SLES 15

SAN hosts and cloud clients

NetApp
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Use SUSE Linux Enterprise Server 15 SP5 with ONTAP

You can use the ONTAP SAN host configuration settings to configure SUSE Linux Enterprise Server 15 SP5 with ONTAP as the target.

Install the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the NetApp Support Site in a 32-bit and 64-bit .rpm file. If you do not know which file is right for your configuration, use the NetApp Interoperability Matrix Tool to verify which one you need.

NetApp strongly recommends installing the Linux Unified Host Utilities, but it is 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.

What you'll need

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 32-bit or 64-bit Linux Unified Host Utilities software package from the NetApp Support Site 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
   ```

> ⓘ   You can use the configuration settings provided in this document to configure cloud clients connected to Cloud Volumes ONTAP and Amazon FSx for ONTAP.

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
```

Example output:

```
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

What you'll need

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.

Steps

1. Map the SAN boot LUN to the host.

2. Verify that multiple paths are available.

   > (i) Multiple paths become 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 that the boot is successful.

Multipathing

For SUSE Linux Enterprise Server 15 SP5, the `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file. The SUSE Linux Enterprise Server 15 SP5 is compiled with all the 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 configurations

In All SAN Array (ASA) configurations, all paths to a given LUN are active and optimized. This improves performance by serving I/O operations through all paths at the same time.

Example

The following example displays the correct output for an ONTAP LUN:

```
# multipath -ll
3600a09803831347657244e527766394e dm-5 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
  |- 3:0:7:9   sdco 69:192  active ready running
  |- 3:0:8:9   sddi 71:0    active ready running
  |- 14:0:8:9  sdjq 65:320  active ready running
  `- 14:0:7:9  sdiw 8:256   active ready running
```

(i) Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Non-ASA configurations

For non-ASA configurations, 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
3600a09803831347657244e527766394e dm-5 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
| |- 3:0:3:0   sdd  8:48    active ready running
| |- 3:0:4:0   sdx  65:112  active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 14:0:2:0  sdfk 130:96  active ready running
  `- 14:0:5:0  sdgz 132:240 active ready running
```

(i) Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Recommended settings

SUSE Linux Enterprise Server 15 SP5 OS is compiled to recognize ONTAP LUNs and automatically set all configuration parameters correctly for both ASA and non-ASA configurations. You can further optimize performance for your host configuration with the following recommended settings.

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

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

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

```
# systemctl enable multipathd
# systemctl start multipathd
```

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

- To exclude unwanted devices, add the following syntax to the `multipath.conf` file .

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

Replace the `<DevId>` with the `WWID` string of the device you want to exclude.

Example

In this example, we are going to determine the WWID of a device and add to the `multipath.conf` file.

Steps

1. Run the following command to determine the WWID:

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

`sda` is the local SCSI disk that we need to add it to the blacklist.

2. Add the `WWID` to the blacklist stanza in `/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 might be overriding the default settings.

The following table demonstrates 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 the `multipath.conf` file that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs might not work as expected. These defaults should only be overridden in consultation with NetApp and/or an 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 issues

There are no known issues for the SUSE Linux Enterprise Server 15 SP5 with ONTAP release.

Use SUSE Linux Enterprise Server 15 SP4 with ONTAP

You can use the ONTAP SAN host configuration settings to configure SUSE Linux Enterprise Server 15 SP4 with ONTAP as the target.

Install the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the NetApp Support Site in a 32-bit and 64-bit .rpm file. If you do not know which file is right for your configuration, use the NetApp Interoperability Matrix Tool to verify which one you need.

NetApp strongly recommends installing the Linux Unified Host Utilities, but it is 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.

What you'll need

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 32-bit or 64-bit Linux Unified Host Utilities software package from the NetApp Support Site 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
   ```

> ⓘ You can use the configuration settings provided in this document to configure cloud clients connected to Cloud Volumes ONTAP and Amazon FSx for ONTAP.

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
```

Example output:

```
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

What you'll need

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.

Steps

1. Map the SAN boot LUN to the host.

2. Verify that multiple paths are available.

   > ⓘ Multiple paths become 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 that the boot is successful.

Multipathing

For SUSE Linux Enterprise Server 15 SP4 the `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file. SUSE Linux Enterprise Server 15 SP4 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 configurations

In All SAN Array (ASA) configurations, all paths to a given LUN are active and optimized. This improves performance by serving I/O operations through all paths at the same time.

Example

The following example displays the correct output for an ONTAP LUN:

```
# multipath -ll
3600a09803831347657244e527766394e dm-5 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
  |- 3:0:7:9    sdco 69:192  active ready  running
  |- 3:0:8:9    sddi 71:0    active ready  running
  |- 14:0:8:9   sdjq 65:320  active ready  running
  `- 14:0:7:9   sdiw 8:256   active ready  running
```

> (i) Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Non-ASA configurations

For non-ASA configurations, 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
3600a09803831347657244e527766394e dm-5 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
| |- 3:0:3:0    sdd  8:48    active ready running
| |- 3:0:4:0    sdx  65:112  active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 14:0:2:0   sdfk 130:96  active ready running
  `- 14:0:5:0   sdgz 132:240 active ready running
```

(i) Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Recommended settings

SUSE Linux Enterprise Server 15 SP4 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 by using the command:
`touch /etc/multipath.conf.`

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

There is no requirement to add anything directly to the `multipath.conf` file, 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 `<DevId>` with the `WWID` string of the device you want to exclude. Use the following command to determine the `WWID`:

Example

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

Steps

1. Run the following command to determine the `WWID`:

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

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

```
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 might 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 might 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
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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 these parameters cannot be removed because other SAN arrays are still attached to the host, they can instead 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 issues

There are no known issues for the SUSE Linux Enterprise Server 15 SP4 with ONTAP release.

Use SUSE Linux Enterprise Server 15 SP3 with ONTAP

You can use the ONTAP SAN host configuration settings to configure SUSE Linux Enterprise Server 15 SP3 with ONTAP as the target.

Install the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the NetApp Support Site in a 32-bit and 64-bit .rpm file. If you do not know which file is right for your configuration, use the NetApp Interoperability Matrix Tool to verify which one you need.

NetApp strongly recommends installing the Linux Unified Host Utilities, but it is 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.

What you'll need

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 32-bit or 64-bit Linux Unified Host Utilities software package from the NetApp Support Site 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
   ```

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Example

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

```
# sanlun lun show all
```

Example output:

```
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

What you'll need

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.

Steps

1. Map the SAN boot LUN to the host.

2. Verify that multiple paths are available.

   > ℹ️ Multiple paths become 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 that the boot is successful.

Multipathing

For SUSE Linux Enterprise Server 15 SP3 the `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file. SUSE Linux Enterprise Server 15 SP3 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 configurations

In All SAN Array (ASA) configurations, all paths to a given LUN are active and optimized. This improves performance by serving I/O operations through all paths at the same time.

Example

The following example displays the correct output for an ONTAP LUN:

```
# multipath -ll
3600a09803831347657244e527766394e dm-5 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
  |- 3:0:7:9    sdco 69:192  active ready running
  |- 3:0:8:9    sddi 71:0    active ready running
  |- 14:0:8:9   sdjq 65:320  active ready running
  `- 14:0:7:9   sdiw 8:256   active ready running
```

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

Non-ASA configurations

For non-ASA configurations, 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
3600a09803831347657244e527766394e dm-5 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
| |- 3:0:3:0    sdd  8:48    active ready running
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`-+- policy='service-time 0' prio=10 status=enabled
  |- 14:0:2:0   sdfk 130:96  active ready running
  `- 14:0:5:0   sdgz 132:240 active ready running
```

(i) Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Recommended Settings

SUSE Linux Enterprise Server 15 SP3 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 by using the following command:

`touch /etc/multipath.conf`

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

```
# systemctl enable multipathd
# systemctl start multipathd
```

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

- To exclude unwanted devices, add the following syntax to the `multipath.conf` file .

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

Replace the `<DevId>` with the `WWID` string of the device you want to exclude.

Example

In this example, we are going to determine the WWID of a device and add to the `multipath.conf` file.

Steps

1. Run the following command to determine the WWID:

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

`sda` is the local SCSI disk that we need to add it to the blacklist.

2. Add the `WWID` to the blacklist stanza in `/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 might be overriding the default settings.

The following table demonstrates 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 the `multipath.conf` file that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs might not work as expected. These defaults should only be overridden in consultation with NetApp and/or an 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"

Parameter	Setting
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 issues

There are no known issues for the SUSE Linux Enterprise Server 15 SP3 with ONTAP release.

Use SUSE Linux Enterprise Server 15 SP2 with ONTAP

You can use the ONTAP SAN host configuration settings to configure SUSE Linux Enterprise Server 15 SP2 with ONTAP as the target.

Install the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the NetApp Support Site in a 32-bit and 64-bit .rpm file. If you do not know which file is right for your configuration, use the NetApp Interoperability Matrix Tool to verify which one you need.

NetApp strongly recommends installing the Linux Unified Host Utilities, but it is 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.

What you'll need

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 32-bit or 64-bit Linux Unified Host Utilities software package from the NetApp Support Site 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
```

> (i) You can use the configuration settings provided in this document to configure cloud clients connected to Cloud Volumes ONTAP and Amazon FSx for ONTAP.

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
```

Example output:

```
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

What you'll need

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.

Steps

1. Map the SAN boot LUN to the host.

2. Verify that multiple paths are available.

   > ℹ️ Multiple paths become 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 that the boot is successful.

Multipathing

For SUSE Linux Enterprise Server 15 SP2 the /etc/multipath.conf file must exist, but you do not need to make specific changes to the file. SUSE Linux Enterprise Server 15 SP2 is compiled with all settings required to recognize and correctly manage ONTAP LUNs. Use the `multipath -ll` command verify the settings for your ONTAP LUNs.

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
3600a09803831347657244e527766394e dm-5 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=enabled
| |- 11:0:1:0 sdj 8:144 active ready running
| |- 11:0:2:0 sdr 65:16 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
|- 11:0:0:0 sdb 8:i6 active ready running
|- 12:0:0:0 sdz 65:144 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

SUSE Linux Enterprise Server 15 SP2 OS is compiled to recognize ONTAP LUNs and automatically set all configuration parameters correctly.

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

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

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

```
# systemctl enable multipathd
# systemctl start multipathd
```

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

- To exclude unwanted devices, add the following syntax to the `multipath.conf` file .

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

Replace the `<DevId>` with the `WWID` string of the device you want to exclude.

Example

In this example, we are going to determine the WWID of a device and add to the `multipath.conf` file.

Steps

1. Run the following command to determine the WWID:

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

   `sda` is the local SCSI disk that we need to add it to the blacklist.

2. Add the `WWID` to the blacklist stanza in `/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 might be overriding the default settings.

The following table demonstrates 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 the `multipath.conf` file that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs might not work as expected. These defaults should only be overridden in consultation with NetApp and/or an 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 issues

The SLES 15 SP2 with ONTAP release has the following known issues:

NetApp Bug ID	Title	Description	Bugzilla ID

1308744	iSCSI boot from SAN fails to boot with a static IP configuration after completing an SLES15SP2 OS installation	iSCSI sanbooted LUN failed to boot up after completing an SLES 15 SP2 OS installation with a static IP configuration. Bootup failure occurs every time with the static IP configuration. This leads to the server refusing to continue the boot up process with the following error message:
		
		```dracut-cmdline[241]: warning: Empty autoconf values default to dhcp```
		
		```dracut: FATAL: FATAL: For argument ip=eth4:static, setting client-ip does not make sense for dhcp```
		
		```dracut: Refusing to continue```
		
		```reboot: System halted```
			1167494

Use SUSE Linux Enterprise Server 15 SP1 with ONTAP

You can use the ONTAP SAN host configuration settings to configure SUSE Linux Enterprise Server 15 SP1 with ONTAP as the target.

Install the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the NetApp Support Site in a 32-bit and 64-bit .rpm file. If you do not know which file is right for your configuration, use the NetApp Interoperability Matrix Tool to verify which one you need.

NetApp strongly recommends installing the Linux Unified Host Utilities, but it is 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.

What you'll need

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 32-bit or 64-bit Linux Unified Host Utilities software package from the NetApp Support Site 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
   ```

> ⓘ You can use the configuration settings provided in this document to configure cloud clients connected to Cloud Volumes ONTAP and Amazon FSx for ONTAP.

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
```

Example output:

```
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

What you'll need

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.

Steps

1. Map the SAN boot LUN to the host.

2. Verify that multiple paths are available.

   > ⓘ   Multiple paths become 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 that the boot is successful.

Multipathing

For SUSE Linux Enterprise Server 15 SP1 the /etc/multipath.conf file must exist, but you do not need to make specific changes to the file. SUSE Linux Enterprise Server 15 SP1 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 configurations

In All SAN Array (ASA) configurations, all paths to a given LUN are active and optimized. This improves performance by serving I/O operations through all paths at the same time.

Example

The following example displays the correct output for an ONTAP LUN:

```
# multipath -ll
3600a0980383034466b2b4a3775474859 dm-3 NETAPP,LUN C-Mode
size=20G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='round-robin 0' prio=50 status=active
| |- 1:0:8:1  sdb 8:16 active ready running
| `- 2:0:8:1  sdd 8:48 active ready running
`-+- policy='round-robin 0' prio=10 status=enabled
  |- 1:0:9:1  sdc 8:32 active ready running
  `- 2:0:9:1  sde 8:64 active ready running
```

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

Non-ASA configurations

For non-ASA configurations, 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
3600a09803831347657244e527766394e dm-5 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
| |- 11:0:1:0 sdj 8:144 active ready running
| |- 11:0:2:0 sdr 65:16 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
 |- 11:0:0:0 sdb 8:i6 active ready running
 |- 12:0:0:0 sdz 65:144 active ready running
```

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

Recommended Settings

SUSE Linux Enterprise Server 15 SP1 OS is compiled to recognize ONTAP LUNs and automatically set all
configuration parameters correctly.
The `multipath.conf` file must exist for the multipath daemon to start, but you can create an empty, zero-
byte file by using the following command:

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

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

```
# systemctl enable multipathd
# systemctl start multipathd
```

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

- To exclude unwanted devices, add the following syntax to the `multipath.conf` file .

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

Replace the `<DevId>` with the `WWID` string of the device you want to exclude.

Example

In this example, we are going to determine the WWID of a device and add to the `multipath.conf` file.

Steps

1. Run the following command to determine the WWID:

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

   `sda` is the local SCSI disk that we need to add it to the blacklist.

2. Add the `WWID` to the blacklist stanza in `/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 might be overriding the default settings.

The following table demonstrates 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 the `multipath.conf` file that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs might not work as expected. These defaults should only be overridden in consultation with NetApp and/or an 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 issues

The SLES 15 SP1 with ONTAP release has the following known issues:

NetApp Bug ID	Title	Description	Bugzilla ID
[1246622](#)	Remote ports transit to a blocked state on SLES15SP1 with Emulex LPe12002 8GB FC during storage failover operations.	Remote ports transit to a blocked state on SLES15SP1 with Emulex LPe12002 8GB 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 as well as an I/O outage for those LUNs. You can check the remoteport's details against the following sample commands: ---- cat/sys/class/fc_host/host*/device/rport*/fc_remote_ports/rport*/port_name cat/sys/class/fc_host/host*/device/rport*/fc_remote_ports/rport*/port_state ----	[1139137](#)

Use SUSE Linux Enterprise Server 15 with ONTAP

You can use the ONTAP SAN host configuration settings to configure SUSE Linux Enterprise Server 15 with ONTAP as the target.

Install the Linux Unified Host Utilities

The NetApp Linux Unified Host Utilities software package is available on the NetApp Support Site in a 32-bit and 64-bit .rpm file. If you do not know which file is right for your configuration, use the NetApp Interoperability Matrix Tool to verify which one you need.

NetApp strongly recommends installing the Linux Unified Host Utilities, but it is 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.

What you'll need

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 32-bit or 64-bit Linux Unified Host Utilities software package from the NetApp Support Site 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
```

> (i) You can use the configuration settings provided in this document to configure cloud clients connected to Cloud Volumes ONTAP and Amazon FSx for ONTAP.

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
```

Example output:

```
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

What you'll need

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.

Steps

1. Map the SAN boot LUN to the host.

2. Verify that multiple paths are available.

   > ⓘ   Multiple paths become 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 that the boot is successful.

Multipathing

For SUSE Linux Enterprise Server 15 the /etc/multipath.conf file must exist, but you do not need to make specific changes to the file. SUSE Linux Enterprise Server 15 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 configurations

In All SAN Array (ASA) configurations, all paths to a given LUN are active and optimized. This improves performance by serving I/O operations through all paths at the same time.

Example

The following example displays the correct output for an ONTAP LUN:

```
# multipath -ll
3600a0980383034466b2b4a3775474859 dm-3 NETAPP,LUN C-Mode
size=20G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='round-robin 0' prio=50 status=active
| |- 1:0:8:1  sdb 8:16 active ready running
| `- 2:0:8:1  sdd 8:48 active ready running
`-+- policy='round-robin 0' prio=10 status=enabled
  |- 1:0:9:1  sdc 8:32 active ready running
  `- 2:0:9:1  sde 8:64 active ready running
```

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

Non-ASA configurations

For non-ASA configurations, 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
3600a09803831347657244e527766394e dm-5 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=enabled
| |- 11:0:1:0 sdj 8:144 active ready running
| |- 11:0:2:0 sdr 65:16 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
 |- 11:0:0:0 sdb 8:i6 active ready running
 |- 12:0:0:0 sdz 65:144 active ready running
```

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

Recommended Settings

SUSE Linux Enterprise Server 15 OS is compiled to recognize ONTAP LUNs and automatically set all configuration parameters correctly.
The `multipath.conf` file must exist for the multipath daemon to start, but you can create an empty, zero-byte file by using the following command:

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

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

```
# systemctl enable multipathd
# systemctl start multipathd
```

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

- To exclude unwanted devices, add the following syntax to the `multipath.conf` file .

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

Replace the `<DevId>` with the `WWID` string of the device you want to exclude.

Example

In this example, we are going to determine the WWID of a device and add to the `multipath.conf` file.

Steps

1. Run the following command to determine the WWID:

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

`sda` is the local SCSI disk that we need to add it to the blacklist.

2. Add the `WWID` to the blacklist stanza in `/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 might be overriding the default settings.

The following table demonstrates 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 the `multipath.conf` file that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs might not work as expected. These defaults should only be overridden in consultation with NetApp and/or an 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 issues

The SLES 15 with ONTAP release has the following known issues:

NetApp Bug ID	Title	Description	Bugzilla ID
1154309	SLES 15 host with more than 20 mapped LUNs might go into maintenance mode after a reboot	SLES 15 host with more than 20 mapped LUNs might go into maintenance mode after a reboot. The maintenance mode becomes single user mode following the message: `Give root password for maintenance (or press Control-D to continue)`	1104173