Configuring the Queue Depth of the nfnic driver on ESXi 6.7 for use with VMWare VVOL

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Introduction

This document describes the process of configuring the maximum Queue Depth and the Outstanding Input/Output (IO) on a native fiberchannel network interface card (nfnic) driver. In the VMware ESXi 6.7 hypervisor, the fiberchannel network interface card (fnic) driver was replaced with the nfnic driver for all Cisco adapters.

The default queue depth of the nfnic driver is set to 32 and on all initial releases of the nfnic driver there is no way to adjust the nfnic queue depth. This limits all Maximum Device Queue Depths and Disk Schedule Number Requests Outstanding to 32. It has also caused issues while using vSphere Virtual Volumes since the recommended queue depth is 128. The effects of this limit can also be seen on any VMs that experience a higher workload and require a larger queue depth in general.

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Background Information

Enhancement created to add ability to configure queue depth parameter:
https://bst.cloudapps.cisco.com/bugsearch/bug/CSCvo09082

Starting with version 4.0.0.35 of the nfnic driver, you can adjust the "lun_queue_depth_per_path" via the ESXi Command Line Interface (CLI). This driver version can be manually installed to the ESXi host if it is not already on it.

The nfnic driver 4.0.0.35 can be found in the UCS Blade Firmware bundle 4.0.4 and can also be downloaded separately from VMware. You should refer to the UCS Hardware and Software Compatibility page to get the latest recommended driver for your specific hardware and software combination.

Checking and Updating the nfnic Driver
Checking installed driver

To check the currently installed version of the nfnc driver, run:

```bash
esxcli software vib list | grep nfnc
```

You should see something like:

```bash
[root@localhost:~] esxcli software vib list | grep nfnc
nfnc                          4.0.0.14-1OEM.670.1.28.10302608         Cisco
VMwareCertified   2019-08-24
[root@localhost:~]
```

If you do not see any output, then you currently do not have the nfnc driver installed. Please refer to the [UCS Hardware and Software Compatibility](#) page to check if your configuration should be using the nfnc or fnic driver.

Upgrading the nfnc driver

Detailed instructions to install the latest drivers are beyond the scope of this guide. Please refer to [UCS Driver Installation for Common Operating Systems](#) or VMware’s documentation for step-by-step instructions to upgrade the driver. Once the driver is upgraded you can use the same commands above to verify the version.

Configuring the nfnc Driver

Configuring the Queue Depth Parameter

Once the correct driver is installed we can check that the module parameters are available to configure with:

```bash
[root@localhost:~] esxcli software vib list | grep nfnc
```

We can see in this output that the default value is set to 32, however, we can configure any value from 1-1024. If using vSphere Virtual Volumes, it is recommended to set this value to 128. We would recommend to reach out to VMware and your storage vendor for any other specific recommendations.

Sample Output:

```bash
[root@localhost:~] esxcli system module parameters list -m nfnc
Name                      Type   Value  Description
------------------------  -----  -----  --------------------------------------------------------
------
lun_queue_depth_per_path  ulong         nfnc lun queue depth per path: Default = 32. Range [1 -
1024]
[root@localhost:~]
```
To change the Queue Depth parameter, the command is below. In the below example we are changing it to 128, but your value may be different depending on your environment.

```
[root@localhost:~] esxcli system module parameters list -m nfnic
Name                      Type   Value  Description
------------------------  -----  -----  --------------------------------------------------------
------
lun_queue_depth_per_path  ulong         nfnic lun queue depth per path: Default = 32. Range [1 - 1024]
[root@localhost:~]
```

Using the same command as above we can config the change has been made:

```
[root@localhost:~] esxcli system module parameters list -m nfnic
Name                      Type   Value  Description
------------------------  -----  -----  --------------------------------------------------------
------
lun_queue_depth_per_path  ulong  128    nfnic lun queue depth per path: Default = 32. Range [1 - 1024]
[root@localhost:~]
```

Configure the outstanding IO on the Protocol Endpoint

We can now configure the Outstanding IOs on the Protocol Endpoint to match the Queue Depth above (in our example, 128) and then check to make sure both values have changed to 128.

NOTE: You may need to reboot the host before this configuration change can be made.

To change the Queue Depth for a specific device:

```
[root@localhost:~] esxcli system module parameters list -m nfnic
Name                      Type   Value  Description
------------------------  -----  -----  --------------------------------------------------------
------
lun_queue_depth_per_path  ulong  128    nfnic lun queue depth per path: Default = 32. Range [1 - 1024]
[root@localhost:~]
```

To find the device ID you can use the below command:

```
[root@localhost:~] esxcli system module parameters list -m nfnic
Name                      Type   Value  Description
------------------------  -----  -----  --------------------------------------------------------
------
lun_queue_depth_per_path  ulong  128    nfnic lun queue depth per path: Default = 32. Range [1 - 1024]
[root@localhost:~]
```

To confirm the changes for a specific device:

```
[root@localhost:~] esxcli system module parameters list -m nfnic
Name                      Type   Value  Description
------------------------  -----  -----  --------------------------------------------------------
------
```
lun_queue_depth_per_path ulong 128

nfnic lun queue depth per path: Default = 32. Range [1 - 1024]

[root@localhost:~]

An example with output. We can see that the "Device Max Queue Depth:" and "No of outstanding IOs with competing worlds:" are both still 32.

[root@localhost:~] esxcli storage core device list -d naa.600a09803830462d803f4c6e68664e2d

Display Name: VMWare_SAS_STG_01
Has Settable Display Name: true
Size: 2097152
Device Type: Direct-Access
Multipath Plugin: NMP
Devfs Path: /vmfs/devices/disks/naa.600a09803830462d803f4c6e68664e2d
Vendor: NETAPP

...snip for length...

Is Boot Device: false
Device Max Queue Depth: 32
No of outstanding IOs with competing worlds: 32
Drive Type: unknown
RAID Level: unknown
Number of Physical Drives: unknown
Protection Enabled: false
PI Activated: false
PI Type: 0
PI Protection Mask: NO PROTECTION
Supported Guard Types: NO GUARD SUPPORT
DIX Enabled: false
DIX Guard Type: NO GUARD SUPPORT
Emulated DIX/DIF Enabled: false

Now we change it to 128 for this device

[root@localhost:~] esxcli storage core device list -d naa.600a09803830462d803f4c6e68664e2d

Display Name: VMWare_SAS_STG_01
Has Settable Display Name: true
Size: 2097152
Device Type: Direct-Access
Multipath Plugin: NMP
Devfs Path: /vmfs/devices/disks/naa.600a09803830462d803f4c6e68664e2d
Vendor: NETAPP

...snip for length...

Is Boot Device: false
Device Max Queue Depth: 32
No of outstanding IOs with competing worlds: 32
Drive Type: unknown
RAID Level: unknown
Number of Physical Drives: unknown
Protection Enabled: false
PI Activated: false
PI Type: 0
PI Protection Mask: NO PROTECTION
Supported Guard Types: NO GUARD SUPPORT
DIX Enabled: false
DIX Guard Type: NO GUARD SUPPORT
Emulated DIX/DIF Enabled: false

And when checking the same output we can see "Device Max Queue Depth:" and "No of outstanding IOs with competing worlds:"
outstanding IOs with competing worlds:" are both now 128. If the changes are not immediately reflected then a reboot of the ESXi host may be needed.

```
[root@localhost:] esxcli storage core device list -d naa.600a09803830462d803f4c6e68664e2d
    Display Name: VMWare_SAS_STG_01
    Has Settable Display Name: true
    Size: 2097152
    Device Type: Direct-Access
    Multipath Plugin: NMP
    Devfs Path: /vmfs/devices/disks/naa.600a09803830462d803f4c6e68664e2d
    Vendor: NETAPP
...
    Device Max Queue Depth: 128
    No of outstanding IOs with competing worlds: 128
    Drive Type: unknown
    RAID Level: unknown
    Number of Physical Drives: unknown
    Protection Enabled: false
    PI Activated: false
    PI Type: 0
    PI Protection Mask: NO PROTECTION
    Supported Guard Types: NO GUARD SUPPORT
    DIX Enabled: false
    DIX Guard Type: NO GUARD SUPPORT
    Emulated DIX/DIF Enabled: false
```