

Cisco UCS fNIC Statistics Guide

Guide
January 2014



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Overview

Cisco Unified Computing System™ (Cisco UCS®) 2.1.2a introduces the fNIC Statistics feature, which provides the capability to gather cumulative and point-in-time I/O and control path statistics for Linux and VMware ESX on Cisco UCS B- and C-Series servers using Cisco UCS Virtual Interface Card (VIC) converged network adapters. Enhanced statistics gathering delivers additional storage troubleshooting tools at the Fibre Channel network interface card (fNIC) (virtual host bus adapter [vHBA]) driver level. This guide reviews the user interface tools for reporting these statistics to the end user, enabling and operating the tools, and categorizing and listing the newly exposed statistics.

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 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 Cisco UCS VIC 1240 modular LAN on motherboard (mLOM)

(1) Cisco UCS B200 M2 with UCS VIC M81KR

fNIC Driver

1.5.0.45 (minimum version)

fNIC Statistics

The new fNIC Statistics feature has the following characteristics:

- Provided by the fNIC driver
- Per-fNIC (per-vHBA) statistics
- Kernel implementation:
 - » 64-bit atomic variables
 - » Atomic operations
- User interface tools:
 - » debugfs – Linux
 - » IOCTL – VMware ESX 5.x

Operating System Support

fNIC statistics 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 above 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/en/US/partner/products/ps10281/prod_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

User Interface Tools

Linux

Tool Name: debugfs

Description: RAM-based file system designed specifically for debugging purposes and used to make kernel information available to the user space.

Enabling debugfs

debugfs must first be mounted in order to access the fNIC statistics. Mounting can occur at run time, or at boot time in /etc/fstab.

Verify if debugfs is already mounted: **# mount**

Mount debugfs: **# mount -t debugfs none /sys/kernel/debug**

Unmount debugfs: **# umount /sys/kernel/debug**

Displaying fNIC Statistics

Each fNIC (vHBA) creates a directory in the /sys/kernel/debug/fnic/statistics/ directory titled host1, host2, and so on. Displaying the fNIC statistics is done per fNIC and must be done on a per-host number basis.

Display fNIC statistics: **# cat /sys/kernel/debug/fnic/statistics/host<#>/stats**

Resetting fNIC Statistics

Each fNIC (vHBA) creates a directory in the /sys/kernel/debug/fnic/statistics/ directory titled host1, host2, and so on. Resetting the fNIC statistics is done per fNIC and must be done on a per-host number basis.

Reset fNIC statistics: **# echo 1 > /sys/kernel/debug/fnic/statistics/host<#>/reset_stats**

VMware

Tool Name: IOCTL / fnic-tracetool

Description: IOCTL is an interface that allows a user space program to access a kernel space device driver. fnic-tracetool is the user space program developed by Cisco for accessing the fNIC statistics through the VMware IOCTL interface. The fnic-tracetool is for Cisco internal use only. This tool is available to Cisco Technical Assistance Center (TAC) and Engineering for requesting fNIC debug and statistics information from customers.

Enabling fnic-tracetool

Copy the fnic-tracetool to the VMware ESX 5.x server and make it executable: **# chmod 777 fnic-tracetool**

Usage: **fnic_tracetool [-d] [-s] <value> [-p] [-r] <vmhbaName> [-h] <vmhbaName> [-i]**

where:

- d Get enable/disable flag status and max buffer size in pages
- s Set trace enable/disable flag
- p Print trace buffer
- r Reset host statistics
- h Print host statistics
- l Print information on fNIC vHBAs



Displaying fNIC Statistics

Displaying the fNIC statistics is done per fNIC and must be done on a per-vmhba basis.

Display fNIC statistics: # `./fnic-tracetool -h vmhba<#>`

Resetting fNIC Statistics

Resetting the fNIC statistics is done per fNIC and must be done on a per-vmhba basis.

Reset fNIC statistics: # `./fnic-tracetool -r vmhba<#>`

fNIC Statistics Categories and Parameters

The fNIC statistics are grouped into seven categories:

- I/O Statistics
- Abort Statistics
- Terminate Statistics
- Reset Statistics
- Firmware Statistics
- VLAN Discovery Statistics
- Other Important Statistics

Point-in-Time Statistics:

- Not cleared by statistics reset
- Number of active I/Os
- Number of active firmware requests

Cumulative Statistics:

- Cleared by statistics reset
- Includes remainder of statistics

I/O Statistics

- Number of active I/Os
- Maximum active I/Os
- Number of I/Os
- Number of I/O completions
 - » Includes I/O failures count
- Number of I/O failures
- Number of I/Os not found
- Number of memory allocation failures
- Number of tag allocation failures
 - » Only in RHEL 5.x and ESX 5.x
- Number of IOREQ null
- Number of SCSI cmd pointer null

Abort and Terminate Statistics

Aborts are issued through the SCSI midlayer.

I/Os are terminated through the driver when the target goes offline.

Firmware timeout:

- Firmware sends frame to driver with timeout header status when timeout occurs in firmware.

Driver timeout:

- Driver sends frame to firmware; if firmware doesn't respond in a specific time interval, driver times out.

Abort Statistics

- Number of aborts
- Number of abort failures
- Number of abort driver timeouts
- Number of abort firmware timeouts
- Number of abort I/Os not found

Terminate Statistics

- Number of terminates
- Maximum terminates
- Number of terminate driver timeouts
- Number of terminate firmware timeouts
- Number of terminate I/Os not found
- Number of terminate failures

Reset Statistics

Device = Storage LUN

Firmware = VIC firmware

fNIC = vHBA/driver

- Number of device resets
- Number of device reset failures
- Number of device reset aborts
- Number of device reset timeouts
- Number of device reset terminates
- Number of firmware resets
- Number of firmware reset completions
- Number of firmware reset failures
- Number of fNIC resets
- Number of fNIC reset completions
- Number of fNIC reset failures

Firmware Statistics

- Number of active firmware requests
- Maximum firmware requests
- Number of firmware out of resources
- Number of firmware I/O errors



VLAN Discovery Statistics

VLAN Discovery Statistics are updated only when Fibre Channel over Ethernet (FCoE) Initiation Protocol (FIP) is in use.

- Number of VLAN discovery requests sent
- VLAN response received with no FCF VLAN ID
- No solicitations received after VLAN set, expiry count
- Flogi rejects count

Other Important Statistics

- Last ISR time
- Last ACK time
- Number of ISRs
- Maximum CQ entries
- Number of ACK index out of range
- Number of data count mismatch
- Number of FCPIO timeouts
- Number of FCPIO aborted
- Number of SGL invalid
- Number of copy WQ allocation failures for ABTs
- Number of copy WQ allocation failures for device reset
- Number of copy WQ allocation failures for I/Os
- Number of icmnd itmf completions
- Number of queue fulls
- Number of rport not ready
- Number of receive frame errors

References

Virtual Interface Card Drivers Installation Guides

http://www.cisco.com/en/US/partner/products/ps10281/prod_installation_guides_list.html

UCSM Managed and Standalone Compatibility Documents

http://www.cisco.com/en/US/products/ps10477/prod_technical_reference_list.html

Example Output

```
# cat /sys/kernel/debug/fnic/statistics/host2/stats
```

```
-----  
                          IO Statistics  
-----  
Number of Active IOs: 128  
Maximum Active IOs: 128  
Number of IOs: 2838387  
Number of IO Completions: 2838259  
Number of IO Failures: 0  
Number of IO NOT Found: 0  
Number of Memory alloc Failures: 0  
Number of IOREQ Null: 0  
Number of SCSI cmd pointer Null: 0
```

Abort Statistics

Number of Aborts: 0
Number of Abort Failures: 0
Number of Abort Driver Timeouts: 0
Number of Abort FW Timeouts: 0
Number of Abort IO NOT Found: 0

Terminate Statistics

Number of Terminates: 0
Maximum Terminates: 0
Number of Terminate Driver Timeouts: 0
Number of Terminate FW Timeouts: 0
Number of Terminate IO NOT Found: 0
Number of Terminate Failures: 0

Reset Statistics

Number of Device Resets: 0
Number of Device Reset Failures: 0
Number of Device Reset Aborts: 0
Number of Device Reset Timeouts: 0
Number of Device Reset Terminates: 0
Number of FW Resets: 2
Number of FW Reset Completions: 2
Number of FW Reset Failures: 0
Number of Fnic Reset: 0
Number of Fnic Reset Completions: 0
Number of Fnic Reset Failures: 0

Firmware Statistics

Number of Active FW Requests 128
Maximum FW Requests: 128
Number of FW out of resources: 0
Number of FW IO errors: 0

Vlan Discovery Statistics

Number of Vlan Discovery Requests Sent 0
Vlan Response Received with no FCF VLAN ID: 0
No solicitations recvd after vlan set, expiry count: 0
Flogi rejects count: 0



Other Important Statistics

Last ISR time: 4884674692 (4883932.221446816)
Last ACK time: 4884674685 (4883932.214447880)
Number of ISRs: 3192579
Maximum CQ Entries: 0
Number of ACK index out of range: 0
Number of data count mismatch: 0
Number of FCPIO Timeouts: 0
Number of FCPIO Aborted: 0
Number of SGL Invalid: 0
Number of Copy WQ Alloc Failures for ABTs: 0
Number of Copy WQ Alloc Failures for Device Reset: 0
Number of Copy WQ Alloc Failures for IOs: 0
Number of icmnd itmf Completions: 0
Number of QUEUE Fulls: 0
Number of rport not ready: 6
Number of receive frame errors: 0



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