Using SUSE Linux Enterprise Server 12 SP3 with NetApp ONTAP

ONTAP SAN Host

Sean Daffy, Amanda Stroman
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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 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.

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 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`

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 SUSE Linux Enterprise Server 12 SP3 the /etc/multipath.conf file must exist, but you do not need to make specific changes to the file. SUSE Linux Enterprise Server 12 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 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
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
```

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
3600a09803831347657244e527766394e dm-5 NETAPP,LUN C-Mode
size=80G features='4 queue_if_no_path pg_init_retries 50 retain_attached_hw_handler'
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
```

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

SUSE Linux Enterprise Server 12 SP3 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 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
1089555	Kernel disruption observed on kernel version SLES12 SP3 with Emulex LPe16002 16GB FC during storage failover operation	A kernel disruption might occur during storage failover operations on kernel version SLES12 SP3 with Emulex LPe16002 HBA. The kernel disruption prompts a reboot of the operating system, which in turn causes an application disruption. If the kdump is configured, the kernel disruption generates a vmcore file under /var/crash/directory. You can investigate the cause of the failure in the vmcore file. Example: In the observed case, the kernel disruption was observed in the module “lpfc_sli_ringtxcmpl_put +51” and is logged in the vmcore file – exception RIP: lpfc_sli_ringtxcmpl_put+ 51. Recover the operating system after the kernel disruption by rebooting the host operating system and restarting the application.	1042847

NetApp Bug ID	Title	Description	Bugzilla ID
1089561	Kernel disruption observed on kernel version SLES12 SP3 with Emulex LPe32002 32GB FC during storage failover operations	A kernel disruption might occur during storage failover operations on kernel version SLES12 SP3 with Emulex LPe32002 HBA. The kernel disruption prompts a reboot of the operating system, which in turn causes an application disruption. If the kdump is configured, the kernel disruption generates a vmcore file under /var/crash/directory. You can investigate the cause of the failure in the vmcore file. Example: In the observed case, the kernel disruption was observed in the module “lpfc_sli_free_hbq+76” and is logged in the vmcore file – exception RIP: lpfc_sli_free_hbq+76. Recover the operating system after the kernel disruption by rebooting the host operating system and restarting the application.	1042807

NetApp Bug ID	Title	Description	Bugzilla ID
1117248	Kernel disruption observed on SLES12SP3 with QLogic QLE2562 8GB FC during storage failover operations	During storage failover operations on the Sles12sp3 kernel (kernel-default-4.4.82-6.3.1) with QLogic QLE2562 HBA, the kernel disruption was observed due to a panic in the kernel. The kernel panic leads to a reboot of the operating system, causing an application disruption. The kernel panic generates the vmcore file under the /var/crash/ directory if kdump is configured. Upon the kernel panic, the vmcore file can be used to understand the cause of the failure. Example: In this case, the panic was observed in the “blk_finish_request+289 ” module. It is logged in the vmcore file with the following string: "exception RIP: blk_finish_request+289" After the kernel disruption, you can recover the operating system by rebooting the Host OS. You can restart the application as required.	1062496

NetApp Bug ID	Title	Description	Bugzilla ID
1117261	Kernel disruption observed on SLES12SP3 with Qlogic QLE2662 16GB FC during storage failover operations	During storage failover operations on Sles12sp3 kernel (kernel-default-4.4.82-6.3.1) with Qlogic QLE2662 HBA, you might observe kernel disruption. This prompts a reboot of the operating system causing application disruption. The kernel disruption generates a vmcore file under /var/crash/ directory if kdump is configured. The vmcore file can be used to understand the cause of the failure. Example: In this case the Kernel disruption was observed in the module "unknown or invalid address" and is logged in vmcore file with the following string - exception RIP: unknown or invalid address. After kernel disruption, the operating system can be recovered by rebooting the host operating system and restarting the application as required.	1062508

NetApp Bug ID	Title	Description	Bugzilla ID
1117274	Kernel disruption observed on SLES12SP3 with Emulex LPe16002 16GB FC during storage failover operations	During storage failover operations on Sles12sp3 kernel (kernel-default-4.4.87-3.1) with Emulex LPe16002 HBA, you might observe kernel disruption. This prompts a reboot of the operating system causing application disruption. The kernel disruption generates a vmcore file under the /var/crash/ directory if kdump is configured. The vmcore file can be used to understand the cause of the failure. Example: In this case kernel disruption was observed in the module “raw_spin_lock_irqsave+30” and is logged in the vmcore file with the following string: – exception RIP: _raw_spin_lock_irqsave +30. After kernel disruption, the operating system can be recovered by rebooting the host operating system and restarting the application as required.	1062514

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.