Using Red Hat Enterprise Linux 8.0 with NetApp ONTAP

ONTAP SAN Host

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NetApp®

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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)/            device     host               lun
vserver(cDOT/FlashRay)   lun-pathname  filename   adapter  protocol  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) 8.0 the /etc/multipath.conf file must exist, but you do not need to make specific changes to the file. RHEL 8.0 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
3600a098038303634722b4d59646c4436 dm-28 NETAPP,LUN C-Mode
size=80G features='3 queue_if_no_path pg_init_retries 50' 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
```

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=80G features='3 queue_if_no_path pg_init_retries 50' 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
```

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 8.0 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.

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
1238719	Kernel disruption on RHEL8 with QLogic QLE2672 16GB FC during storage failover operations	Kernel disruption might occur during storage failover operations on a Red Hat Enterprise Linux (RHEL) 8 kernel with a QLogic QLE2672 host bus adapter (HBA). The kernel disruption causes the operating system to reboot. The reboot causes application disruption and generates the vmcore file under the /var/crash/directory if kdump is configured. Use the vmcore file to identify the cause of the failure. In this case, the disruption is in the “kmem_cache_alloc+160 ” module. It is logged in the vmcore file with the following string: "[exception RIP: kmem_cache_alloc+160] ". Reboot the host OS to recover the operating system and then restart the application.	1710009
1226783	RHEL8 OS boots up to "emergency mode" when more than 204 SCSI devices are mapped on all Fibre Channel (FC) host bus adapters (HBA)	If a host is mapped with more than 204 SCSI devices during an operating systemreboot process, the RHEL8 OS fails to boot up to "normal mode" and enters "emergency mode". This results in most of the host services becoming unavailable.	1690356

NetApp Bug ID	Title	Description	Bugzilla ID
1230882	Creating a partition on an iSCSI multipath device during the RHEL8 installation is not feasible.	iSCSI SAN LUN multipath devices are not listed in disk selection during RHEL 8 installation. Consequently, the multipath service is not enabled on the SAN boot device.	1709995
1235998	The "rescan-scsi-bus.sh -a" command does not scan more than 328 devices	If a Red Hat Enterprise Linux 8 host maps with more than 328 SCSI devices, the host OS command "rescan-scsi-bus.sh -a" only scans 328 devices. The host does not discover any remaining mapped devices.	1709995
1231087	Remote ports transit to a blocked state on RHEL8 with Emulex LPe16002 16GB FC during storage failover operations	Remote ports transit to a blocked state on RHEL8 with Emulex LPe16002 16GB Fibre Channel (FC) during storage failover operations. When the storage node returns to an optimal state, the LIFs also come up and the remote port state should read "online". Occasionally, the remote port state might continue to read as "blocked" or "not present". This state can lead to a "failed faulty" path to LUNs at the multipath layer	1702005

NetApp Bug ID	Title	Description	Bugzilla ID
1231098	Remote ports transit to blocked state on RHEL8 with Emulex LPe32002 32GB FC during storage failover operations	Remote ports transit to a blocked state on RHEL8 with Emulex LPe32002 32GBFibre Channel (FC) during storage failover operations. When the storage node returns to an optimal state, the LIFs also come up and the remote port state should read "online". Occasionally, the remote port state might continue to read as "blocked" or "not present". This state can lead to a "failed faulty" path to LUNs at the multipath layer.	1705573

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.