g  cDOT
data_vserver            /vol/vol2/lun2  /dev/sdd  host16  FCP      120.0g  cDOT
data_vserver            /vol/vol2/lun2  /dev/sde  host15  FCP      120.0g  cDOT
```

# SAN Booting

## *Before you begin*

If you decide to use SAN booting, it must be supported by your configuration. You can use the [NetApp Interoperability Matrix Tool](#) to verify that your OS, HBA, HBA firmware and the HBA boot BIOS, and ONTAP version are supported.

1. Map the SAN boot LUN to the host.
2. Verify multiple paths are available.

Remember, multiple paths will only be available after the host OS is up and running on the paths.

3. Enable SAN booting in the server BIOS for the ports to which the SAN boot LUN is mapped.

For information on how to enable the HBA BIOS, see your vendor-specific documentation.

4. Reboot the host to verify the boot is successful.

# Multipathing

For Red Hat Enterprise Linux (RHEL) 8.1 the `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file. RHEL 8.1 is compiled with all settings required to recognize and correctly manage ONTAP LUNs.

You can use the `multipath -ll` command to verify the settings for your ONTAP LUNs.

The following sections provide sample multipath output for a LUN mapped to ASA and non-ASA personas.

## All SAN Array Configuration

For All SAN Array (ASA) configuration there should be one group of paths with single priorities. All the paths are Active/Optimized, meaning they are serviced by the controller and I/O is sent on all the active paths.

## *Example*

The following example displays the correct output for an ONTAP LUN with four Active/Optimized paths:

```
# multipath -ll
3600a09803831347657244e527766394e dm-5 NETAPP,LUN C-Mode
size=80G features='4 queue_if_no_path pg_init_retries 50 retain_attached_hw_handle'
hwhandler='1 alua' wp=rw
`-+- policy='service-time 0' prio=50 status=active
| - 11:0:7:1 sdfi 130:64 active ready running
| - 11:0:9:1 sdiy 8:288 active ready running
| - 11:0:10:1 sdml 69:464 active ready running
| - 11:0:11:1 sdpt 131:304 active ready running
```

#### *Note*

Do not use an excessive number of paths to a single LUN. No more than 4 paths should be required. More than 8 paths might cause path issues during storage failures.

## Non-ASA Configuration

For non-ASA configuration there should be two groups of paths with different priorities. The paths with the higher priorities are Active/Optimized, meaning they are serviced by the controller where the aggregate is located. The paths with the lower priorities are active but are non-optimized because they are served from a different controller. The non-optimized paths are only used when no optimized paths are available.

#### *Example*

The following example displays the correct output for an ONTAP LUN with two Active/Optimized paths and two Active/non-Optimized paths:

```
# multipath -ll
3600a098038303634722b4d59646c4436 dm-28 NETAPP,LUN C-Mode
size=10G features='3 queue_if_no_path pg_init_retries 50' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
| | - 16:0:6:35 sdwb 69:624 active ready running
| | - 16:0:5:35 sdun 66:752 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
| - 15:0:0:35 sdaj 66:48 active ready running
| - 15:0:1:35 sdbx 68:176 active ready running
```

#### *Note*

Do not use an excessive number of paths to a single LUN. No more than 4 paths should be required. More than 8 paths might cause path issues during storage failures.

## Recommended Settings

The RHEL 8.1 OS is compiled to recognize ONTAP LUNs and automatically set all configuration

parameters correctly for both ASA and non-ASA configuration.

The `multipath.conf` file must exist for the multipath daemon to start, but you can create an empty, zero-byte file using the command:

```
touch /etc/multipath.conf
```

The first time you create this file, you might need to enable and start the multipath services.

```
[root@jfs0 ~]#systemctl enable multipathd
[root@jfs0 ~]# systemctl start multipathd
```

There is no requirement to add anything directly to `multipath.conf`, unless you have devices that you do not want to be managed by multipath or you have existing settings that override defaults.

You can add the following syntax to the `multipath.conf` file to exclude the unwanted devices.

#### *Note*

Replace the `<DevId>` with the WWID string of the device you want to exclude. Use the following command to determine the WWID:

```
blacklist {
    wwid <DevId>
    devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st)[0-9]*"
    devnode "^hd[a-z]"
    devnode "^cciss.*"
}
```

#### *Example*

In this example, `sda` is the local SCSI disk that we need to blacklist.

1. Run the following command to determine the WWID:

```
# /lib/udev/scsi_id -gud /dev/sda
360030057024d0730239134810c0cb833
```

2. Add this WWID to the blacklist stanza in the `/etc/multipath.conf`:

```
blacklist {
    wwid 360030057024d0730239134810c0cb833
    devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st)[0-9]*"
    devnode "^hd[a-z]"
    devnode "^cciss.*"
}
```

You should always check your `/etc/multipath.conf` file for legacy settings, especially in the defaults

section, that may be overriding default settings.

The table below shows the critical `multipathd` parameters for ONTAP LUNs and the required values. If a host is connected to LUNs from other vendors and any of these parameters are overridden, they will need to be corrected by later stanzas in `multipath.conf` that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs may not work as expected. These defaults should only be overridden in consultation with NetApp and/or OS vendor and only when the impact is fully understood.

Parameter	Setting
detect_prio	yes
dev_loss_tmo	"infinity"
failback	immediate
fast_io_fail_tmo	5
features	"2 pg_init_retries 50"
flush_on_last_del	"yes"
hardware_handler	"0"
no_path_retry	queue
path_checker	"tur"
path_grouping_policy	"group_by_prio"
path_selector	"service-time 0"
polling_interval	5
prio	"ontap"
product	LUN.*
retain_attached_hw_handler	yes
rr_weight	"uniform"
user_friendly_names	no
vendor	NETAPP

### Example

The following example shows how to correct an overridden default. In this case, the `multipath.conf` file defines values for `path_checker` and `no_path_retry` that are not compatible with ONTAP LUNs. If they cannot be removed because of other SAN arrays still attached to the host, these parameters can be corrected specifically for ONTAP LUNs with a device stanza.

```
defaults {
  path_checker      readsector0
  no_path_retry     fail
}

devices {
  device {
    vendor      "NETAPP  "
    product     "LUN.*"
    no_path_retry  queue
    path_checker  tur
  }
}
```

## Known Problems and Limitations



NetApp Bug ID	Title	Description	Bugzilla ID
<a href="#">1275843</a>	Kernel disruption might occur on Red Hat Enterprise Linux 8.1 with QLogic QLE2672 16GB FC HBA during storage failover operation	Kernel disruption might occur during storage failover operations on the Red Hat Enterprise Linux 8.1 kernel with a QLogic QLE2672 Fibre Channel (FC) host bus adapter (HBA). The kernel disruption causes Red Hat Enterprise Linux 8.1 to reboot, leading to application disruption. If the kdump mechanism is enabled, the kernel disruption generates a vmcore file located in the /var/crash/ directory. You can check the vmcore file to determine the cause of the disruption. A storage failover with the QLogic QLE2672 HBA event affects the "kmem_cache_alloc+131" module. You can locate the event in the vmcore file by finding the following string: "[exception RIP: kmem_cache_alloc+131]" After the kernel disruption, reboot the Host OS and recover the operating system. Then restart the applications	<a href="#">1760819</a>

NetApp Bug ID	Title	Description	Bugzilla ID
<a href="#">1275838</a>	Kernel disruption occurs on Red Hat Enterprise Linux 8.1 with QLogic QLE2742 32GB FC HBA during storage failover operations	Kernel disruption occurs during storage failover operations on the Red Hat Enterprise Linux 8.1 kernel with a QLogic QLE2742 Fibre Channel (FC) host bus adapter (HBA). The kernel disruption causes Red Hat Enterprise Linux 8.1 to reboot, leading to application disruption. If the kdump mechanism is enabled, the kernel disruption generates a vmcore file located in the /var/crash/ directory. You can check the vmcore file to determine the cause of the disruption. A storage failover with the QLogic QLE2742 HBA event affects the "kmem_cache_alloc+131" module. You can locate the event in the vmcore file by finding the following string: "[exception RIP: kmem_cache_alloc+131]" After the kernel disruption, reboot the Host OS and recover the operating system. Then restart the applications.	<a href="#">1744082</a>

NetApp Bug ID	Title	Description	Bugzilla ID
<a href="#">1266250</a>	Login to multiple paths fails during the Red Hat Enterprise Linux 8.1 installation on iSCSI SAN LUN	You cannot login to multiple paths during the Red Hat Enterprise Linux 8.1 installation on iSCSI SAN LUN multipath devices. Installation is not possible on multipath iSCSI device and the multipath service is not enabled on the SAN boot device.	<a href="#">1758504</a>

## Release Notes

### ASM Mirroring

ASM mirroring might require changes to the Linux multipath settings to allow ASM to recognize a problem and switch over to an alternate fail group. Most ASM configurations on ONTAP use external redundancy, which means that data protection is provided by the external array and ASM does not mirror data. Some sites use ASM with normal redundancy to provide two-way mirroring, normally across different sites. See [Oracle Databases on ONTAP](#) for further information.

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