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Overview
Cisco Unified Computing System™ (Cisco UCS®) 2.1.2a introduces the fNIC Tunables feature, which provides the capability to tune the fNIC Queue Depth and I/O Throttle Count parameters of the Cisco UCS Virtual Interface Card (VIC) Fibre Channel network interface card (fNIC) driver in Linux and VMware ESX implementations. This guide provides an overview of these two parameters and the methodologies and syntax for modifying their values. Prior to Cisco UCS 2.1.2a, both of these parameters were statically set to industry best practice defaults, and these values are still recommended for the vast majority of architectures. The ability to tune these parameters provides flexibility for those customers whose architectures may require nondefault values. Modifying default values to specific solutions is beyond the scope of this guide.

Audience
This document is intended for Cisco systems engineers and customers involved in systems administration and performance engineering on Cisco UCS Linux and VMware ESX implementations. It assumes advanced knowledge and understanding of Linux and VMware operating system configurations in the context of storage technologies.

Test Environment
Cisco UCS
Cisco UCS Manager (UCSM) 2.1.2a
(2) Cisco UCS 6248UP 48-Port Fabric Interconnects
(2) Cisco UCS 2208XP I/O Modules
(1) Cisco UCS 5108 Blade Server Chassis
(1) Cisco UCS B200 M3 Blade Server with UCS VIC 1240 modular LAN on motherboard (mLOM)
(1) Cisco UCS B200 M2 Blade Server with UCS VIC M81KR

fNIC Driver
1.5.0.45 (minimum version)

fNIC Tunable Parameters
The two new fNIC tunable parameters introduced in UCSM 2.1.2a are Queue Depth and I/O Throttle Count. Definitions for each of these parameters are as follows:

- **Queue Depth**: The total number of I/O requests that can be outstanding on a per-logical unit number (LUN) basis.
- **I/O Throttle Count**: The total number of I/O requests that can be outstanding on a per-virtual host bus adapter (vHBA) basis.

Operating System Support
The Queue Depth and I/O Throttle Count tunable parameters are supported on the following operating systems:

- Red Hat Linux 6.x (RHEL 6.x)
- Red Hat Linux 5.x (RHEL 5.x)
- SUSE Linux Enterprise 11 (SLES 11)
- XenServer (XS)
- VMWare ESX 5.x (ESX)
- **Not Supported**: VMware ESX 4.x
Install fNIC Drivers

This guide assumes that the UCS 2.1.2a or later fNIC drivers have been installed and are running. Please see the Cisco UCS Manager Install and Upgrade Guides, Virtual Interface Card Drivers section, for complete driver installation instructions: http://www.cisco.com/c/en/us/support/servers-unified-computing/ucs-manager/products-installation-guides-list.html

In addition, please review the Cisco UCS Hardware Compatibility List (HCL) to confirm hardware, operating system, and driver compatibility: http://www.cisco.com/en/US/products/ps10477/prod_technical_reference_list.html

Configuring fNIC Tunables

LUN Queue Depth

Description: The total number of I/O requests that can be outstanding on a per-LUN basis.

Parameter name: fnic_max_qdepth

Default value: 32

Configuration capabilities:

• Boot Time
  » Requires reboot for changes to take effect.
  » Changes are persistent across reboots.

• Load Time
  » Disruptive to SAN attached storage.
  » Requires stopping SAN I/O, removing fNIC module dependencies, and removing and reloading the fNIC module.
  » Not possible with the Boot from SAN configuration.
  » Changes are nonpersistent across reboots.

• Run Time
  » Nondisruptive.
  » Changes apply only to newly discovered LUNs after modification.
  » Changes are nonpersistent across reboots.
Table 1 lists the boot configuration capabilities of the supported operating systems.

<table>
<thead>
<tr>
<th>Table 1. Local Boot and Boot from SAN Configuration Capabilities by Operating System (X signifies available capability)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boot Time</strong></td>
</tr>
<tr>
<td>RHEL 5.x, 6.x – Local Boot</td>
</tr>
<tr>
<td>RHEL 5.x, 6.x – Boot from SAN</td>
</tr>
<tr>
<td>SLES 11 – Local Boot</td>
</tr>
<tr>
<td>SLES 11 – Boot from SAN</td>
</tr>
<tr>
<td>XS – Local Boot</td>
</tr>
<tr>
<td>XS – Boot from SAN</td>
</tr>
<tr>
<td>ESX 5.x – Local Boot</td>
</tr>
<tr>
<td>ESX 5.x – Boot from SAN</td>
</tr>
</tbody>
</table>

**Displaying fnic_max_qdepth Parameter Value**

The current and postconfiguration value of the fnic_max_qdepth parameter can be displayed using the following commands.

**RHEL 6.x / SLES11 / XS**

1. To display the current fnic_max_qdepth, run the following command:

   ```
   # cat /sys/module/parameters/fnic_max_qdepth
   ```

2. To display the current fnic_max_qdepth on a per-LUN basis, which is relevant if the value was changed using the run-time configuration for newly discovered LUNs, run the following command at the command-line interface (CLI) (install lsscsi if not already installed):

   ```
   # lsscsi –l
   ```

**ESX 5.x**

1. From the ESX CLI, run the following command (the fnic_max_qdepth parameter will not be listed until it has been explicitly set per the configuration instructions below):

   ```
   # cat /etc/vmware/esx.conf |grep fnic
   ```

   **Results:**

   ```
   /vmkernel/module/fnic/options = fnic_max_qdepth=128
   ```

2. From the ESX CLI, run the following esxcli command (the fnic_max_qdepth value will be empty until the fnic_max_qdepth parameter has been explicitly set per the configuration instructions below):

   ```
   # esxcli system module parameters list –m fnic
   ```

   **Results:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>fnic_max_qdepth</td>
<td>uint</td>
<td>128</td>
<td>Queue depth to report for each LUN</td>
</tr>
</tbody>
</table>
Boot-Time Configuration

Example commands for setting fnic_max_qdepth to 128:

RHEL 6.x / SLES11 / XS

1. In /etc/grub.conf, append fnic.fnic_max_qdepth=<value> to the kernel line:

   kernel /vmlinuz-2.6.32-358.el6.x86_64 ro root=/dev/mapper/vg_craigsrh-lv_root rd_NO_LUKS LANG=en_US.UTF-8 rd_NO_MD SYSFONT=latarcyrheb-sun16 crashkernel=auto rd_LVM_lv=vg_craigsrh/lv_swap rd_LVM_lv=vg_craigsrh/lv_root KEYBOARDTYPE=pc KEYTABLE=us rd_NO_DM rhgb quiet fnic.fnic_max_qdepth=128

2. Reboot for the new fnic_max_qdepth to take effect.

RHEL 5.x

1. In /etc/modprobe.conf, add an "options fnic" line to set fnic_max_qdepth at boot time:

   options fnic fnic_log_level=4 fnic_trace_max_pages=128 fnic_max_qdepth=128

2. Rebuild initrd:

   mkinitrd -v -f /boot/initrd-`uname -r` .img `uname –r`

3. Reboot for the new fnic_max_qdepth to take effect.

ESX 5.x

1. Set fnic_max_qdepth by running the following command in ESX 5 CLI:

   # esxcli system module parameters set -p fnic_max_qdepth=128 -m fnic

2. Reboot for the new fnic_max_qdepth to take effect.

Load-Time Configuration

RHEL / SLES11 / XS

1. Run one of the following commands at the CLI:

   # modprobe fnic fnic_max_qdepth=128

   or

   # insmod fnic.ko fnic_max_qdepth=128

Run-Time Configuration

RHEL / SLES11 / XS

1. Configure fnic_max_qdepth with sysfs entry with the following command at the CLI:

   # echo 128 > /sys/module/fnic/parameters/fnic_max_qdepth
IO Throttle Count

**Description:** The total number of I/O requests that can be outstanding on a per-vHBA basis.

**Parameter name:** I/O Throttle Count

**Parameter values:**

**Note:** Prior to the UCSM 2.1.2a release, Cisco UCSM displayed an I/O Throttle Count parameter in the non-standalone Linux and ESX Adapter Policies, and in the standalone Cisco Integrated Management Controller vHBA Properties field. This parameter was programatically ignored; modifying it had no effect on the actual adapter setting, which remained statically set. As of the Cisco UCSM 2.1.2a release, this value is now honored.

**Note:** Some values’ actual parameter settings are different than what is displayed in the UCSM and Cisco Integrated Management Controller (IMC) GUIs. These differences are implemented to support backward compatibility and forward consistency.

UCSM GUI / CIMC GUI configurable range = 1 to 1024

UCSM GUI default (non-standalone) = 16 displayed / 2048 actual parameter setting

CIMC GUI default (standalone) = 512 displayed / 512 actual parameter setting

UCSM GUI / CIMC GUI < 256 displayed / 256 actual parameter setting

UCSM GUI / CIMC GUI = 16 displayed / 2048 actual parameter setting

**Configuration capabilities:** Boot time only.
UCSM Non-Standalone I/O Throttle Count Configuration

The I/O Throttle Count for non-standalone servers is configured through the UCSM GUI or equivalent UCSM XML commands. The I/O Throttle Count parameter is configurable in the Linux and VMWare FC Adapter Policies.

To change the I/O Throttle Count parameter, in the UCSM navigation tree, click the Servers tab, then expand the Policies and Adapter Policies in the navigation tree. Click the FC Adapter Policy Linux or FC Adapter Policy VMWare, and then, in the main window, expand the Options drop-down. Configure the I/O Throttle Count field per the list of parameter values above, and then click the Save Changes button.
Cisco Integrated Management Controller Standalone I/O Throttle Count Configuration

The I/O Throttle Count for standalone servers is configured in the Cisco Integrated Management Controller GUI.

To change the I/O Throttle Count parameter, log in to the CIMC, navigate to the Server tab, click the Summary link and then click Power on Server. Once the server has been powered on, click the Inventory link, select the Cisco VIC Adapters tab, choose the Adapter Card, and then select the vHBAs tab. Click fc0 or fc1, then click the Properties button. The vHBA Properties window will display. Scroll down to the Fibre Channel Port section, configure the I/O Throttle Count field per the parameter values listed above, then click the Save Changes button.

References

Virtual Interface Card Drivers Installation Guides

UCSM Managed and Standalone Compatibility Documents