

# What You Make Possible



# UCS Supported Storage Architectures and Best Practices with Storage

BRKCOM-2002

# Exec Summary: UCS 1.4 Storage Features

- New Direct Connect Topologies Introduced
  - Allows lower cost point for small UCS Pod like deployments
  - Remote Location scenarios
  - Use of FCoE Storage Targets with UCS
- FC Port Channeling and VSAN Trunking
  - More flexibility in engineering FC traffic vs. 1 VSAN per uplink
  - Aggregate Uplinks transparent to host Multi-path drivers
  - Requires MDS or N5K to Work (both features)

# Exec Summary: UCS 2.0 Storage Features

- iSCSI Boot Support
  - Integrated boot policies, stateless support
  - iSCSI HBA modeling (identifiers, equipment view, etc)
  - M81KR (Palo) and Broadcom 57711 Support
- Hard Disk Drive (HDD) Monitoring without an OS agent
  - Use of LSI interfaces and exposed metrics

# Exec Summary: UCS 2.1 Storage Features

- FCoE Multi-Hop
  - Northbound FCoE from UCS to Access SAN/LAN's
  - Multiple Topologies Supported
  - End-to-End FCoE a Reality
- Local Zoning
  - UCS Pod Deployments
  - Direct Attached Storage
  - Eliminates Upstream Zoning Device (MDS/N5K)

# Exec Summary: UCS 2.1 Storage Features

- PCIe Flash Storage
  - Rack and Blade Solutions
- EMC VFCache
  - Rack and Blade Solution
- Unified Appliance Port
  - File and Block Storage on Single Port

# Topics

- Introduction of Converged Network Adapters (CNAs)
  - CNAs and Port WWNs Considerations
- UCS Storage Modes of Operation and Recommendations
  - End Host Mode - NPV (N\_Port Virtualisation)
  - FC Switching Mode
- FC/FCoE Uplink Connectivity
  - SAN Uplinks, Port Trunking / Channeling, Boot from SAN
- Direct Connectivity of Storage
  - Port Types, Local Zoning
- IP-Based Storage
  - Appliance Ports, iSCSI
- Storage Acceleration
  - PCIe Flash Storage, EMC VFCache
- Monitoring, Troubleshooting, Advanced CLI

# Introduction of Converged Network Adapters

*CNAs and Port WWNs Considerations*

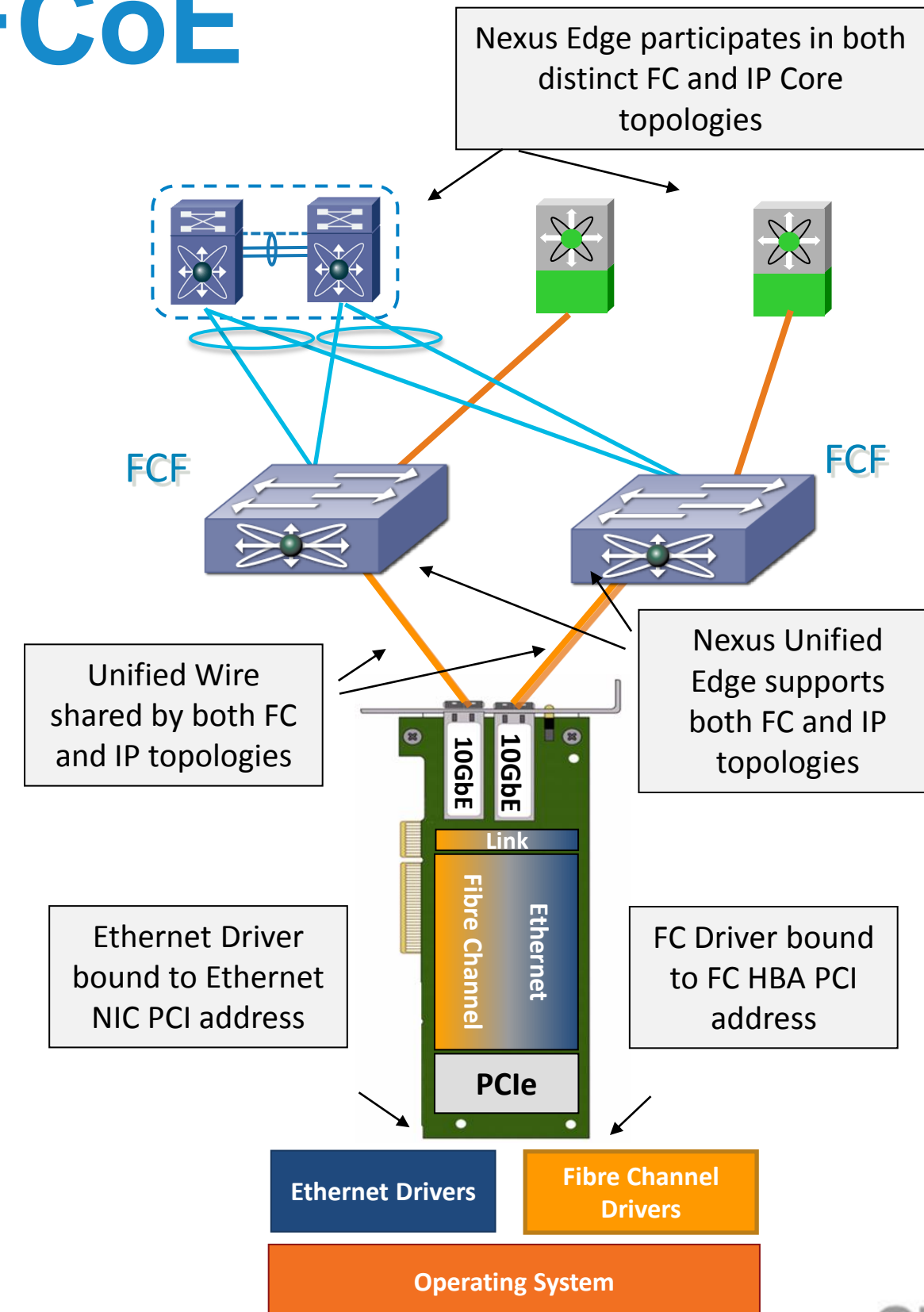




# Unified Fabric with FCoE

## CNA: Converged Network Adapter

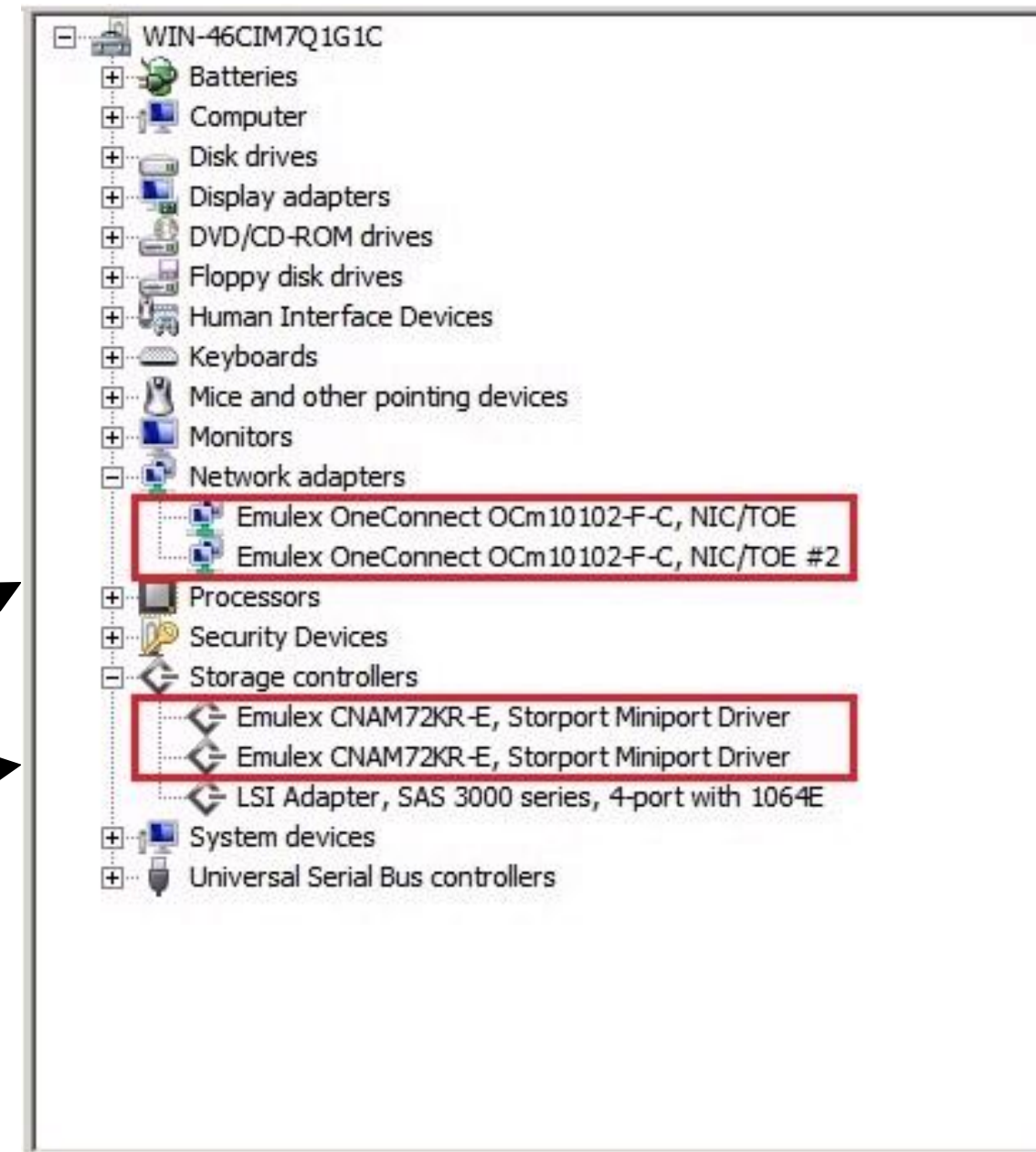
- CNA presents multiple PCI addresses to the Operating System (OS)
- OS loads two unique sets of drivers and manages two unique application topologies
- Server participates in both topologies since it has two stacks and thus two views of the same 'unified wire'
  - Host FC Multi-Pathing driver provides failover between two fabrics (SAN 'A' and SAN 'B')
  - UCS hardware based Fabric Failover (preferred) or OS NIC Teaming provides Ethernet traffic failover



# CNA: Converged Network Adapter

## Operating System View

- Emulex / Qlogic
- Standard drivers
- Same management
- Operating System sees:
  - N port or Dual port  
(depending on hardware)  
**10 Gb Ethernet Adapter**
  - N port or Dual Port  
(depending on hardware)  
**Fibre Channel HBA's**
  - Up to two HBA's per  
server with non-Cisco  
CNAs



# Cisco UCS Virtual Interface Cards

## Cisco UCS VIC Comparison

Model	B-Series			C-Series	
	VIC 1280	VIC 1240	VIC M81KR	VIC 1225	VIC P81E
<b>Maximum Interfaces</b>	256 (16 vHBA's)	256 (16 vHBA's)	128 (8 vHBA's)	256 (16 vHBA's)	128 (8 vHBA's)
<b>Network Throughput</b>	8X10 Gb	4X10 Gb 8X10 Gb (w/Expander)	2X10 Gb	2X10 Gb	2X10 Gb
<b>Host connectivity</b>	16 lanes of PCIe Gen2	16 lanes of PCIe Gen2	16 lanes of PCIe Gen1	16 lanes of PCIe Gen2	16 lanes of PCIe Gen1
<b>Interface Type</b>	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
<b>Form Factor</b>	Mezzanine	Module LOM	Mezzanine	PCIExpress (half height)	PCIExpress (full-height)
<b>UCS Server Compatibility</b>	UCS M2 (B200, B230,B440) and M3 Blades	UCS M3 Blades	UCS M2 Blades	UCS M2 (C260, C460, C220,C240) and M3 Rack Servers	UCS Rack Servers

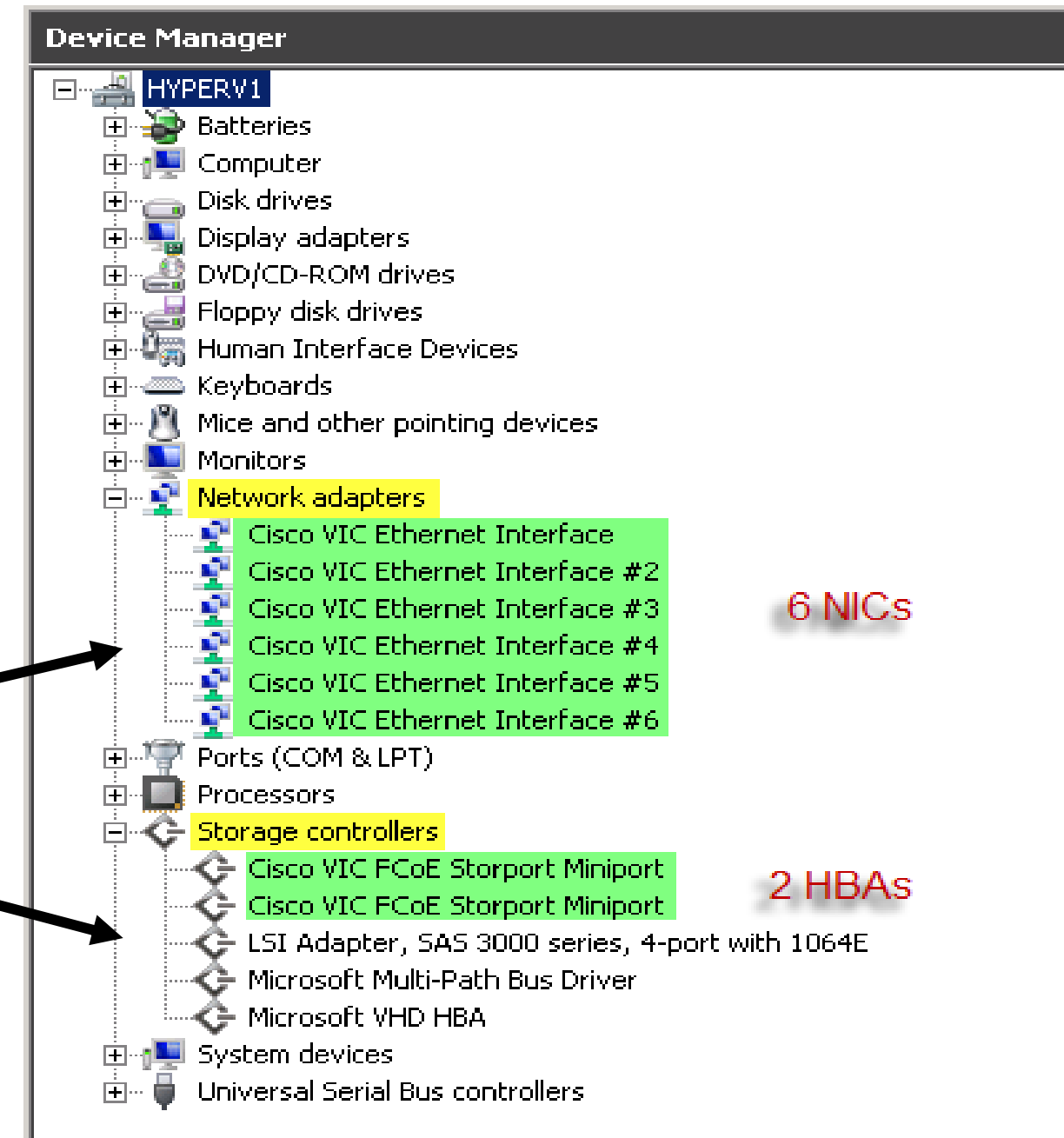
See HCL for Latest Compatibility Information:

[http://www.cisco.com/en/US/docs/unified\\_computing/ucs/interoperability/matrix/r\\_hcl\\_C\\_rel1.46.pdf](http://www.cisco.com/en/US/docs/unified_computing/ucs/interoperability/matrix/r_hcl_C_rel1.46.pdf)

# CNA: Converged Network Adapter

## Operating System View

- Cisco VIC
- Standard drivers
- Same management
- Operating System sees:
  - N port or Dual port  
(depending on hardware)  
**10 Gb Ethernet Adapter**
  - N port or Dual Port  
(depending on hardware)  
**Fibre Channel HBA's**
  - Up to 8 or 16 HBA's per server



# vHBAs: VIC/Non-VIC

- WWN assignment: just like Ethernet MAC addresses
  - Either inherited from burnt-in WWN (**not** with M81KR/1240/1280!)
  - Or manually set
  - Or borrowed from a pool (recommended)
- **Backplane path failover does not exist for HBAs!**
  - A vHBA **either** goes through switch A **or** B at any given time
  - OS-level multipathing provides path resiliency
- Same dynamic pinning concept as with 10GE NICs
- Manual override allowed by using SAN pin-groups

# A Word on World-Wide Name Formats

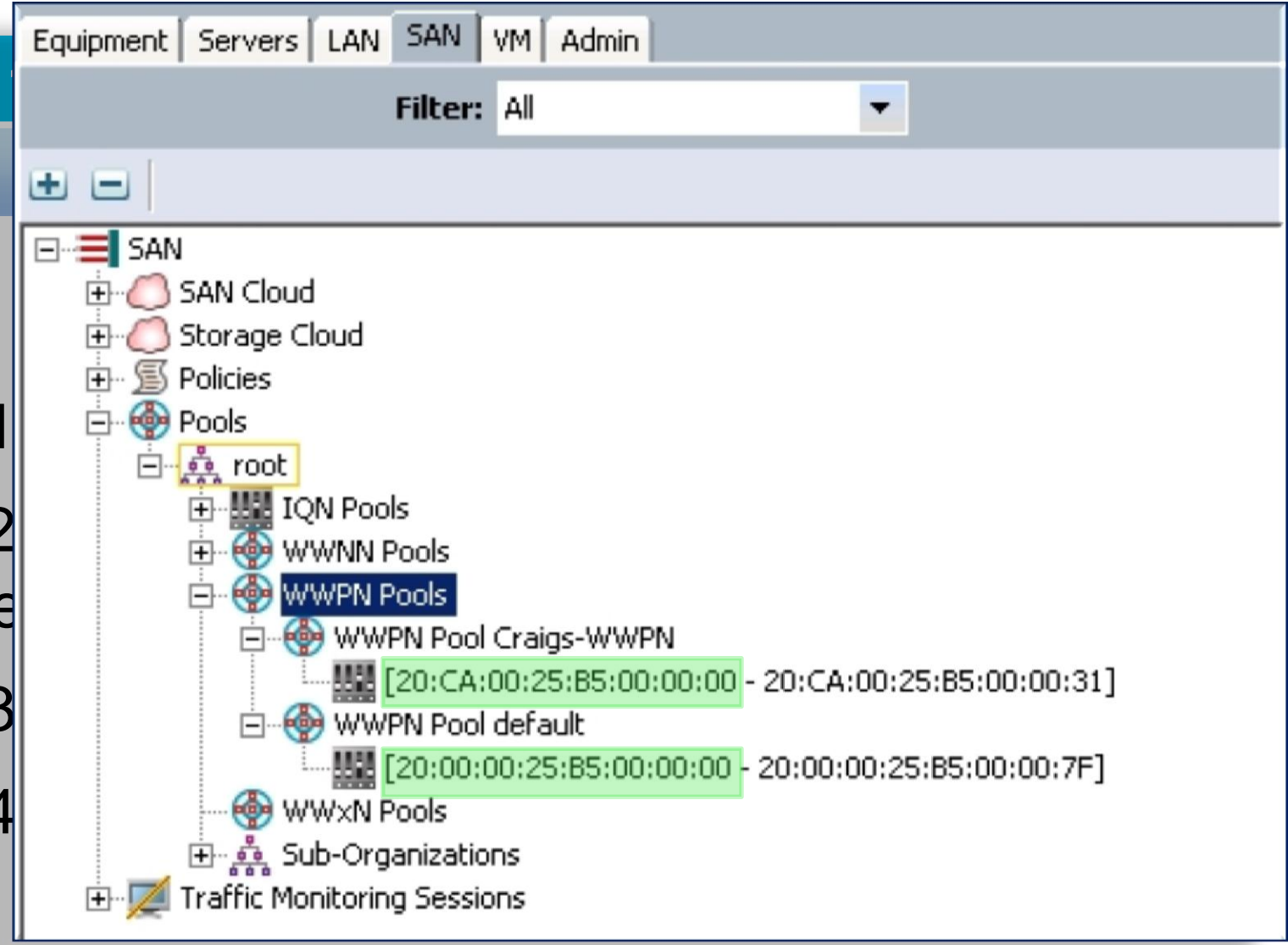
- Avoid interop issues by choosing IEEE Extended Type 2 WW Names inside pools:

Section 2

Section 4  
K:XX:XX

recommended

- Section 1
- Section 2 on a node
- Section 3
- Section 4



WWN  
identify specific ports  
the WWN

# Best Practice for WWN Pools

- Cisco MDS switches will not let just any random port WWN FLOGI!
- Diagnostic is not trivial.
- If your vFC (server-side) interface does not come up, check for malformed WWNs on the upstream MDS using “show flogi internal event-history errors”

```
Event:E_DEBUG, length:146, at 154805 usecs after Fri Sep 4 17:55:13 2009  
[102] Err(NAA=5 and IEEE Company ID is zero)invalid node name  
50:00:00:00:00:00:00:07 from interface fc1/9; nport name is 20:00:00:00:00:00:04:02.
```

- As stated on the previous slide, prefer IEEE Type 2 WWNs

# Fabric Interconnects

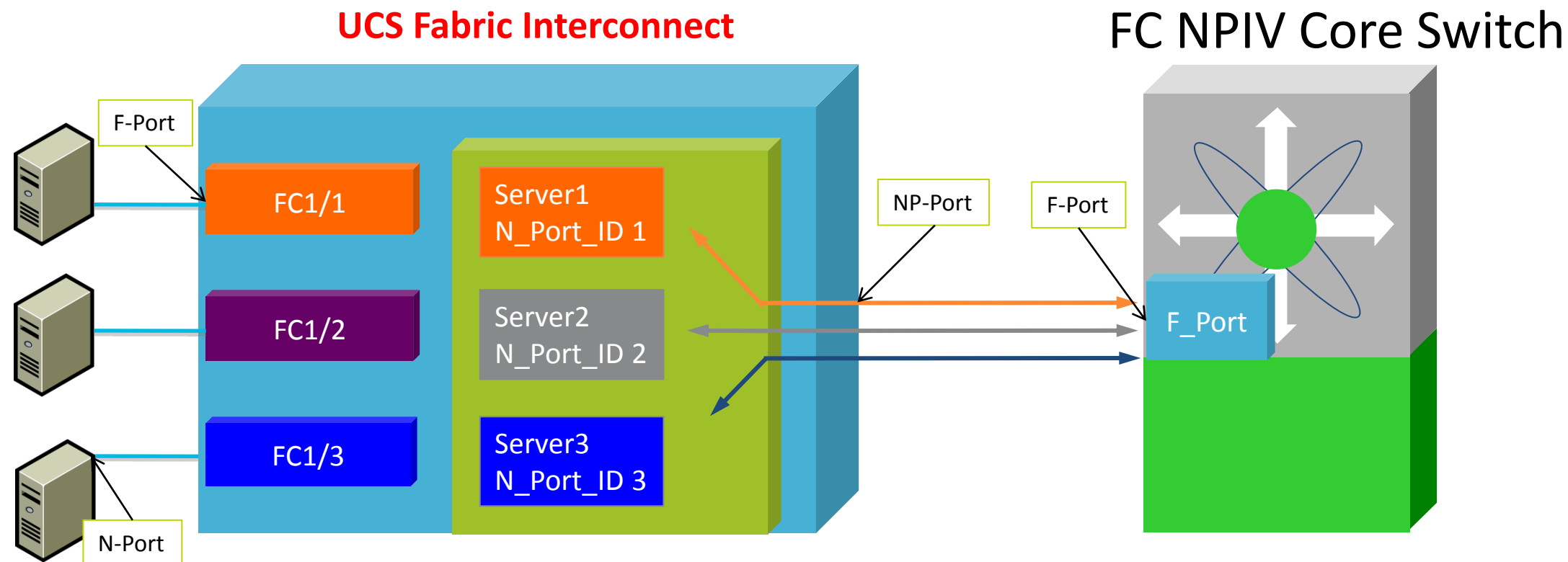
*Modes of Operation*





# What is NPV?

- N-Port Virtualiser (**NPV**) utilises NPIV functionality to allow a “switch” to act like a server performing multiple logins through a single physical link
- Physical servers connected to the **NPV** switch login to the upstream **NPIV** core switch
  - Physical uplink from **NPV** switch to FC **NPIV** core switch does actual “**FLOGI**”
  - Subsequent logins are converted (proxy) to “**FDISC**” to login to upstream FC switch
- No local switching is done on an FC switch in **NPV** mode
- FC edge switch in **NPV** mode Does not take up a **domain ID**



# N-Port Virtualisation (NPV) Mode

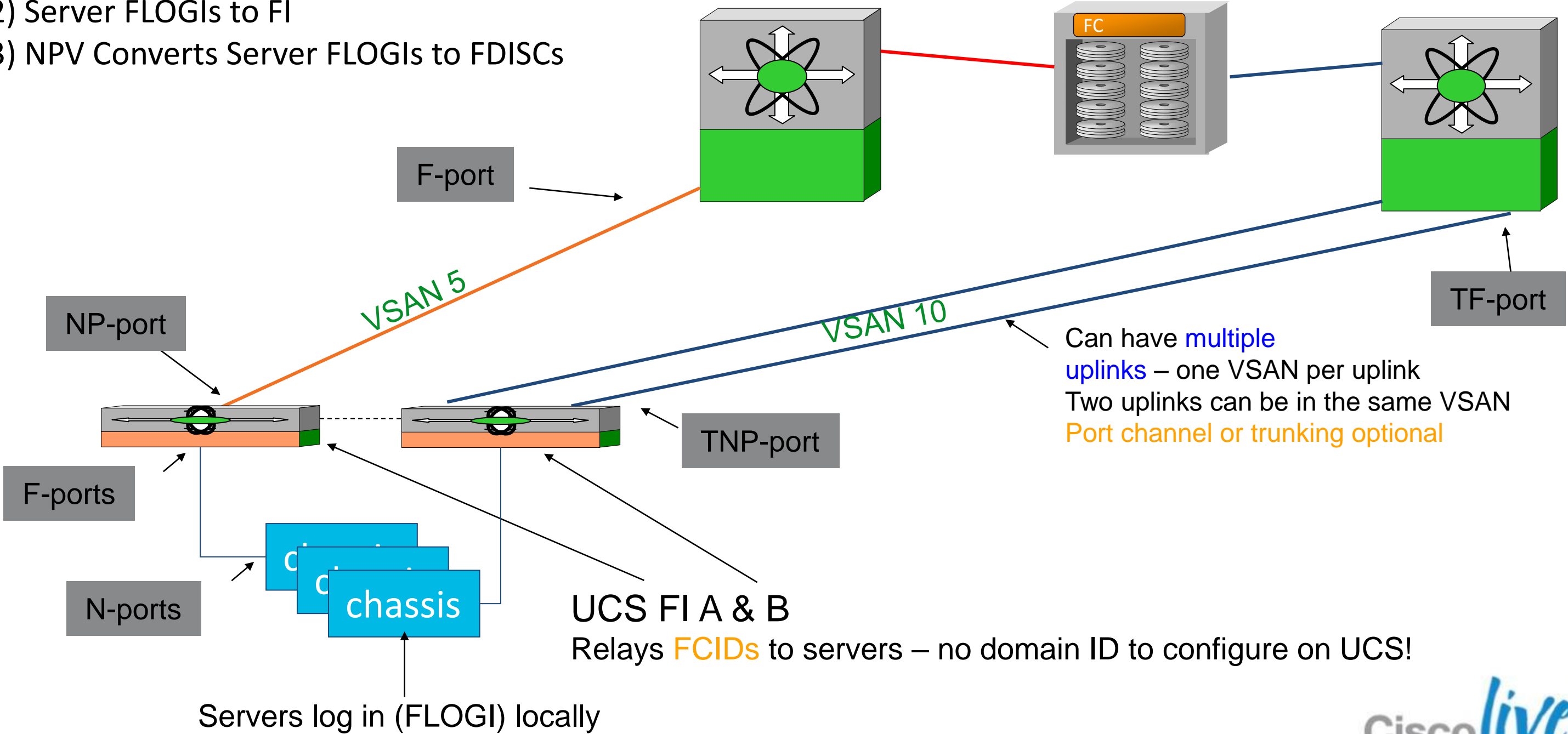
- UCS FI works in NPV mode **by default**
  - Server-facing ports are regular F ports
  - Uplinks toward SAN core fabric are NP ports
- UCS distributes (relays) FCIDs to attached devices
  - No domain ID to maintain locally
- **Zoning, FSPF, DPVM, etc** are **not configured** on the UCS Fabrics
- Domain Mgr, FSPF, Zone Server, Fabric Login Server, Name Server
  - They **do not run** on UCS Fabrics
- **No local switching**
  - All FC traffic routed via the core SAN switches

recommended

# N-Port Virtualisation (NPV): An Overview

- 1) FI FLOGIs to NPV Core
- 2) Server FLOGIs to FI
- 3) NPV Converts Server FLOGIs to FDISCs

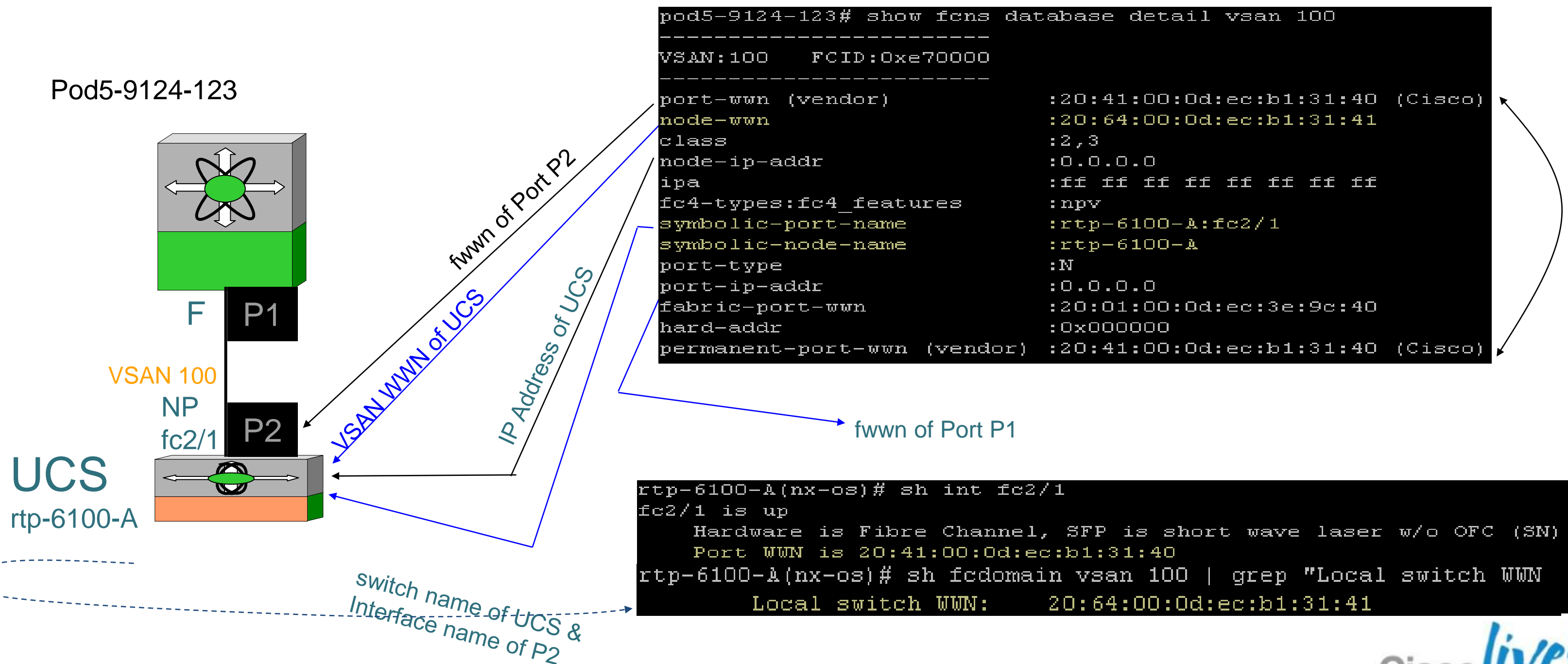
NPV-Core Switch (MDS/N5k/N7k or 3<sup>rd</sup> party switch with NPIV support)



UCS FI A & B  
Relays FCIDs to servers – no domain ID to configure on UCS!

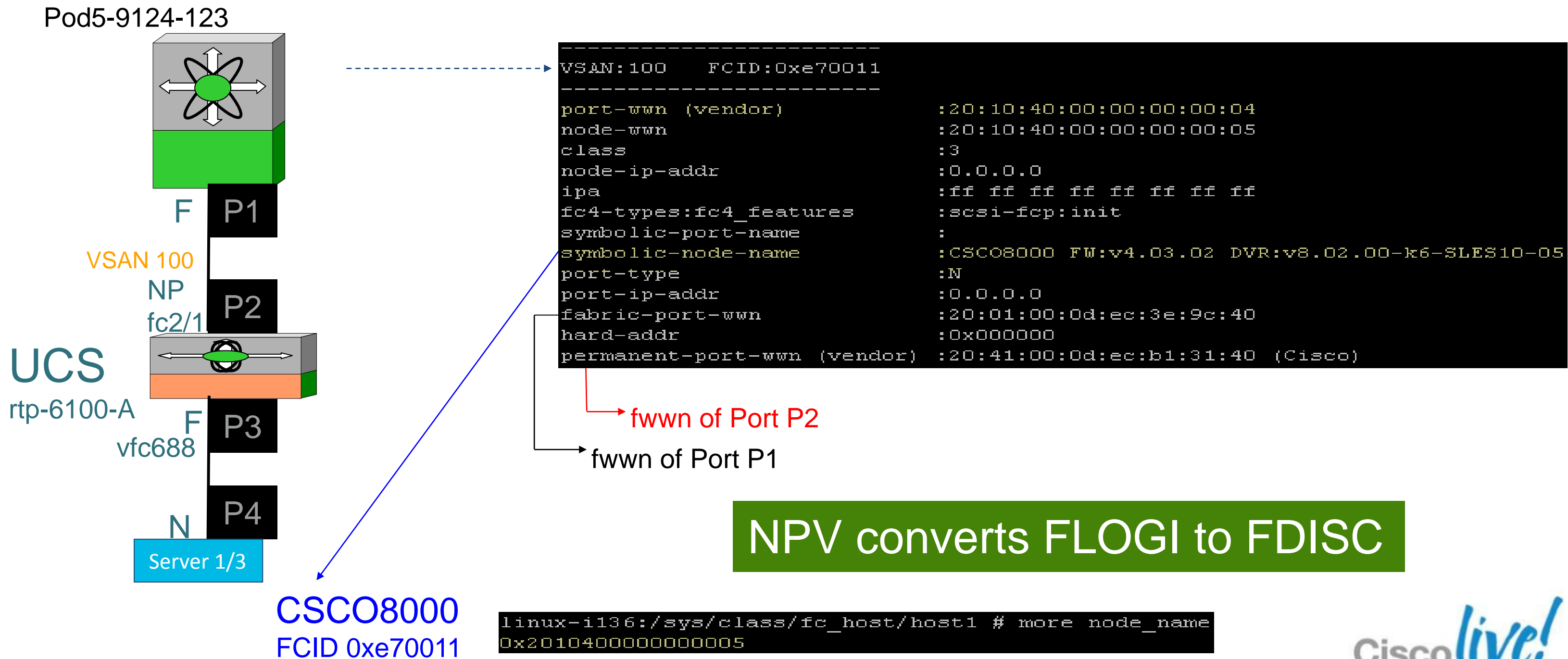
# NPV: Internal Logins (FLOGIs)

- When an NP port comes up, UCS itself first FLOGIs into the core



# NPV: Logins from Servers (FDISCs)

- Server HBAs log into the npv-core as follows:



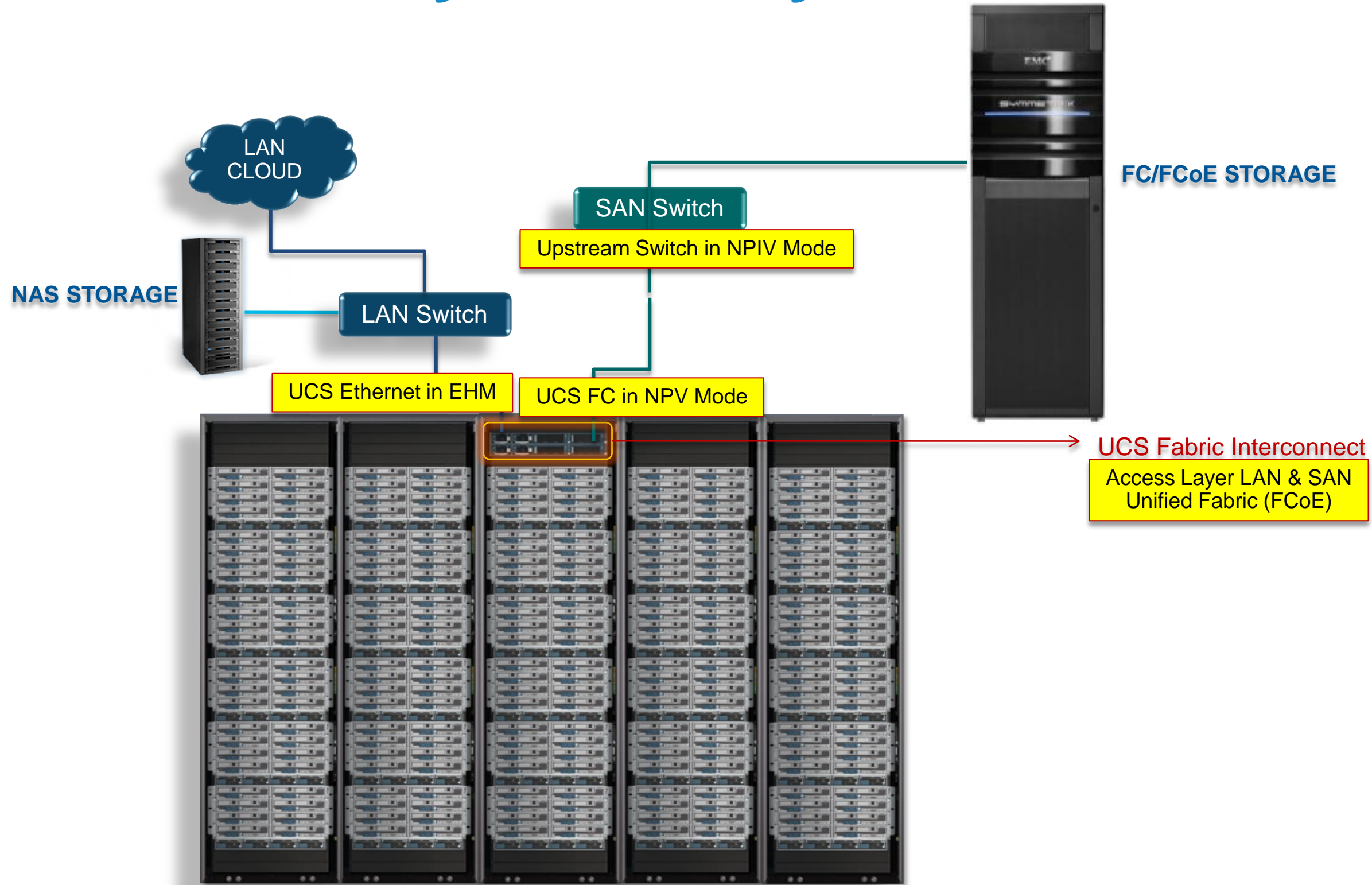
# UCS Storage Defaults and Recommendations for FC/FCoE

- Default (recommended) - N\_Port Virtualisation (NPV) Mode
  - End Host Mode for FC/FCoE, UCS Functions as Node Port (initiator)
  - Small to Large Scale Deployments of Homogeneous or Heterogeneous Operating Systems
  - Extensive Interoperability with SAN and Array Ecosystem
- Option - FC Switching Mode
  - Upstream MDS or Nexus FC Switch Required
    - 2.0 and Below - Mandatory
    - 2.1.1 - If Local Zoning **NOT** Enabled
  - UCS Local Zoning
  - Direct Connect from Fabric Interconnect to Storage Array FC/FCoE Target
  - Designed for POD or Small Scale
  - Limited Interoperability with Storage Ecosystem

# UCS Storage Defaults and Recommendations for NAS

- Default (recommended) - End Host Mode
  - Superior Traffic Engineering - Native L2 Multipathing; No Spanning-Tree
  - Easier Integration into Network
  - 1.4 Introduced Appliance Ports which allow Direct Connect NAS Filers
- Options - Ethernet Switching Mode
  - As of 1.4 no Storage Based Reasons to use this Mode
  - Previous Releases Required Switching Mode for Direct Connect NAS

# UCS Connectivity Summary





# FC/FCoE Uplink Connectivity

*SAN Uplinks, Port Trunking/Channeling, Boot from SAN*



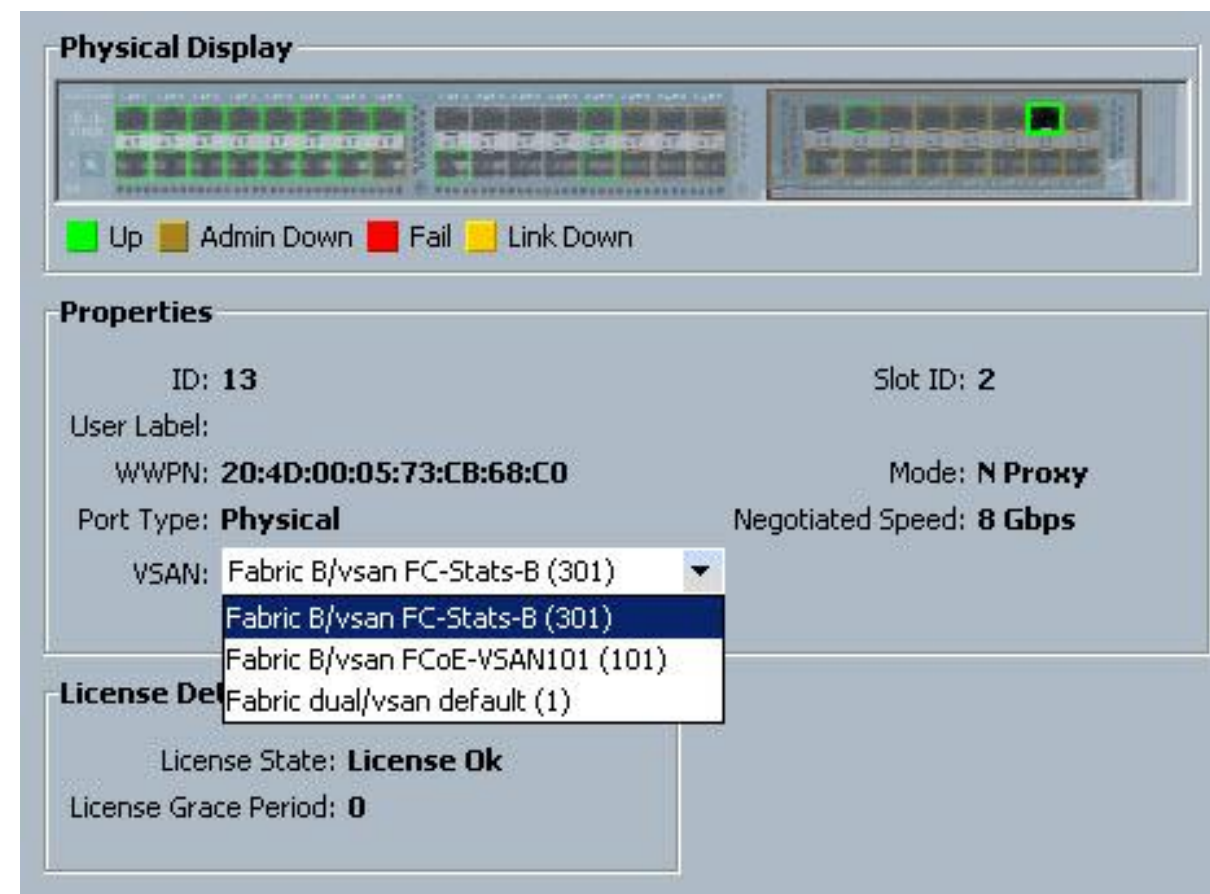
# Block Storage Uplink Versatility

- Fibre Channel (FC)
  - Cisco MDS
  - Cisco Nexus N5k
  - Brocade (See Cisco HCL)
- Fibre Channel over Ethernet (FCoE)
  - Cisco MDS
    - 95xx with FCoE Line Card
  - Cisco Nexus
    - N5k
    - N7k with F1/F2 Line Card



# Fibre Channel Uplink Connectivity

- Default SAN integration is very straightforward:
  - Configure UCS Port to FC and Configure as Uplink Port
  - Connect UCS to external SAN switch (MDS / N5k / Brocade)
  - Make FC uplink member of one and only one VSAN
  - No F\_Port or NP\_Port trunking by default





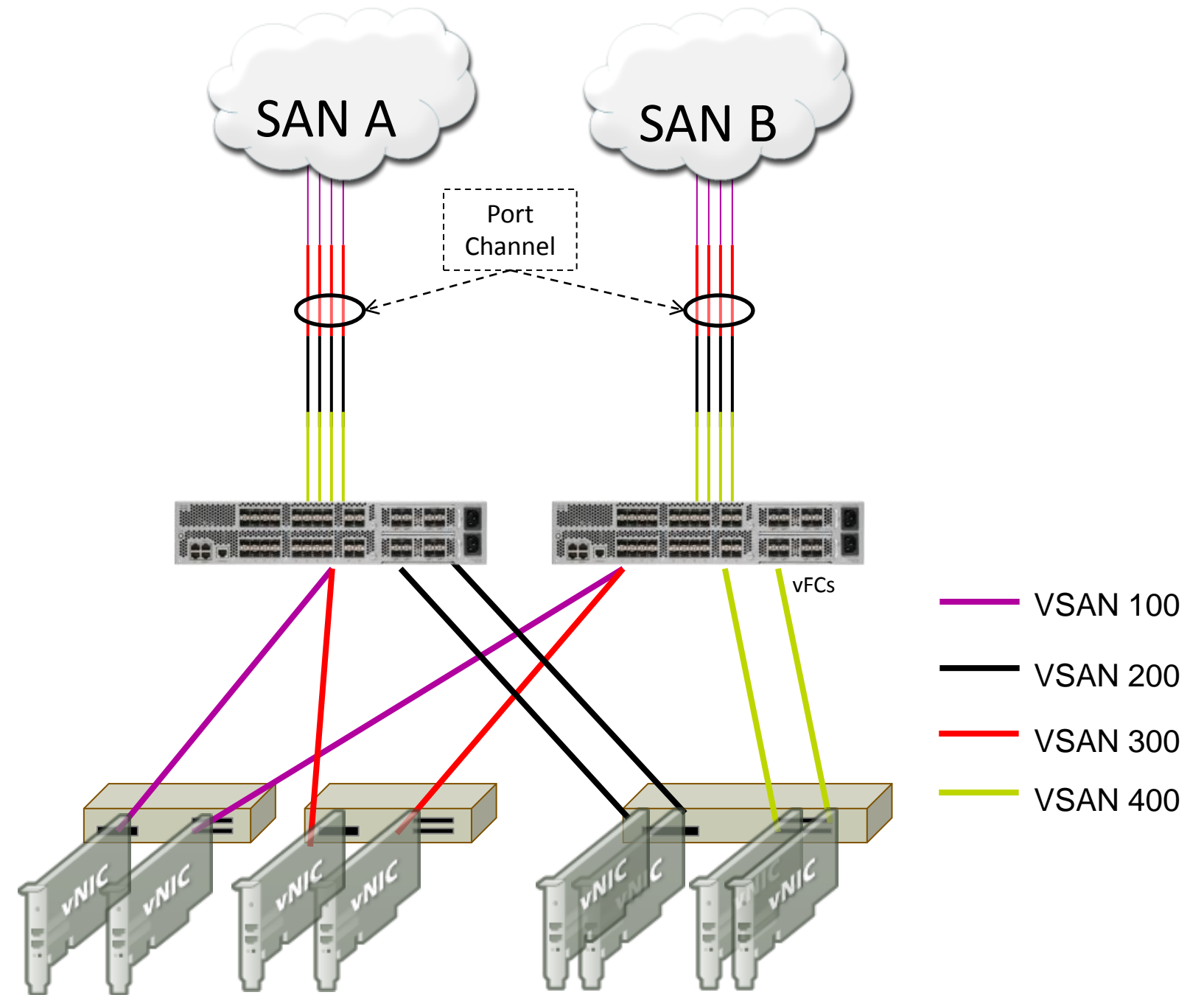
# How FC/FCoE Trunking is Enabled (Global)

- Global Setting for both FIs
- Default is Not enabled
- Enabling Flaps Ports
  - Maintenance Window
- End Host Mode – TNP
- FC Switch Mode – TE
- Don't Forget MDS/N5k Configs!

The screenshot displays the Cisco Unified Computing System Manager interface for a system named FIELD-TME-DELMAR. The left pane shows a tree view under the SAN section, with Fabric A selected. A red box highlights the 'Filter: All' dropdown menu. The right pane shows the configuration for Fabric A, with the 'Uplink FCoE Interfaces' tab selected. The 'Actions' pane on the right contains several options, with 'Enable FC Uplink Trunking' and 'Disable FC Uplink Trunking' highlighted by red boxes. The 'Properties' pane on the right shows the current configuration: ID: A, Network Type: San, Transport Type: Fc, and Locale: External.

# FC/FCoE Port Channels

- Aggregate and maximise available bandwidth and resiliency
- Up to 16 FC ports can be aggregated together for a single FC port channel
- Different combination of ports from different expansion modules on the FI can be placed on the same port channel
  - In case of port speed mismatch – port channel forces port speed to highest commonly supported speed
- VSANs can be trunked over the port channel
- FC/FCoE Port Channels supported in NPV and Switch mode FI operation
- **FC/FCoE Port Channeling not available for direct connect FC/FCoE Storage Port types**



# Creation and Management of FC Port Channels

The screenshot displays the Cisco Unified Computing System Manager interface for a system named FIELD-TME-DELMAR. On the left, a navigation tree shows the hierarchy: SAN > SAN Cloud > Fabric A > FC Port Channels > FC Port-Channel 11 (Fabric A). A red box highlights this path, with a red arrow pointing from the 'SAN' tab in the top navigation bar to the selected item. The main panel shows the configuration for FC Port-Channel 11 (Fabric A) with the following details:

- Status:** Overall Status: Up
- Properties:**
  - ID: 11
  - Fabric ID: A
  - Port Type: Aggregation
  - Transport Type: Fc
  - Name: [Empty field]
  - VSAN: Fabric A/vsan FC-Stats-A (300)
  - Port Channel Admin Speed: Auto
  - Operational Speed(Gbps): 16
- Actions:** Enable Port Channel, Disable Port Channel, Add Ports

# FC/FCoE Port Channeling Requirements and Defaults

- Must activate the channel (like Ethernet)
- Can work in NPV or FC switch mode
- FC - MDS/N5K only
- FCoE – MDS/N5k/N7k
- Load Balancing algorithm same as N5K
  - Load balancing is based on the source ID, destination ID, and exchange ID (OX ID).
- Storage FC/FCoE ports *cannot be channeled or trunked*

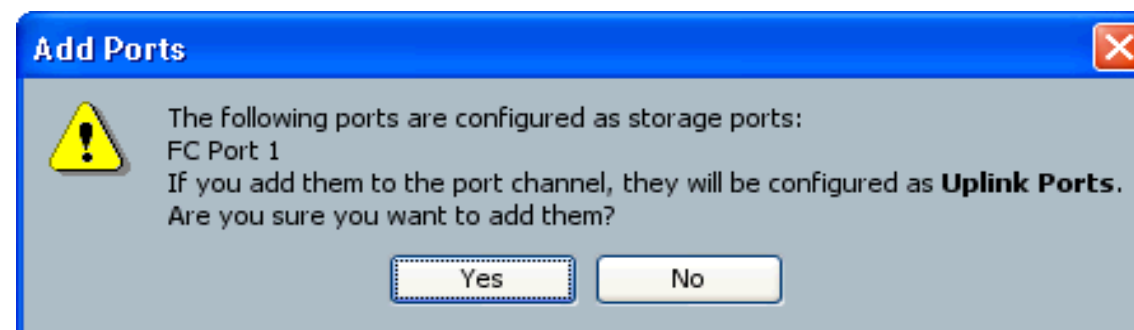
```
SJ2-151-B26-A(nxos)# show interface fc 2/1
```

```
fc2/1 is up
```

```
Hardware is Fibre Channel, SFP is short wave laser w/o OFC (SN)
```

```
Port WWN is 20:41:00:05:73:a2:b3:00
```

```
Admin port mode is F, trunk mode is off
```





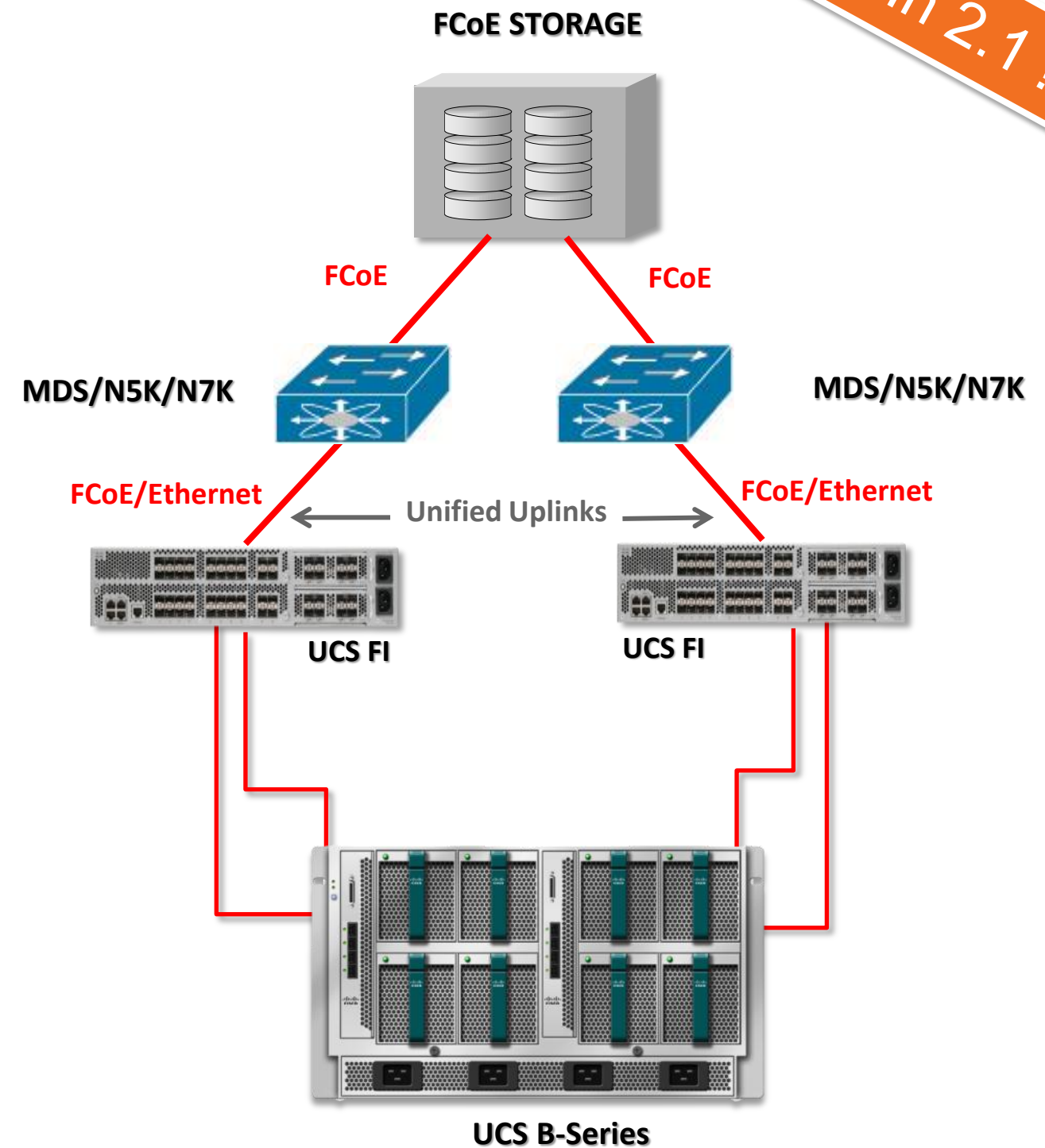
# FC Port Channel and Trunking Interoperability Caveats

	UCS f san-port-channel	UCS f port-trunk
MDS 9509/9513 Gen-2, w/Gen-2 Line Card, 9222i, 9148	4.2 and above	4.2 and above
9124, 9134	4.2 and above	Not supported
MDS 9509/9506/9216 any Gen-1	Not supported	Not supported

- If the UCS system has VSAN configured in the range of 3840-4079 and an attempt is made to enable Port Channel or Trunk, a dialog will indicate configured VSANs in that range will go disabled.
- This is due to those VSANs being reserved starting with NX-OS 4.1 in order to support port-channel/trunk features. This will cause those VSANs to stop switching traffic on those VSANs.
- NOTE: MDS and UCS FI restricted VSAN ranges are not identical.

# Multi-Hop FCoE

- End-to-End FCoE
- MDS, N5K, N7K FCoE Capable Switches Supported Upstream
- New Port Type – “Unified Uplink”
  - Carries FCoE and Normal Ethernet Traffic
- Fabric Interconnect in NPV Mode Primary use Case
  - VNP Ports
- FI in FC Switching Mode
  - VE Ports also Supported



# Multi-Hop FCoE

New In 2.1 !!!

- Pure FCoE or Converged FCoE/Ethernet Uplinks
  - Northbound Switch Dependent
- FCoE Uplinks
  - Individual
  - Port Channels (Max 12, Max 8 Members Per)
- FCoE Uplink Trunking/Port Channels
  - Trunking is Global
  - All VSAN's Available on All Uplinks
- FCoE Uplink Port is a “Border Port”
  - NPV Mode – NP/TNP
  - FC Switching Mode – E/VE
- No QoS Impacts Due to FCoE Uplinks
  - Separate Queues for FCoE and Ethernet

# Multi-Hop FCoE Northbound Connectivity Comparison

New In 2.1 !!!

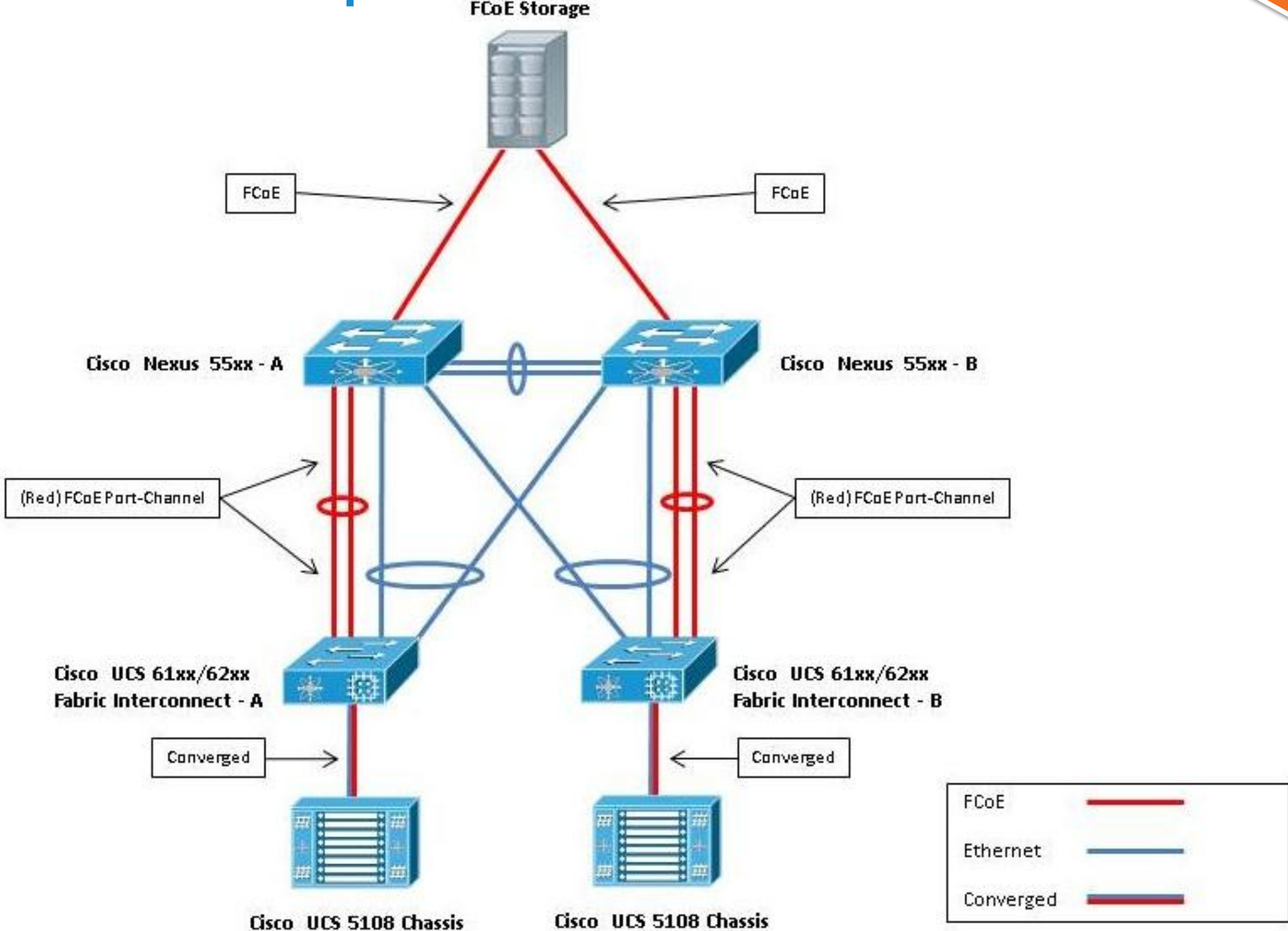
	MDS	N5k	N7k
FCoE Uplinks	✓	✓	✓
Converged Uplinks	N/A	✓	✗
Converged vPC	N/A	✗	✗

- FCoE Uplinks Carry Pure FCoE Storage Traffic
- FCoE Uplinks Individual or Port-Channel
- Converged Uplinks Carry FCoE AND Ethernet LAN traffic
- Converged Uplinks Individual or Port-Channel

# Multi-Hop FCoE – First Hop Topologies

## UCS to N5k – FCoE Uplinks

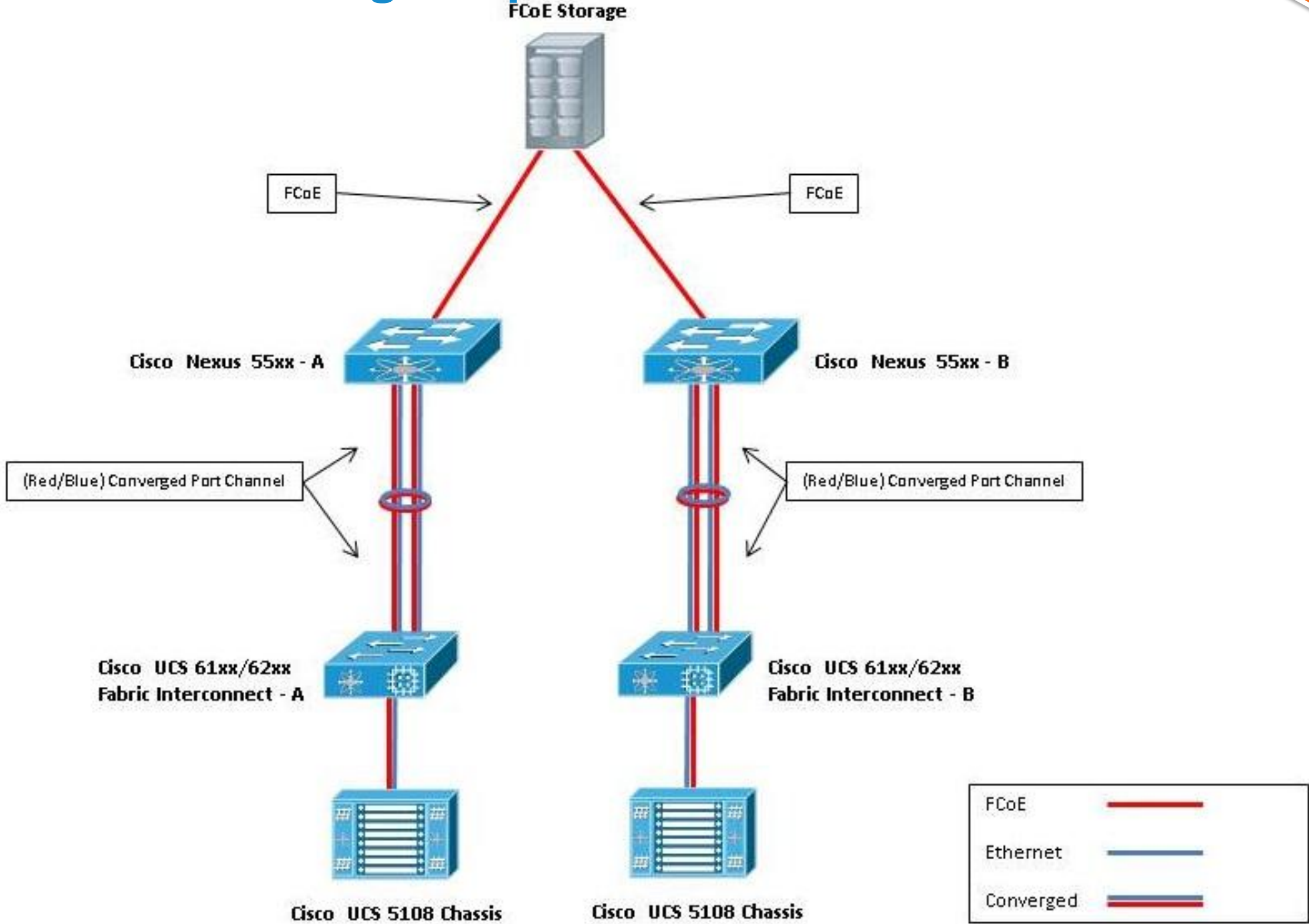
New In 2.1 !!!



# Multi-Hop FCoE – First Hop Topologies

## UCS to N5k – Converged Uplinks

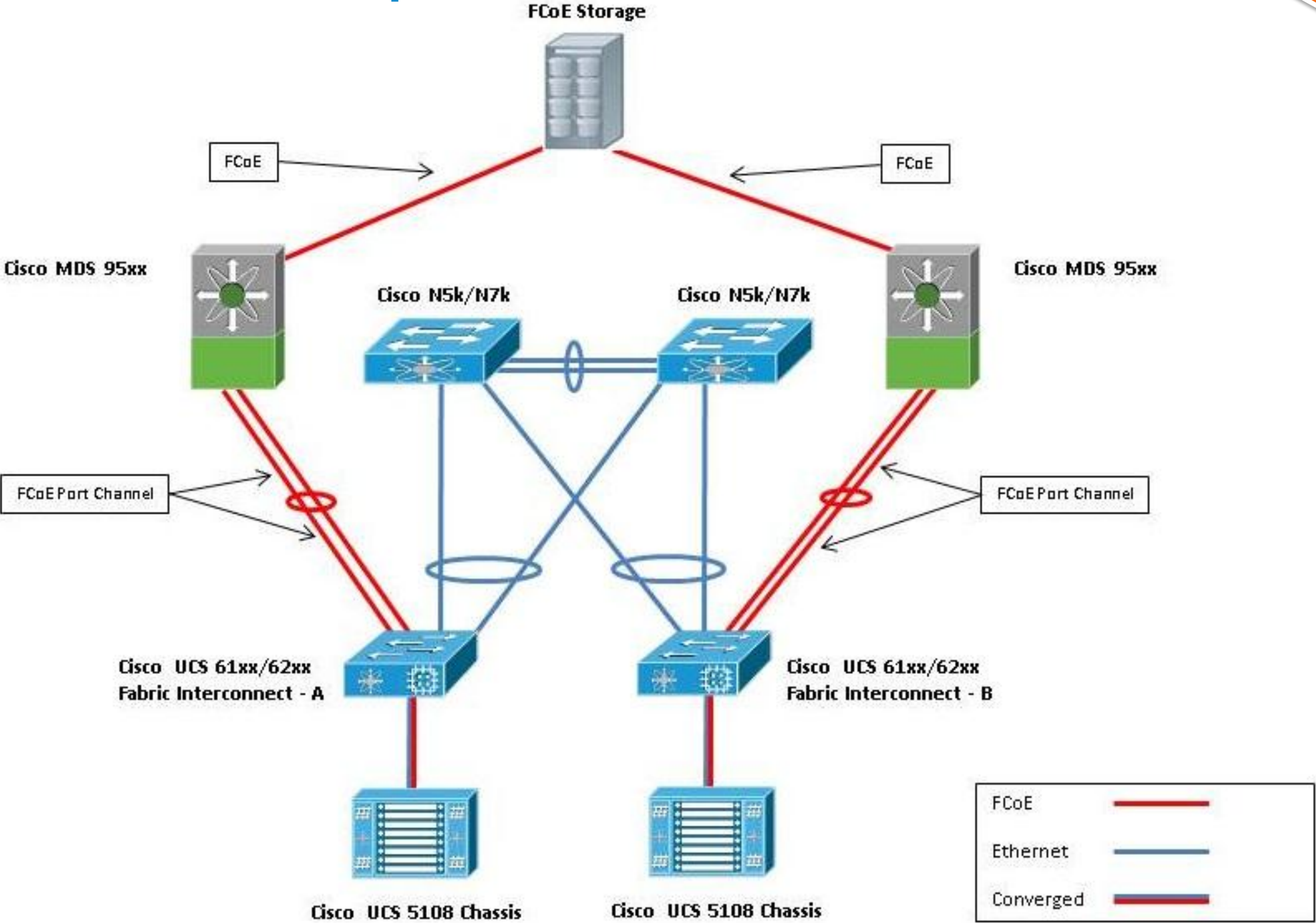
New In 2.1 !!!



# Multi-Hop FCoE – First Hop Topologies

## UCS to MDS – FCoE Uplinks

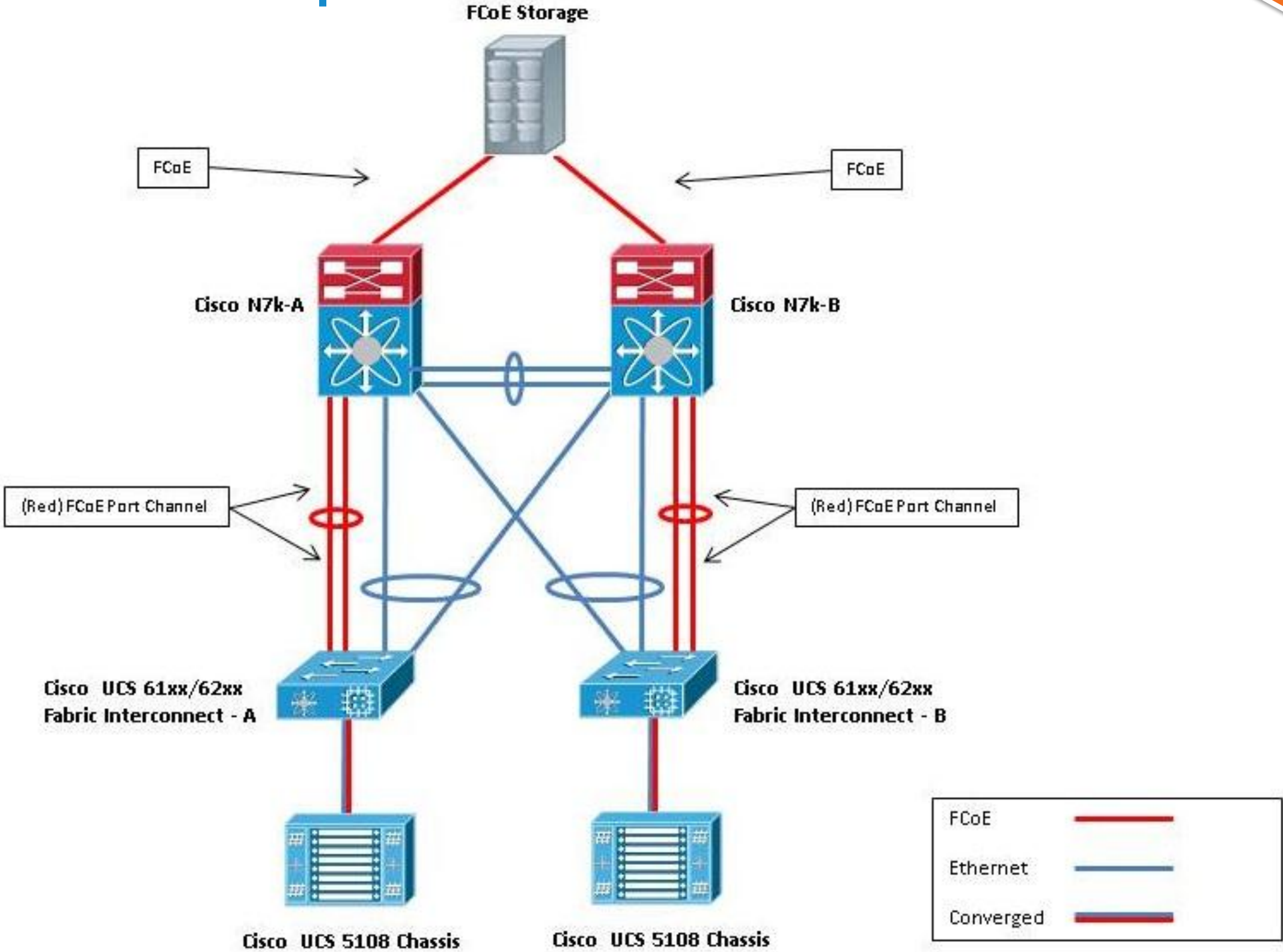
New In 2.1 !!!



# Multi-Hop FCoE – First Hop Topologies

## UCS to N7k– FCoE Uplinks

New In 2.1 !!!





# FC/FCoE SAN Boot

- Create Service Profile
- Configure Storage (simple or expert)
  - Create vHBA's (1, 2, or more (M81KR))
  - Assign Initiator WWPN (manual or pool)
  - Assign VSAN to vHBA's
  - Assign vHBA Placement
  - Select or Create Boot Policy
  - Assign Target WWPN and LUNID
- Associate Server
- Zone
- Mask
- Boot to vMedia
- Install Drivers and OS

The screenshot shows the configuration interface for a service profile, divided into two main sections: Storage and Server Boot Order.

**Storage Section:**  
Title: Storage  
Description: Optionally specify disk policies and SAN configuration information.  
Local Storage: Select Local Storage Policy to use (dropdown menu). A note states: "If nothing is selected, the default Local Storage configuration policy will be assigned to this service profile."  
Action: + Create Local Disk Configuration Policy

**Server Boot Order Section:**  
Title: Server Boot Order  
Description: Optionally specify the boot policy for this service profile.  
Select a boot policy.  
Boot Policy: CraigsWinSANBOOT (dropdown menu). Action: + Create Boot Policy

**Policy Details:**  
Name: CraigsWinSANBOOT  
Description:  
Reboot on Boot Order Change: no  
Enforce vNIC/vHBA/iSCSI Name: no  
**WARNINGS:**  
The type (primary/secondary) does not indicate a boot order presence. The effective order of boot devices within the same device class (LAN/Storage/iSCSI) is determined by PCIe bus scan order. If Enforce vNIC/vHBA/iSCSI Name is selected and the vNIC/vHBA/iSCSI does not exist, a config error will be reported. If it is not selected, the vNICs/vHBAs/iSCSI are selected if they exist, otherwise the vNIC/vHBA/iSCSI with the lowest PCIe bus scan order is used.

**Boot Order Table:**

Name	Order	vNIC/vHBA/iSCSI vNIC	Type	Lun ID	WWN
Storage	1				
SAN primary		20000025b500001e	Primary		
SAN Target primary			Primary	1	26:02:00:01:55:35:0F:0E
SAN secondary		20000025B500001D	Secondary		
SAN Target primary			Primary	1	26:00:00:01:55:35:0F:0E
CD-ROM	2				

Buttons at the bottom: Create iSCSI vNIC, Set iSCSI Boot Parameters

# Uplink Connectivity Caveats

- Enhanced Zoning
  - **Not** Currently Supported (In FC Switching Mode)
  - Will Result in Merge Failure
- Enhanced Device-Alias
  - **Not** Supported (In FC Switching Mode)
- Inter-VSAN-Routing (IVR)
  - **Not** Supported (In FC Switching Mode)
- FC to FCoE Bridging
  - **Supported** (FI to N5k – FC, N5k to Northbound – FCoE)
- Default VSAN 1
  - Global VSAN – Exists on UCS Fabric A and Fabric B
  - Best Practice not to use as General VSAN
  - Changing Default VSAN 1 associated FCoE VLAN ID Will Cause Global VSAN Disruption

# Uplink Connectivity Caveats

- UCS to Brocade Connectivity
  - Trunking / Port Channels **Not** Supported
  - VSAN's Northbound of FI's **Not** Supported
    - VSAN's can be utilised Internal to UCS for Northbound Traffic Engineering
  - See Cisco HCL for Latest Supported Brocade FOS Versions
    - [http://www.cisco.com/en/US/products/ps10477/prod\\_technical\\_reference\\_list.html](http://www.cisco.com/en/US/products/ps10477/prod_technical_reference_list.html)
- External SAN Management Software
  - N5K MIBs are all Exposed but READ ONLY
  - 6xxx can be added to DCNM (Upstream Zoning) but the Manageability is Limited

# Fabric Interconnects

*Direct Storage Connectivity and Local Zoning Options*



# UCS Direct Connect Storage

- Four UCS port types related to direct storage capability
  - Storage FC Port** – direct connect this port to FC port on array
  - Storage FCoE Port** – direct connect this port to FCoE port on array
  - Appliance Port** - direct connect this port to 10G Ethernet port on array
  - Unified Storage Port** – direct connect this port to NetApp Unified Target Adapter on array

The image displays two screenshots of the UCS Manager interface, illustrating the configuration options for a 16-port Flex Port Expansion Module. The left screenshot shows the 'LAN Uplinks Manager' context menu with 'Configure as FCoE Storage Port' and 'Configure as Appliance Port' highlighted. The right screenshot shows the 'Physical Display' context menu with 'Configure as FC Storage Port' highlighted. Both screenshots show the 'Properties' section with the following details:

- ID: 2
- Product Name: 16-port Flex Port Expansion Module For UCS Fabric Interconnect
- Vendor: Cisco Systems, Inc.
- PID: UCS-FI-E16UP
- Revision: 0
- Serial Number (SN): JAF1452CKDL
- Number of Ports: 16
- Description: 02 16 port flexible GEM
- Beacon LED:  Off  Eth  Fc

# Port Types vs. FI Operating Mode

## (Green Means Valid in Mode of Operation)

### Valid Port Types Available with UCS 2.1 Release

- End Host Mode is the Default Mode for the Fabric Interconnects
- Direct Connect to NAS in Ethernet Switching Mode is Accomplished via Standard Ethernet Uplink Port

### FI Mode vs. Valid Port Type in that Mode

FI Operational Role	Server Port	Uplink Port	Uplink FC Port	FCoE Uplink Port	FC Storage Port	FCoE Storage Port	Appliance Port
Ethernet: EHM FC: EHM							
Ethernet: EHM FC: Switching							
Ethernet: Switching FC: EHM							
Ethernet: Switching FC: Switching							

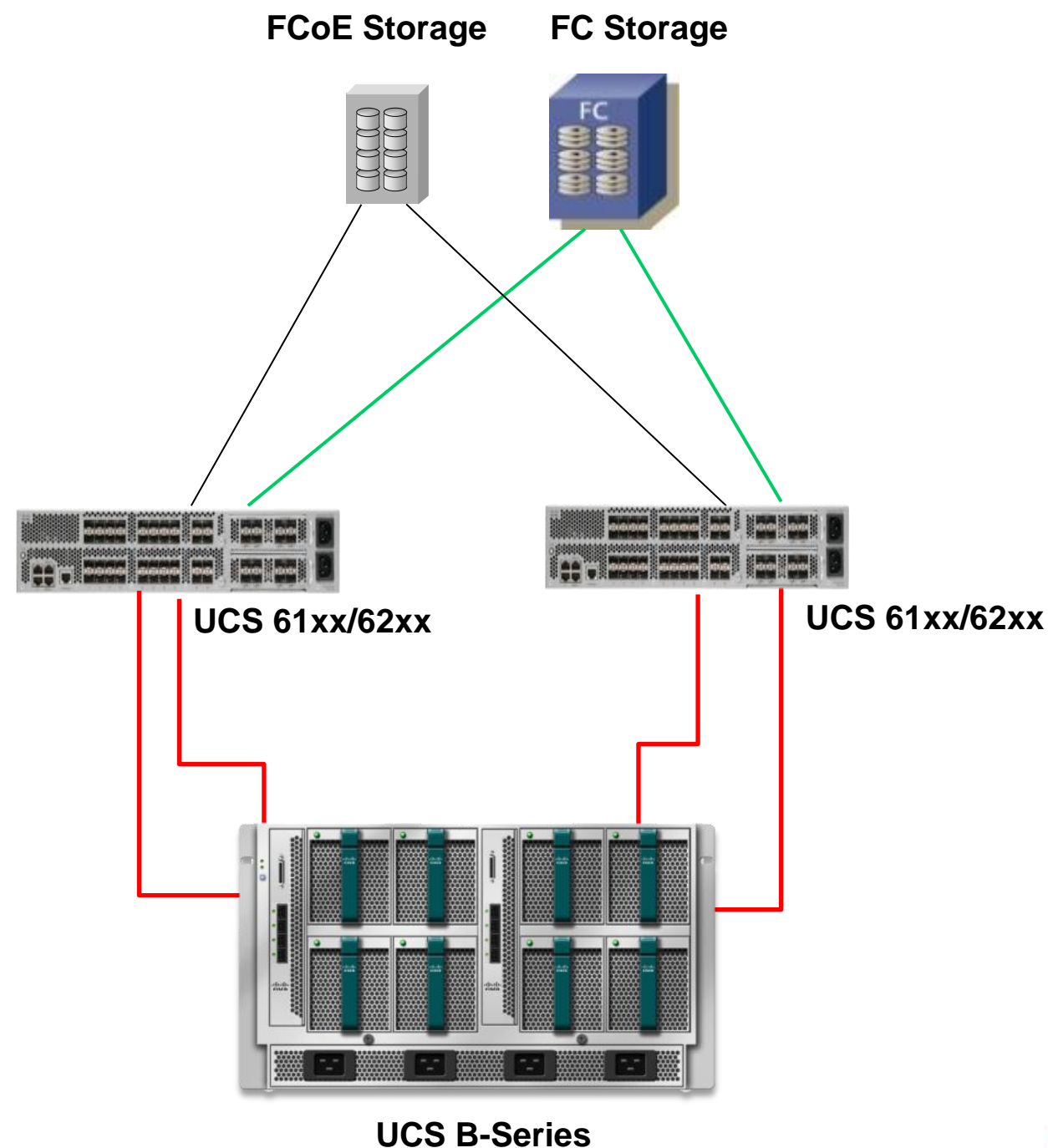
# Direct Connection of FC/FCoE Storage

## Customer benefits

- Support to directly connect FC/ FCoE storage to Fabric Interconnects
- End to end FCoE topologies possible
- Lower cost point for small deployments (no access layer FC/FCoE switches required)

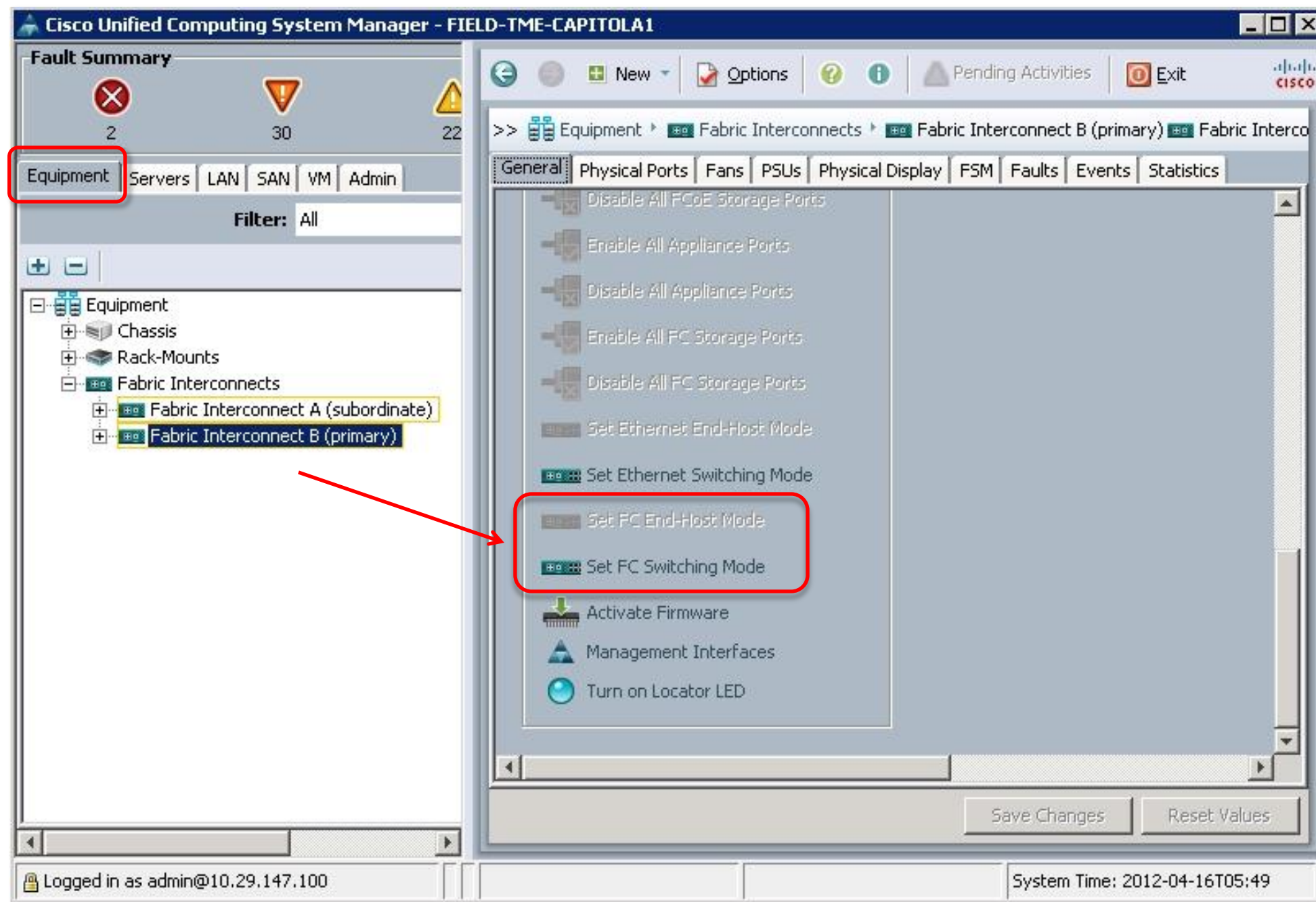
## Feature details

- Support for EMC, HDS, and NetApp direct attached FC/FCoE storage
- Local Zoning **OR** Upstream Zoning
- UCS Configured in FC Switch Mode
- Ethernet and FC switching modes are independent



# How to Place FI into FC Switching Mode

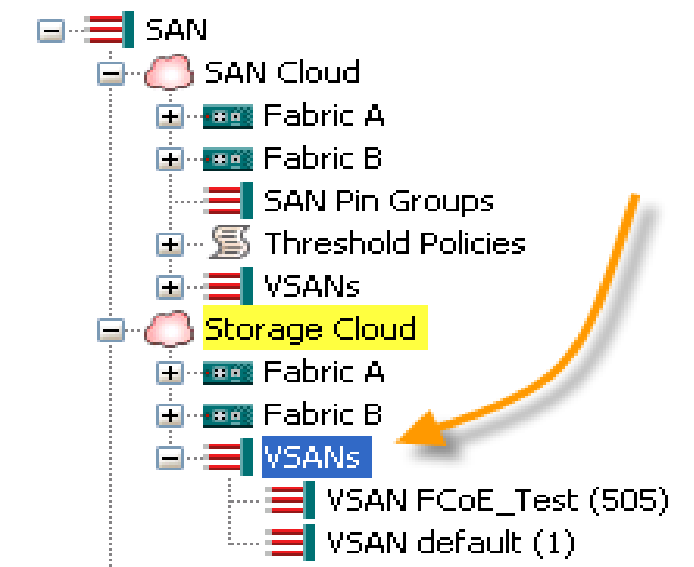
- This operation results in both FIs going into reboot cycles which takes 15 min or so, system wide downtime, by design
- When FC switch mode is turned on, all the Uplink FC ports come up in TE mode





# Configuring an FC Storage Port

- To connect an FC storage device directly into one of the 6x00's FC ports, the user must configure the port as an FC storage port
- The VSAN is configured under the Storage Cloud object
- Internally, the port is configured as follows:
  - As a F\_Port
  - As an access port
  - The speed is kept as auto
  - The user is also allowed to select a named VSAN for that port.



# Configuring an FC Storage Port (GUI)

The screenshot displays the Cisco Unified Computing System Manager (CUCS) GUI for the system 'FIELD-TME-DELMAR'. The interface is divided into several sections:

- Left Panel:** A tree view showing the system hierarchy: Equipment > Fabric Interconnects > Fabric Interconnect B (subordinate) > Fixed Module > FC Ports > FC Port 31. FC Port 31 is selected and highlighted.
- Top Panel:** A 'Fault Summary' section with four icons representing different fault levels: Critical (6), Major (37), Minor (17), and Informational (149).
- Main Content Area:** A detailed view for 'FC Port 31'. It includes:
  - General:** 'Equipment > Fabric Interconnects > Fabric Interconnect B (subordinate) > Fixed Module'.
  - General Tab:** Shows a 'Fault Summary' with all counts at 0, a 'Status' section with 'Overall Status: Admin Down' and 'Admin State: Disabled', and an 'Actions' list. The 'Configure as FC Storage Port' action is highlighted with a red rectangle.
  - Physical Display:** A visual representation of the port's physical state with a legend: Up (green), Admin Down (yellow), Fail (red), Link Down (orange).
  - Properties:** ID: 31, User Label, WWPN: 20:1F:00:05:73:CB:68:C0, Port Type: Physical, and VSAN: Fabric B/vsan Local\_Zoning\_B (201).
  - License Details:** License State: Unknown, License Grace Period: 0.

# Configuring a VSAN on an FC Port (GUI)

The screenshot displays the Cisco Unified Computing System Manager (CUCS) GUI for a system named 'FIELD-TME-DELMAR'. The interface is divided into several sections:

- Left Panel (Navigation Tree):** Shows a hierarchical view of the system components. Under 'Fabric Interconnects', 'Fabric Interconnect A (primary)' is expanded to show 'Fixed Module', which contains 'Ethernet Ports' and 'FC Ports'. 'FC Port 31' is selected and highlighted.
- Top Panel (Fault Summary):** Shows a summary of system faults: 6 Critical (red X), 37 Major (orange triangle), 17 Minor (yellow triangle), and 153 Informational (green triangle).
- Right Panel (Configuration View):** Shows the configuration for 'FC Port 31'.
  - Fault Summary:** 0 Critical, 0 Major, 0 Minor, 0 Informational faults.
  - Status:** Overall Status is 'Up' (green arrow). Admin State is 'Enabled'.
  - Actions:** Includes 'Enable Port', 'Disable Port', 'Configure as Uplink Port', 'Configure as FC Storage Port', and 'Show Interface'.
  - Physical Display:** Shows a visual representation of the port's physical state with a legend: Green for 'Up', Brown for 'Admin Down', Red for 'Fail', and Yellow for 'Link Down'.
  - Properties:** ID: 31, User Label: (empty), WWPN: 20:1F:00:05:73:CB:2E:C0, Port Type: Physical.
  - VSAN Configuration:** A dropdown menu for 'VSAN:' is open, showing options: 'Fabric A/vsan Local\_Zoning\_A (200)', 'Fabric dual/vsan FC\_Test (500)' (which is selected), and 'Fabric dual/vsan default (1)'. The current VSAN is 'Fabric A/vsan Local\_Zoning\_A (200)'.
  - License Details:** License State: License Ok, License Grace Period: 0.

# Configuring an FCoE Storage Port (GUI)

The screenshot shows the Cisco Unified Computing System Manager (CUCS) GUI. The left pane displays a tree view of the system hierarchy: Equipment > Fabric Interconnects > Fabric Interconnect A (primary) > Fixed Module > Ethernet Ports > Port 18. The right pane shows the configuration details for Port 18. The 'Status' section indicates the port is 'Admin Down' with the additional info 'Administratively down' and 'Admin State: Disabled'. The 'Actions' section has a 'Reconfigure' button highlighted with a red box. A context menu is open over 'Reconfigure', with 'Configure as FCoE Storage Port' also highlighted with a red box. Other options in the menu include 'Configure as Uplink Port', 'Configure as FCoE Uplink Port', 'Configure as Server Port', and 'Configure as Appliance Port'. The 'Properties' section shows the port is ID 18, Slot ID 1, MAC 00:05:73:CB:2E:B9, Mode Access, Port Type Physical, and Role Unconfigured. The 'Transceiver' section shows a SFP5101SR-C1 SFP.

# Configuring an FCoE Storage Port (Cont.)

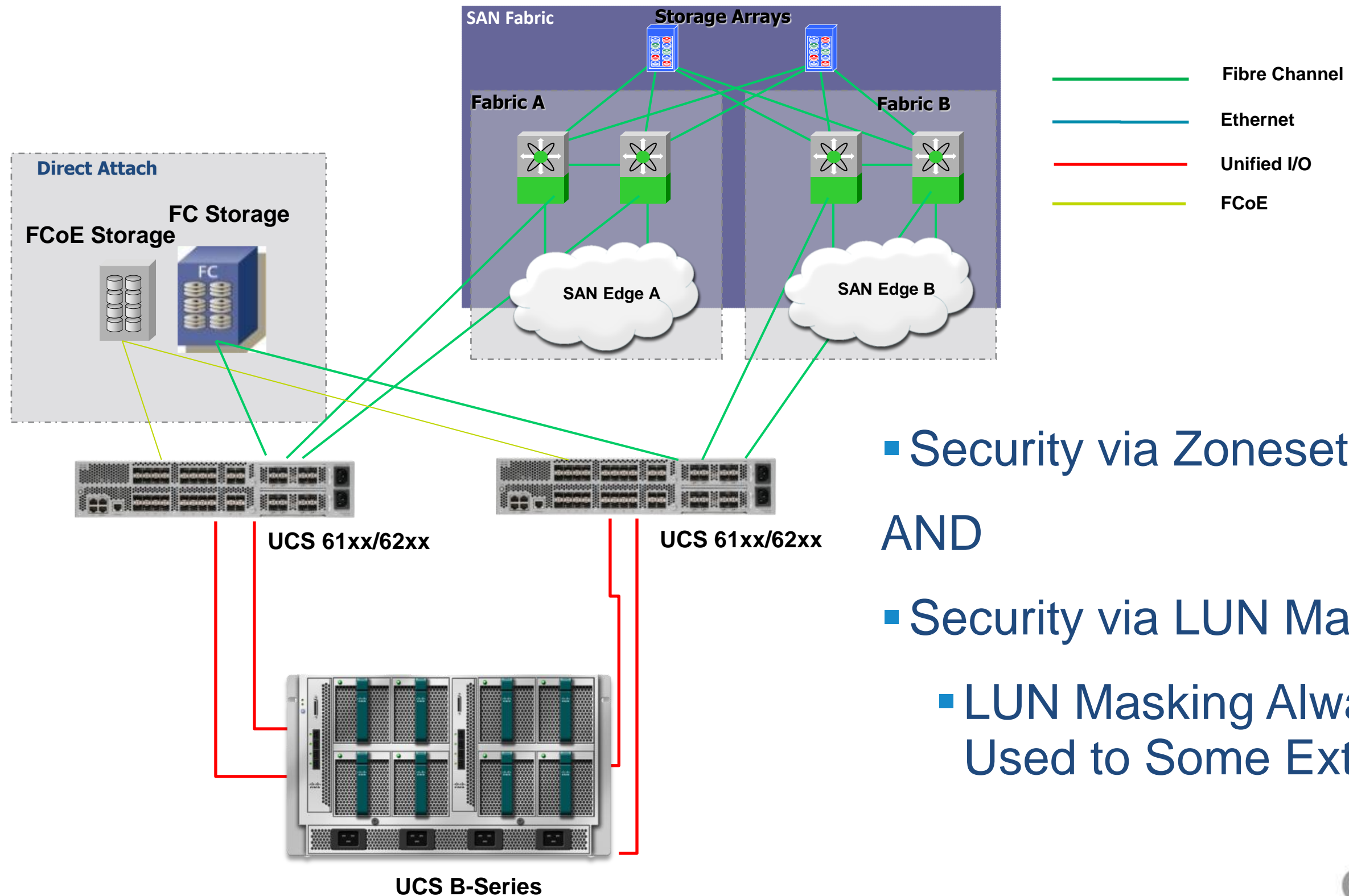
- Since the Ethernet port is configured as trunk, a native VLAN must be configured on that port
- The FCoE VLAN ID can not be the same as the native VLAN ID
- User is not required to provide a native VLAN value
  - Default VLAN (4048) is always used as the native VLAN for FCoE storage ports unless changed

The screenshot displays the Cisco Unified Computing System Manager interface for a device named FIELD-TME-DELMAR. The left sidebar shows a navigation tree with 'SAN' selected, and 'Storage Cloud' highlighted. The main panel shows the configuration for 'SAN Storage Manager'. In the 'Properties' section, the 'FCoE Native VLAN' is configured with a 'VLAN ID' of 4048. Red arrows highlight the 'SAN' menu item and the 'FCoE Native VLAN' configuration field.

# FCoE Port Must Be Assigned to a VSAN

The screenshot displays the Cisco Unified Computing System Manager interface for a system named FIELD-TME-DELMAR. The left-hand navigation pane shows a tree structure: Equipment > Fabric Interconnects > Fabric Interconnect A (primary) > Fixed Module > Ethernet Ports > Port 18. The main content area shows the configuration for Port 18. A red box highlights the 'VSAN' dropdown menu, which is set to 'Fabric dual/vsan FC\_Test (500)'. A red arrow points from this dropdown menu back to the 'Port 18' entry in the navigation pane. Other visible details include the port's ID (18), Slot ID (1), MAC address (00:05:73:CB:2E:B9), Mode (Trunk), Port Type (Physical), and Role (Fcoe Storage). The transceiver is identified as a 10 Gbase SR (SPP5101SR-C1) from CISCO-EXCELIGHT.

# Hybrid Topology with Direct-Attach and SAN

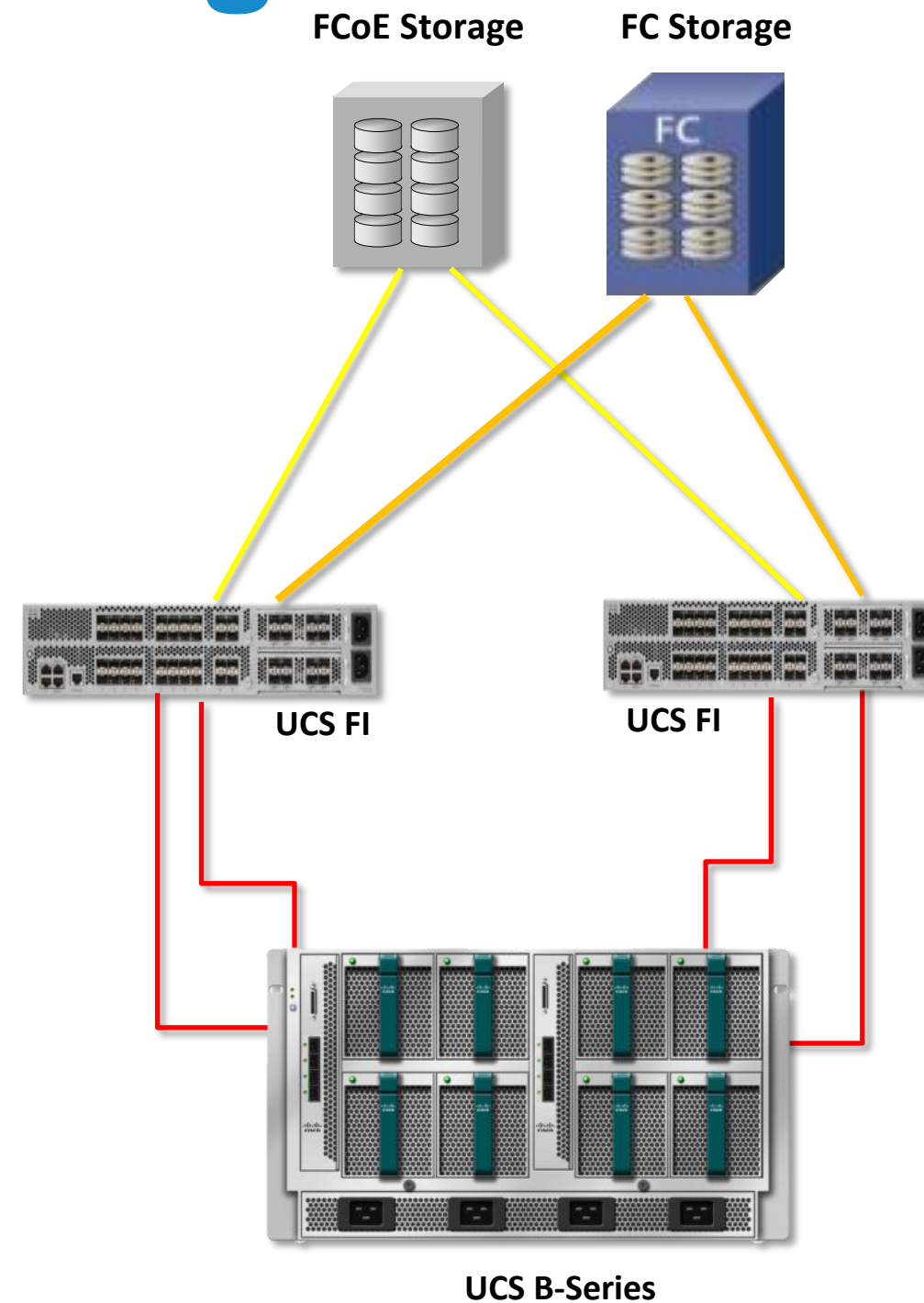


- Security via Zoneset Merge
- AND
- Security via LUN Masking
  - LUN Masking Always Used to Some Extent

# FC/FCoE Local Zoning

New In 2.1 !!!

- Direct connect FC/FCoE storage to FI with no upstream SAN switch
- FI's in FC Switch Mode
- Implicit zone creation
  - No need to create zones manually
  - Single-Initiator-Single-Target Zones and
  - Single-Initiator-Multiple-Target Zones





# Key Considerations of FC/FCoE Direct Connect

New In 2.1 !!!

- As of April 2011 Default Zoning **Not** Supported
  - Default Zoning Explicitly set to **DENY** in 2.1.1a
  - Default Zoning GUI/CLI Controls Removed
  - Do **Not** Upgrade to 2.1.1a if Default Zoning is being Used
- Local Zoning **OR** Upstream Zoning
  - Parallel Local and Upstream Zoning Currently **NOT** Supported
  - Upstream Zoning Provided by MDS/N5k
  - Migrating from Upstream to Local Zoning
    - CLI Commands to Remove Residual Upstream Zoning
- Supported FC/FCoE Direct Connect Arrays
  - Check Note 5 on HCL for Updated List

# FC/FCoE Local Zoning

New In 2.1 !!!

- Storage Connection Policy
  - Container for FC/FCoE Target Endpoint
  - Specifies Single Initiator/Single Target or Single Initiator/Multiple Targets
- vHBA Initiator Group
  - The “Zone” – Associates the vHBA Initiator to the Storage Connection Policy
- Data and Boot LUNs
  - Data Zones Created in the **ZONES** Section of Service Profile
  - Boot Zones Auto Created in the **BOOT ORDER** section of Service Profile
  - If Boot Zones Created in ZONES Section, **Duplicate** Zones Created
- Local Zones Existence
  - Local Zones **Exist** When Service Profile Associated to a Server
  - Local Zones **Removed** When Server Profile Disassociated from Server
- Target to Target Zoning – Currently **not** Supported

# FC/FCoE Zoning Provisioning Workflow

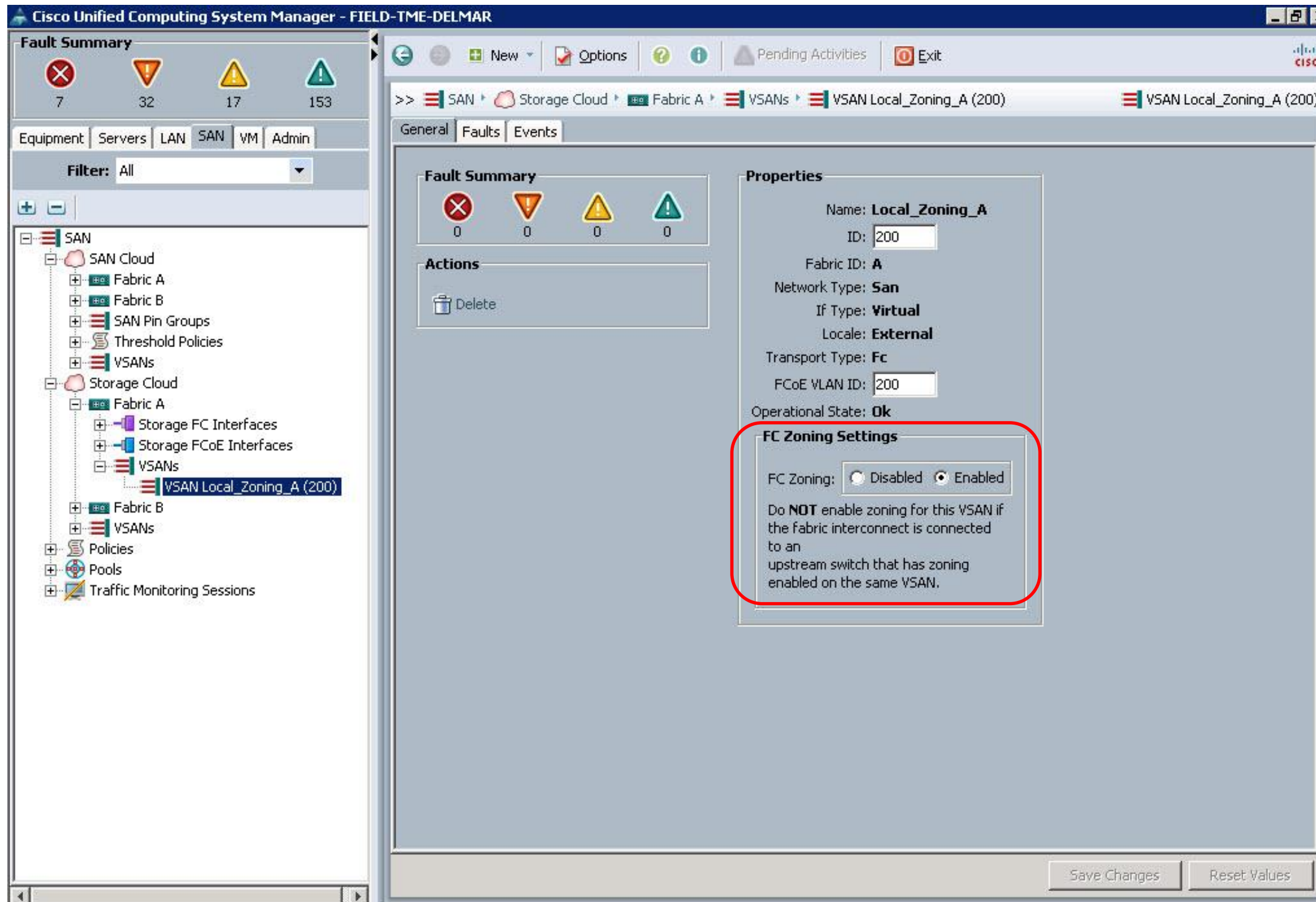
New In 2.1 !!!

1. Connect storage array to UCS Fabric Interconnect (FC or FCoE)
2. Create VSAN – Enable or Disable FC zoning for the VSAN
3. Create Service Profile
4. In the vHBA configuration, set the VSAN
5. FC Zoning configuration:
  1. **Specify Storage Policy**
    - Specify Target ports (one WWN to type for each port)
  2. **Create Storage Group, which contains the vHBAs that need to be zoned**
    - Specify SIST or SIMT – SIST is selected by default
6. The same Storage Policy can be reused across multiple service profiles
7. Associate the service profile
8. That's it! Zoning will be configured automatically
9. Each vHBA will be zoned against the storage ports specified in the Storage Policy
10. Actual zone configuration is displayed in the GUI/CLI

Can be specified in a vHBA template  
AND  
Service Profile Template

# FC/FCoE Zoning GUIs – Enable VSAN Zoning

New In 2.1 !!!



# FC/FCoE Zoning GUIs – Zoning Tab

New In 2.1 !!!

Create Service Profile (expert)

## Unified Computing System Manager

Create Service Profile (expert)

- ✓ Identify Service Profile
- ✓ Networking
- ✓ Storage
- ✓ Zoning**
- vNIC/vHBA Placement
- Server Boot Order
- Maintenance Policy
- Server Assignment
- Operational Policies

### Zoning

Specify zoning information

Zoning configuration involves the following **steps**:

- Select** vHBA Initiator(s) (vHBAs are created on storage page)
- Select** vHBA Initiator Group(s)
- Add** selected Initiator(s) to selected Initiator Group(s)

Name
fc0
fc1

>> Add To >>

Name	Storage Connection Policy Name
------	--------------------------------

Delete Add Modify

< Prev Next > Finish Cancel

# FC/FCoE Zoning GUIs – vHBA Initiator Group

New In 2.1 !!!

**Create vHBA Initiator Group**

Name:

Description:

Storage Connection Policy:  + Create Storage Connection Policy

**Specific Storage Connection Policy**

Specific storage connection policy **defined locally** is assigned to vHBA initiator group.

**Properties**

Description:

Zoning Type:  None  Single Initiator Single Target  Single Initiator Multiple Targets

**FC Target Endpoints**

Filter Export Print

WWPN	Path	VSAN	
			<span>+ Add</span>

OK Cancel

**Create FC Target Endpoint**

WWPN:

Description:

Path:  A  B

Select VSAN:  + Create VSAN

OK Cancel

# FC/FCoE Zoning GUIs – vHBA Initiator Group

New In 2.1 !!!

**Create vHBA Initiator Group**

**vHBA Initiator Group**

Name:

Description:

Storage Connection Policy:  [+ Create Storage Connection Policy](#)

**Specific Storage Connection Policy**

Specific storage connection policy **defined locally** is assigned to vHBA initiator group.

**Properties**

Description:

Zoning Type:  None  Single Initiator Single Target  Single Initiator Multiple Targets

**FC Target Endpoints**

Filter Export Print

WWPN	Path	VSAN
50:06:01:6A:47:24:30...	A	Local_Zoning_A
50:06:01:62:47:24:30...	A	Local_Zoning_A

OK Cancel

# FC/FCoE Zoning GUIs – vHBA Initiator Group

New In 2.1 !!!

The screenshot shows the 'Create Service Profile (expert)' wizard in the Unified Computing System Manager. The 'Zoning' step is active, with a progress bar on the left showing steps 1 through 9. The 'Zoning' section is titled 'Specify zoning information' and includes instructions: 'Zoning configuration involves the following steps: 1. Select vHBA Initiator(s) (vHBAs are created on storage page) 2. Select vHBA Initiator Group(s) 3. Add selected Initiator(s) to selected Initiator Group(s)'. Two selection windows are present: 'Select vHBA Initiators' with 'fc0' selected, and 'Select vHBA Initiator Groups' with 'Local\_Zone\_A' selected. A '>> Add To >>' button is highlighted between them. At the bottom, there are navigation buttons: '< Prev', 'Next >', 'Finish', and 'Cancel'.



# FC/FCoE Zoning GUIs – Zoning Complete

New In 2.1 !!!

**Create Service Profile (expert)**

## Unified Computing System Manager

Create Service Profile (expert)

- ✓ Identify Service Profile
- ✓ Networking
- ✓ Storage
- ✓ **Zoning**
- ☐ vNIC/vHBA Placement
- ☐ Server Boot Order
- ☐ Maintenance Policy
- ☐ Server Assignment
- ☐ Operational Policies

### Zoning

Specify zoning information

Zoning configuration involves the following **steps**:

- Select** vHBA Initiator(s) (vHBAs are created on storage page)
- Select** vHBA Initiator Group(s)
- Add** selected Initiator(s) to selected Initiator Group(s)

#### Select vHBA Initiators

Name
fc0
fc1

>> Add To >>

#### Select vHBA Initiator Groups

Name	Storage Connection Policy Name
Local_Zone_B	
Storage Initiator fc1	
Local_Zone_A	
Storage Initiator fc0	

Delete Add Modify

< Prev Next > Finish Cancel

# FC/FCoE Zoning GUIs – FC Zones Tab

New In 2.1 !!!

The screenshot displays the Cisco Unified Computing System Manager interface. On the left, a navigation tree shows the hierarchy: Servers > Service Profiles > root > Local\_Zoning. The main window shows the 'FC Zones' tab selected, with a table of configurations. The table has columns for Name, Initiator WWPN, Target WWPN, and Initiator Name. The data rows show various local zoning configurations for different servers, such as 'ucs\_FIELD-TME-DELMAR\_A\_1\_Local\_Zoning\_fc0'.

Name	Initiator WWPN	Target WWPN	Initiator Name	...	...	...	...	...	...
ucs_FIELD-TME-DELMAR_A_1_Local_Zoning_fc0	20:CA:00:25:B5:00:00:1B		fc0	A...A...A	200	1			
FC Target 50:06:01:62:47:24:30:EC		50:06:01:62:47:24:30:EC							
ucs_FIELD-TME-DELMAR_A_2_Local_Zoning_fc0	20:CA:00:25:B5:00:00:1B		fc0	A...A...A	200	2			
FC Target 50:06:01:6A:47:24:30:EC		50:06:01:6A:47:24:30:EC							
ucs_FIELD-TME-DELMAR_A_3_Local_Zoning_fc0	20:CA:00:25:B5:00:00:1B		fc0	A...A...A	200	3			
FC Target 50:06:01:6A:47:24:30:EC		50:06:01:6A:47:24:30:EC							
ucs_FIELD-TME-DELMAR_A_4_Local_Zoning_fc0	20:CA:00:25:B5:00:00:1B		fc0	A...A...A	200	4			
FC Target 50:06:01:62:47:24:30:EC		50:06:01:62:47:24:30:EC							
ucs_FIELD-TME-DELMAR_B_1_Local_Zoning_fc1	20:CA:00:25:B5:00:00:0B		fc1	A...A...B	201	1			
FC Target 50:06:01:63:47:24:30:EC		50:06:01:63:47:24:30:EC							
ucs_FIELD-TME-DELMAR_B_2_Local_Zoning_fc1	20:CA:00:25:B5:00:00:0B		fc1	A...A...B	201	2			
FC Target 50:06:01:6B:47:24:30:EC		50:06:01:6B:47:24:30:EC							
ucs_FIELD-TME-DELMAR_B_3_Local_Zoning_fc1	20:CA:00:25:B5:00:00:0B		fc1	A...A...B	201	3			
FC Target 50:06:01:63:47:24:30:EC		50:06:01:63:47:24:30:EC							
ucs_FIELD-TME-DELMAR_B_4_Local_Zoning_fc1	20:CA:00:25:B5:00:00:0B		fc1	A...A...B	201	4			
FC Target 50:06:01:6B:47:24:30:EC		50:06:01:6B:47:24:30:EC							



# IP-based Storage

*Appliance Ports and iSCSI*



# UCS Manager Appliance Ports

## What is an Ethernet Appliance

A specialized device for use on a Ethernet network, for example Network Attached Storage , iSCSI, security appliances, Nexus 1010...

## What qualifies to be an appliance

An Appliance is a specialized external host, does not run STP (See Note 12 in HCL for supported Storage Arrays)

## Purpose of Appliance Port

Connect Ethernet appliances only

The screenshot displays the Cisco Unified Computing System Manager (UCS Manager) interface for the system 'FIELD-TME-DELMAR'. The 'LAN' tab is selected, and the 'Appliance Links' sub-tab is active. The left-hand navigation pane shows a tree structure under 'LAN' with 'Appliances' highlighted. A red circle highlights the 'Appliances' folder and its sub-items: 'Fabric A' (containing 'Interfaces' with 'Appliance Interface 1/18' and 'Appliance Interface 2/3', and 'Port Channels'), and 'Fabric B' (containing 'Interfaces' with 'Appliance Interface 1/18' and 'Appliance Interface 2/3', and 'Port Channels'). The right-hand pane shows a table of 'Appliance Interfaces' with columns for Name, Fabric ID, Administrative State, and Overall Status. The table lists four interfaces, all with 'Enabled' administrative state and 'Up' overall status.

Name	Fabric ID	Administrative State	Overall Status
Appliance Interface 1/18	A	Enabled	Up
Appliance Interface 2/3	A	Enabled	Up
Appliance Interface 1/18	B	Enabled	Up
Appliance Interface 2/3	B	Enabled	Up



Do Not to use this port type for switch connectivity to avoid traffic loops

# Appliance Ports How to Configure

The screenshot displays the Cisco Unified Computing System Manager interface. The left-hand navigation pane shows a tree structure under 'Equipment' with 'Fabric Interconnect A (primary)' expanded to 'Expansion Module 2' and 'Ethernet Ports'. 'Port 3' is selected and highlighted with a red box. A red arrow points from this box to the 'Reconfigure' button in the 'Actions' section of the main pane. A context menu is open over the 'Reconfigure' button, with 'Configure as Appliance Port' selected and highlighted with a red box. The main pane also shows a 'Fault Summary' (0 errors, 0 warnings, 0 alerts, 0 info) and a 'Physical Display' of the port's status (Admin Down).

# Appliance Port Exposed Settings

- QoS per port settings, normal UCS QoS constructs
- Manual (static) pinning using pin groups for border port selection
- Select which VLANs can traverse this port
- Optionally specify the destination MAC address of the filer . Some Filers do not broadcast their MAC address

The screenshot shows the 'Configure as Appliance Port' configuration window. It includes the following sections and callouts:

- QoS Settings:** A callout box points to the 'Priority' dropdown menu, which is set to 'Best Effort'. Other QoS settings include 'Pin Group' (set to '<not set>'), 'Network Control Policy' (set to 'default'), 'Flow Control Policy' (set to 'default'), and 'Admin Speed(gbps)' (radio buttons for '1 Gbps' and '10 Gbps', with '10 Gbps' selected). There are also three '+ Create' buttons for 'LAN Pin Group', 'Network Control Policy', and 'Flow Control Policy'.
- VLAN Trunking:** A callout box points to the 'Port Mode' section, where 'Trunk' is selected over 'Access'. Below this is a table of VLANs:

Select	Name	Native VLAN
<input type="checkbox"/>	default	<input type="radio"/>
<input type="checkbox"/>	iSCSI EMC	<input type="radio"/>
<input type="checkbox"/>	iSCSI Netapp	<input type="radio"/>

Below the table is a '+ Create VLAN' button. At the bottom of the window, there is an 'Ethernet Target Endpoint' section with a callout box pointing to it. The callout box contains the text: 'Optional - If Not then MAC Learning'. This section includes a 'Name' field and a 'MAC Address' field, both currently empty. 'OK' and 'Cancel' buttons are at the bottom right.

# VLANs and Appliance Ports

- Similar to VSAN concept, there are two scopes
- Traditional, LAN Cloud
- Appliance Cloud with scope restricted to appliance ports and associated VLANs
- Use the same VLAN ID in both scopes

The screenshot displays the Cisco Unified Computing System Manager interface. At the top, a 'Fault Summary' bar shows 6 critical faults (red X), 39 warnings (orange triangle), 17 errors (yellow triangle), and 153 informational messages (green triangle). Below this, navigation tabs for 'Equipment', 'Servers', 'LAN', 'SAN', 'VM', and 'Admin' are visible, with 'LAN' selected. A 'Filter: All' dropdown is present. The main content area shows a tree view under the 'LAN' category. Two red boxes highlight specific sections: the top box, labeled 'LAN Scope', encompasses the 'LAN Cloud' folder and its sub-items: Fabric A, Fabric B, QoS System Class, LAN Pin Groups, Threshold Policies, VLAN Groups, and a 'VLANs' folder containing 'VLAN default (1)', 'VLAN iSCSI\_EMC (204)', 'VLAN iSCSI\_NetApp (205)', and 'VLAN lab-net (147)'. The bottom box, labeled 'Appliance Scope', encompasses the 'Appliances' folder and its sub-items: Fabric A, Fabric B, and a 'VLANs' folder containing 'VLAN default (1)', 'VLAN iSCSI\_EMC (204)', and 'VLAN iSCSI\_Netapp (205)'. Other visible items in the tree include 'Internal LAN', 'Policies', 'Pools', and 'Traffic Monitoring Sessions'.

# Appliance Ports Have Uplink Ports

- Appliance ports like server ports have an uplink or border port assigned either via static or dynamic pinning
- Loss of last uplink port will result in the appliance port being taken down in UCS
  - Same behaviour as current network control policy



# Storage Controller Ethernet Port High Availability

- Both NetApp and EMC have similar technologies for aggregating ports on their controllers and providing failure handling.
- An In-depth comparison of these technologies is beyond the scope of this document
  - Storage Vendor documentation should be consulted for details of their feature set
- It is important to understand the core behaviour of these technologies as they relate to UCS Appliance Ports in failure cases
- For additional information:
  - [http://www.cisco.com/en/US/prod/collateral/ps10265/ps10276/whitepaper\\_c11-702584.html](http://www.cisco.com/en/US/prod/collateral/ps10265/ps10276/whitepaper_c11-702584.html)

# Storage Vendor Ethernet Port Aggregation and Failover Terminology

- EMC
  - Fail Safe Network (FSN), layered availability of interfaces
    - UCS needs active/passive
  - Member links can be individual links or consist of port channels
  - Etherchannel is Port channel but “ON” only
  - Link Aggregation is LACP based
- NetApp
  - Multi-Level Virtual Interface (VIF) interface groups
    - UCS needs active/passive
  - Member links can be individual links or consist of port channels
  - Multi-mode Static is Port channel but “ON” only
  - Multi-mode dynamic is LACP based.

# iSCSI Boot

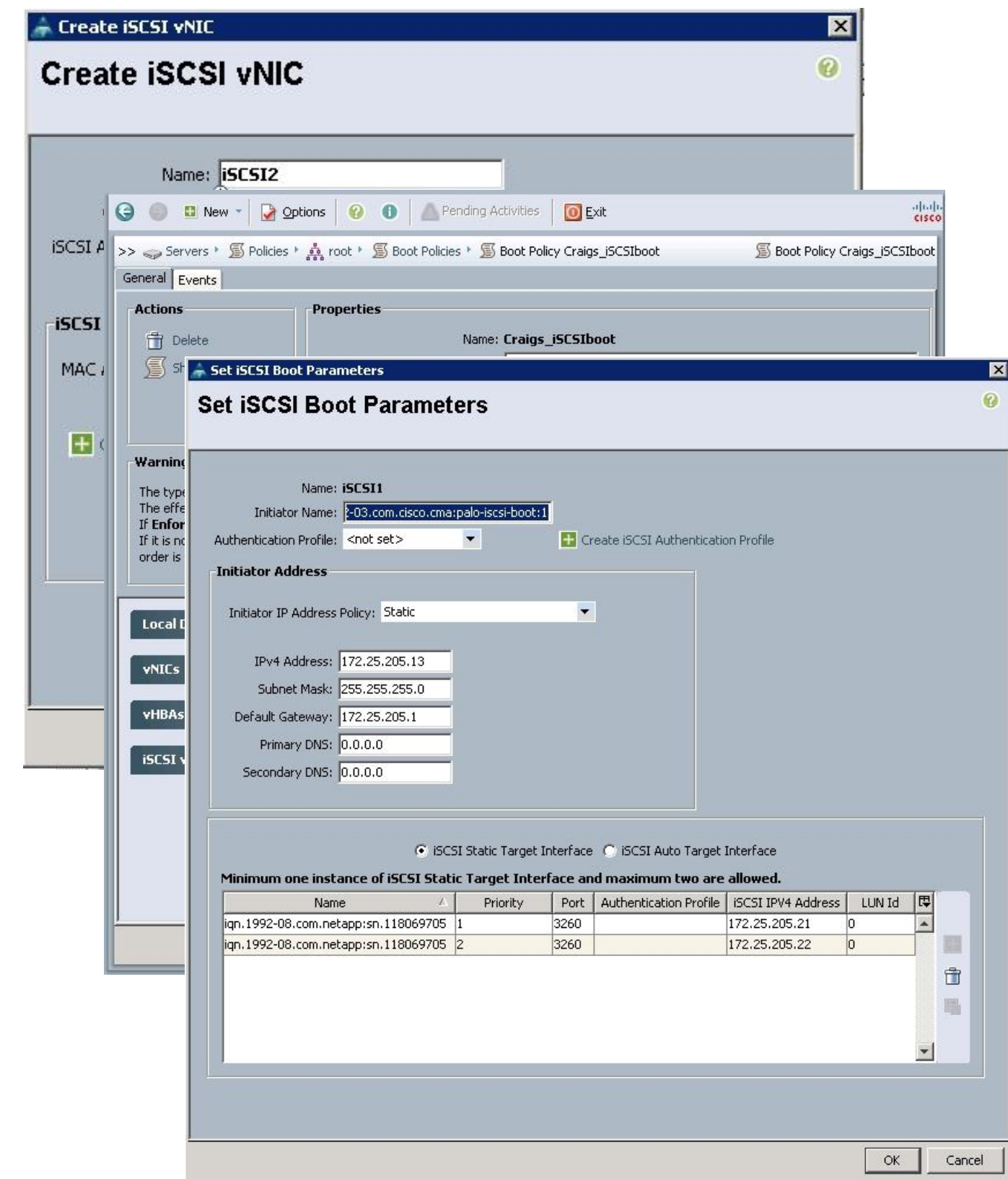
- 1.3: Not supported
- 1.4: Supported via manual configuration of Adapter
  - Broadcom 55771 Mezzanine Card Only
  - Not productised to any extent by UCSM
  - Not stateless, user configures manually, and UCS Manager is totally unaware of changes to mezzanine card configuration.
- 2.0: Fully Supported in UCS Manager
  - Fully productised by UCS Manager boot polices
  - Support for Broadcom and Cisco VIC Family of Cards
  - IQN Pools

# iSCSI Feature Overview

- Primary purpose is to support booting via iSCSI
- iSCSI Hardware Offload is not a requirement to support booting, only supporting iSCSI Boot Firmware Table (iBFT) in the option ROM
- UCS manager represents an iSCSI device in the model and GUI
- Object called an “iSCSI vNIC” is created as a child object to the standard parent vNIC
- Pools (IP/IQN) and Policies to support iSCSI vNIC attributes

# iSCSI Boot Flow

- Create iSCSI vNICs
- Create iSCSI boot policy
- Provide UCSM with iSCSI boot information
  - Target ip, iqn
  - Initiator ip/mask/gw, iqn
- vMedia map the OS and drivers
- **Adapter successfully initializes**
- Install OS and Drivers (if required)



# iSCSI and Appliance Port Redundancy

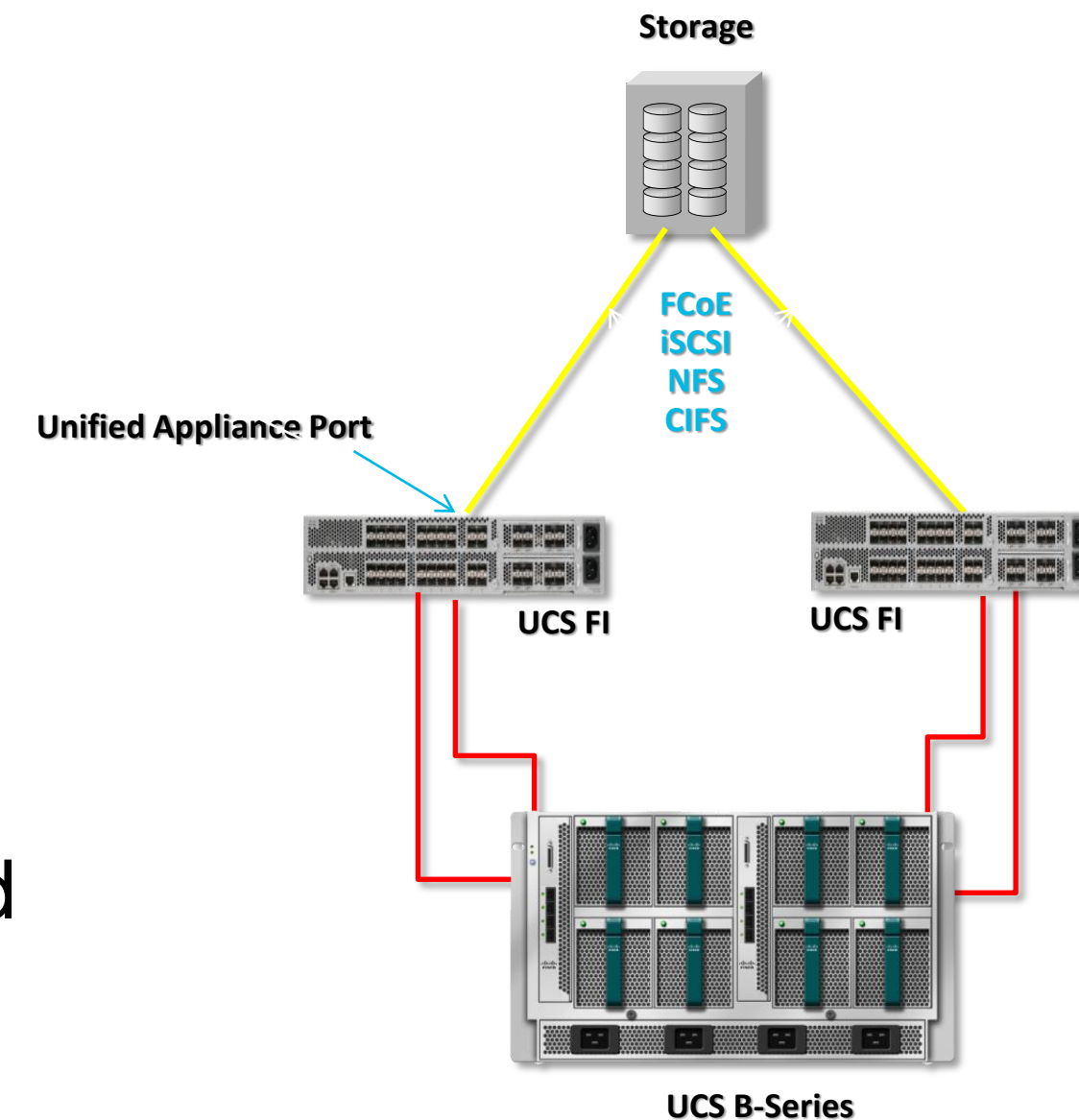
- Host Multi-pathing drivers are used in lieu of link aggregation network technology
- MS does not support using s/w iSCSI and port channels for iSCSI failover
- Best practice is to use MPIO drivers
- Failure semantics look like FC in this regard

# iSCSI Storage Caveats

- iSCSI Boot
  - Default Gateway of 0.0.0.0
  - Symptom: Slow Network Performance
  - Requires Microsoft HotFix 402637
  - <http://support.microsoft.com/kb/2727330>
- Missing iSCSI LUN
  - N5k Northbound **WITHOUT** L3 Daughtercard
  - Set Gateway Address to Storage Target IP
- EUI Formatting Not Supported
- O/S PCIe Device Instantiation
  - Cisco VIC – No – iSCSI Software Implementation
  - Broadcom – Yes (Available on B-M2 and Below) – iSCSI Offload Implementation
- C-Series iSCSI – UCSM Integrated Similar to B-Series, Standalone See HCL

# Unified Appliance Support

- File and block data over a single port/cable
  - FCoE, iSCSI, NFS, CIFS
- Port and cable consolidation
- New port type: Unified Appliance Port
  - Appliance port of today + FCoE
- Initial support for NetApp storage and their Unified Target Adapter





# Unified Storage Ports How to Configure

The screenshot displays the Cisco Unified Computing System Manager interface. On the left, a tree view shows the hierarchy: Equipment > Fabric Interconnects > Fabric Interconnect A (primary) > Expansion Module 2 > Ethernet Ports > Port 3. The 'Equipment' tab is selected in the top navigation bar. A red box highlights 'Equipment' in the top bar and 'Port 3' in the tree view. A red arrow points from 'Port 3' to the 'Reconfigure' action in the 'Actions' panel. The 'Reconfigure' action is also highlighted with a red box. A context menu is open over 'Reconfigure', with 'Configure as FCoE Storage Port' highlighted in a red box. The main panel shows the configuration for 'Port 3', including a 'Fault Summary' (0 errors), 'Physical Display' (Up), 'Status' (Overall Status: Up, Admin State: Enabled), and 'Properties' (ID: 3, Slot ID: 2, Mode: Trunk, Port Type: Physical, Role: Appliance Storage). The 'Role: Appliance Storage' is highlighted with a red box. The 'Transceiver' section shows details for a SFP: SFPbase SR, 5100SR-C1, CO-SUMITOMO, 134901CF.

# Unified Storage Ports How to Configure

The screenshot displays the Cisco Unified Computing System Manager interface. On the left, a navigation tree shows the hierarchy: Equipment > Fabric Interconnects > Fabric Interconnect A (primary) > Expansion Module 2 > Ethernet Ports > Port 3. The 'Equipment' tab is highlighted in red. The main pane shows the configuration for Port 3. The 'Properties' section includes: ID: 3, Slot ID: 2, User Label, MAC: 00:05:73:B8:FA:12, Mode: Trunk, Port Type: Physical, and Role: Unified Storage (highlighted in red). The 'Transceiver' section shows: Type: 10 Gbase SR, Model: SPP51005R-C1, Vendor: CISCO-SUMITOMO, and Serial: SPC134901CF. The 'Fault Summary' shows 0 critical, 1 warning, 0 major, and 0 minor faults. The 'Status' is Up. The 'Actions' list includes Enable Port, Disable Port, Reconfigure, Unconfigure, Show Interface, and Configure VLAN.

# Storage Acceleration

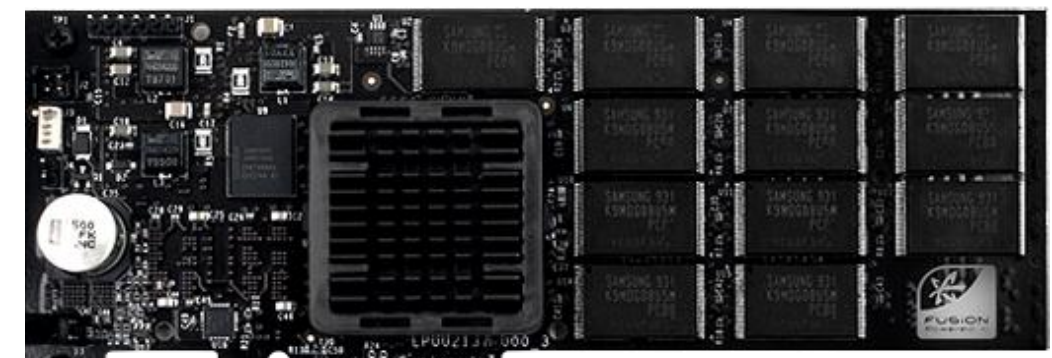
*PCIe Flash Storage and EMC VFCache*



# PCIe Flash Storage

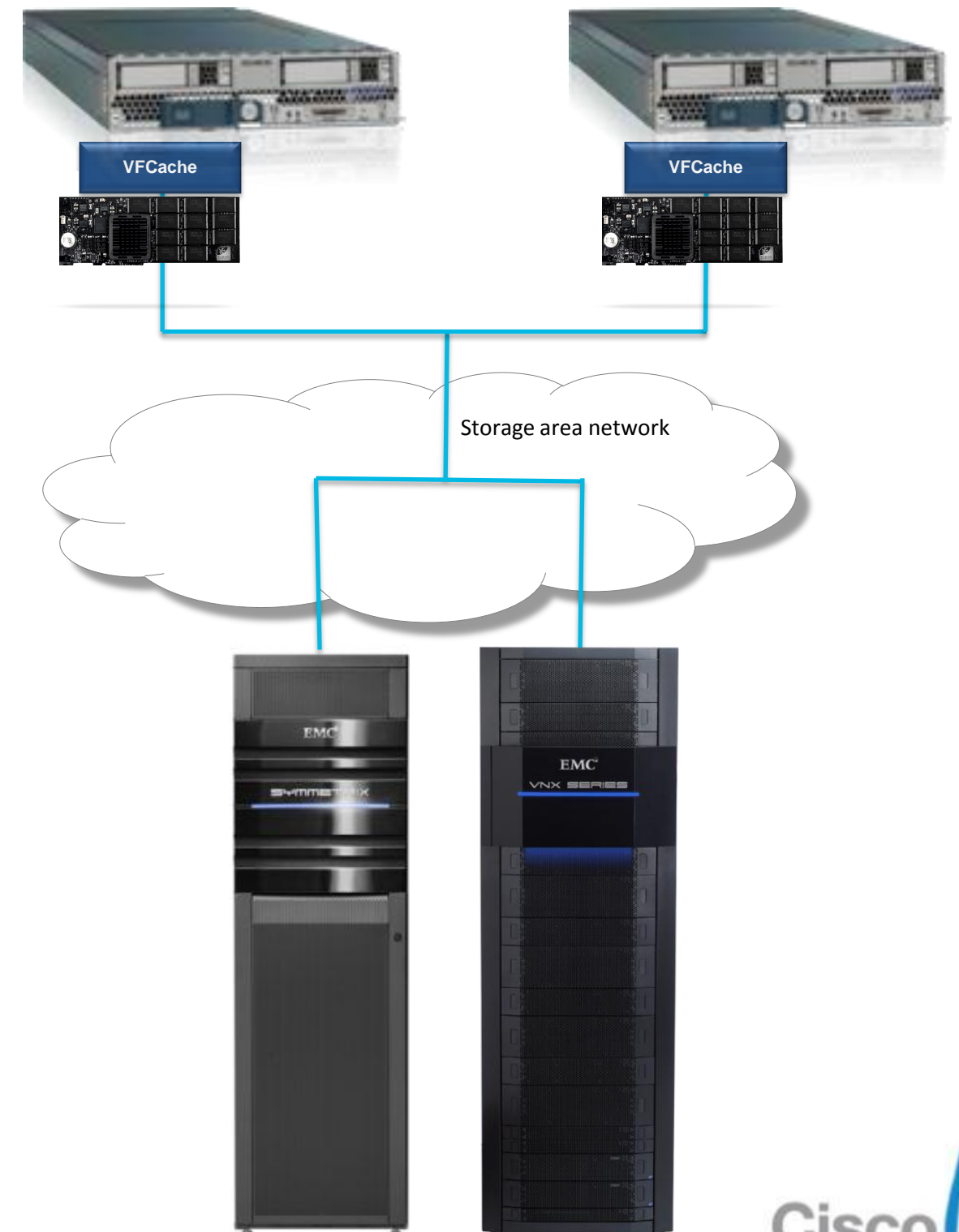
- Rack servers:
  - Joint testing and qualification with Fusion-IO
  - PCIe cards and support for cards available directly from Fusion-IO
- Blade servers
  - Fusion-IO and LSI to build PCIe flash mezzanine cards
  - For Romley-based servers
  - Will be in the standard mezzanine slot
  - mLOM slot provides standard I/O
  - Initial support for discovery and inventory
- Array Based Flash Solutions
  - EMC VFCache Available Now
  - Other Vendor Solutions Planned

New In 2.1 !!!



# EMC VFCache

- Rack servers
  - EMC eLab certifying end-to-end VFCache offering with UCS rack servers
  - PCIe flash cards and support for cards available from EMC
- Blade Servers
  - VFCache compatible LSI mezzanine cards
  - For Romley-based servers only
  - Will be in the standard mezzanine slot
  - mLOM slot provides standard I/O



New In 2.1 !!!

# Monitoring, Troubleshooting and Advanced CLI



# Monitoring the Storage Path - GUI

- GUI – VIF Paths Tab
  - vHBA to IOM to FI to Uplink
- GUI – Statistics Tab
  - vHBA
  - IO Module Backplane Port
  - Fabric Interconnect Server Port
  - Fabric Interconnect Uplink Port

# Monitoring the Storage Path – GUI

## VIF Screen – With Gen2 VIC to FI Port Channels (220x)

The screenshot shows the Cisco Unified Computing System Manager GUI. The left pane displays a tree view of the system configuration, including servers, service profiles, and FC-Stats. The right pane shows the VIF Paths screen for the Service Profile FC-Stats. The table below is a representation of the data shown in the screenshot.

Name	Adapter Port	FEX Host Port	FEX Network Port	FI Server Port	vNIC	FI Uplink	Link State
Path A/1	0/PC-1318	left/PC-1028	left/1028	A/0/1028			
Virtual Circuit 14091						unpinned	Up
Virtual Circuit 5897					eth0	A/1/16	Up
Virtual Circuit 5899					fc0	A/PC- 11	Up
Path B/1	0/PC-1319	right/PC-1156	right/1156	B/0/1156			
Virtual Circuit 14092						unpinned	Up
Virtual Circuit 5898					eth1	B/1/14	Up
Virtual Circuit 5900					fc1	B/PC- 12	Up

**Adapter Port:** Statistics Under Service Profile vHBA

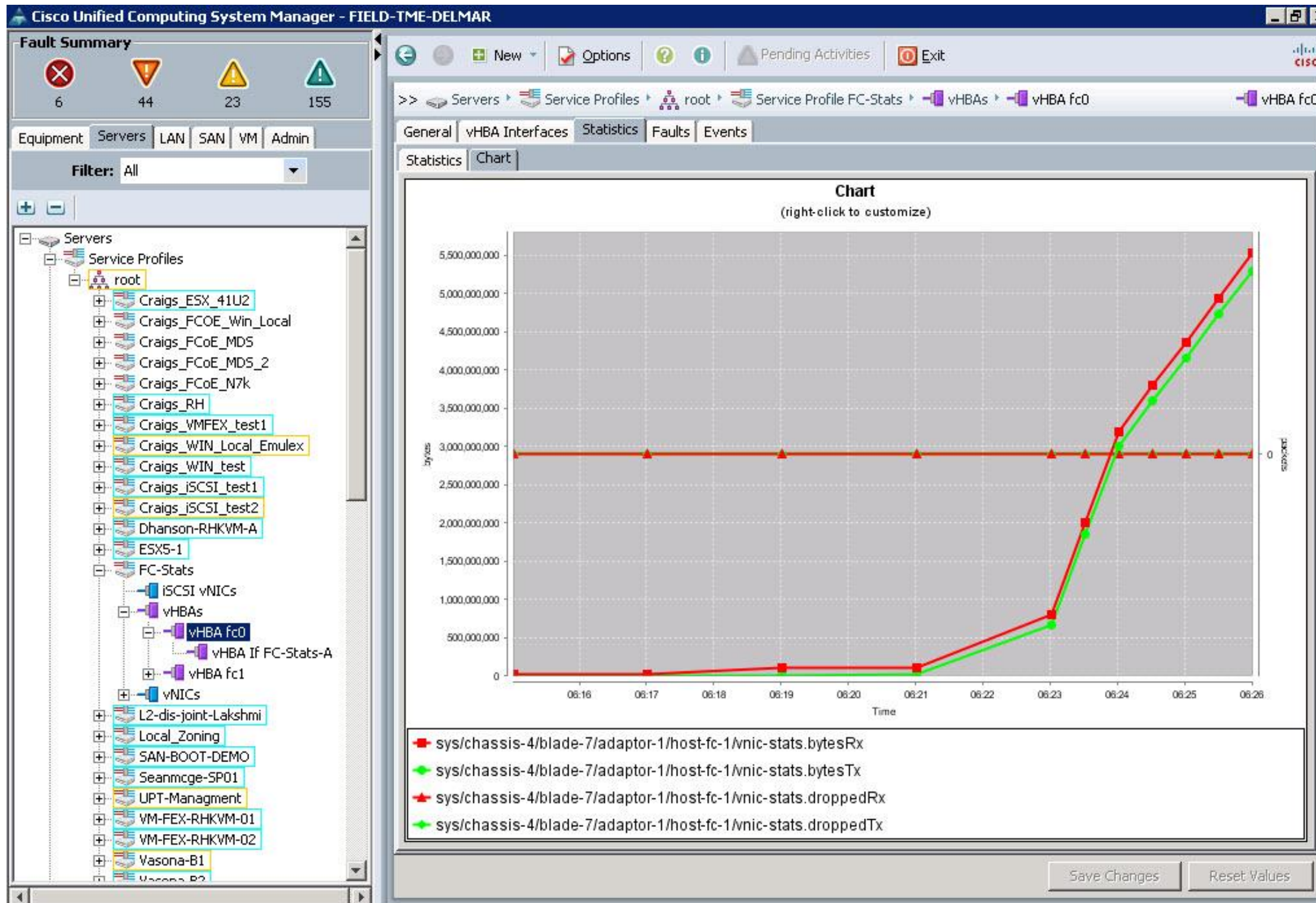
**Fex/Network/FI Server Port:** Find Port Channel in Equipment/IOM/Fabric Ports/, Click on one of the Ports and follow to Peer which is the Fabric Interconnect Server Port – View Statistics

**FI Uplink Port:** Find Port Channel in SAN\SAN Cloud\Fabric A or B\FC Port Channels – View Statistics



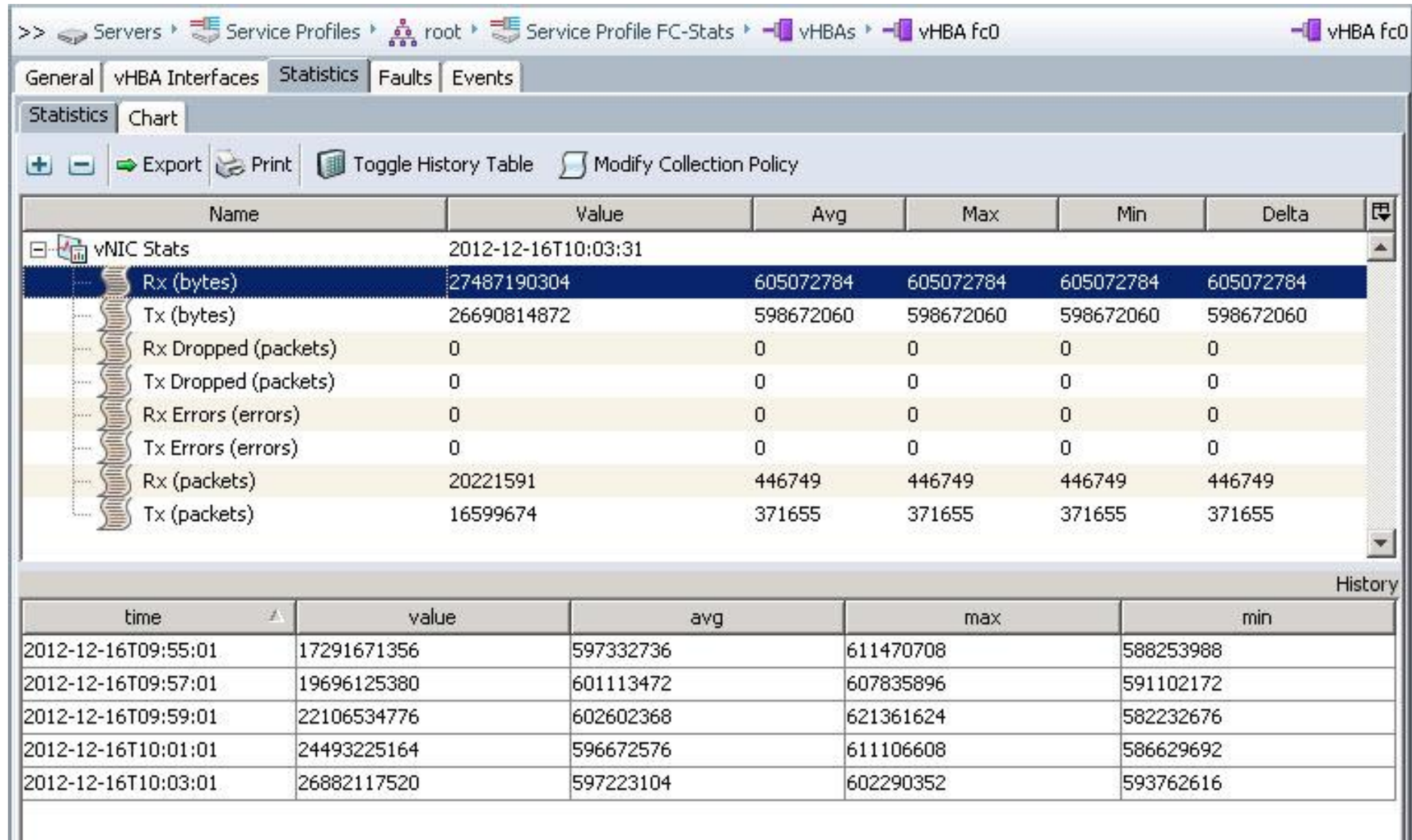
# Monitoring the Storage Path – GUI

## vHBA Statistics - Chart



# Monitoring the Storage Path – GUI

## vHBA Statistics - Chart



# Monitoring the Storage Path - CLI

- CLI
  - **vHBA** - `/org/service-profile/vhba # show stats`
  - **IOM Module “HIF” Port (Backplane Port)**
    - `connect IOM x` (x designates IOM number)
    - For 2104 IOM: `show platform software redwood sts`**
      - `show platform software redwood rmon 0 hifx` (x designates hif number)
    - For 220x IOM: `show platform software woodside sts`**
      - `show platform software woodside rmon 0 hifx` (x designates hif number)
  - **Map “HIF” to “NIF” (Not Possible if IOM to FI Port Channels being Used)**
    - `connect nxos`
    - `show fex x detail` (replace x with fex #)
    - `show interface fex-fabric`

# Monitoring the Storage Path - CLI

- CLI Continued

- **IOM Module “NIF” Port (Fabric Port)**

- Connect IOM x** (x designates IOM number)

- For 2104 IOM: **show platform software redwood rmon 0 nifx** (x designates nif number)

- For 220x IOM: **show platform software woodside rmon 0 nifx** (x designates nif number)

- **Map Backplane Port to FI Server Ports Interface/Port Channel**

- Connect NXOS**

- Find IOM/FI Port Channel associated with FEX Port(s)

- show fex # detail** (replace x with fex #)

- Find interfaces associated with IOM/FI Port Channel and Statistics

- show interface po #** (replace x with po #)

# Monitoring the Storage Path - CLI

- CLI Continued

- Find FI FC PO /Uplinks and Show PO/Uplink Statistics

**connect nxos**

**show npv flogi-table** (match vfc/fcid/wwpn of vHBA to External Interface/po)

**show interface san-port-channel #** (replace # with po #)

**or**

From UCS CLI prompt: **show service-profile circuit name x** (replace x with SP name)

**connect nxos**

**show interface san-port-channel #** (replace # with po # found in show circuit output)



# Monitoring the Storage Path - CLI

For 220x IOM: show platform software woodside rmon 0 hifx (x designates hif number)

```
fex-1# show platform software woodside rmon 0 hif7
```

TX	Current	Diff	RX	Current	Diff
TX_PKT_LT64	0		RX_PKT_LT64	0	0
TX_PKT_64	104		RX_PKT_64	3096	1
TX_PKT_65	7364845	57754	RX_PKT_65	5247791	9878
TX_PKT_128	636480	4836	RX_PKT_128	10830	2
TX_PKT_256	64772	14	RX_PKT_256	6	0
TX_PKT_512	1227470	9810	RX_PKT_512	620983	3855
TX_PKT_1024	612768	4898	RX_PKT_1024	342	2
TX_PKT_1519	331	2	RX_PKT_1519	336	2
TX_PKT_2048	16072524	127650	RX_PKT_2048	16095776	100543
TX_PKT_4096	0	0	RX_PKT_4096	0	0
TX_PKT_8192	0	0	RX_PKT_8192	0	0
TX_PKT_GT9216	0	0	RX_PKT_GT9216	0	0
TX_PKTTOTAL	25979294	204964	RX_PKTTOTAL	21979160	114283
TX_OCTETS	35311474567	280245933	RX_OCTETS	35078289706	216664152
TX_PKTOK	25979294	204964	RX_PKTOK	21979160	114283
TX_UCAST	25815363	204930	RX_UCAST	21965413	114281
TX_MCAST	91440	16	RX_MCAST	13742	2
TX_BCAST	72491	18	RX_BCAST	5	0
TX_VLAN	0	0	RX_VLAN	0	0
TX_PAUSE	0	0	RX_PAUSE	0	0
TX_USER_PAUSE	104	0	RX_USER_PAUSE	0	0
TX_FRM_ERROR	0	0			
			RX_OVERSIZE	0	0
			RX_TOOLONG	0	0
			RX_DISCARD	0	0
			RX_UNDERSIZE	0	0
			RX_FRAGMENT	0	0
			RX_CRC_NOT_STOMPED	0	0
			RX_CRC_STOMPED	0	0
			RX_INRANGEERR	0	0
			RX_JABBER	0	0
TX_OCTETSOK	35311474567	280245933	RX_OCTETSOK	35078289706	216664152

# Monitoring the Storage Path - CLI

From UCS CLI prompt: `show service-profile circuit name x` (replace x with SP name)

```
FIELD-TME-DELMAR-A# show service-profile circuit name FC-Stats
Service Profile: FC-Stats
Server: 4/7
Fabric ID: A
  VIF          vNIC          Link State  Oper State  Prot State  Prot Role  Admin Pin  Oper Pin  Transport
  -----
    14091
    5897 eth0      Up          Active     No Protection  Unprotected  0/0        0/0        Ether
    5899 fc0      Up          Active     No Protection  Unprotected  0/11       0/11       Fc
Fabric ID: B
  VIF          vNIC          Link State  Oper State  Prot State  Prot Role  Admin Pin  Oper Pin  Transport
  -----
    14092
    5898 eth1      Up          Active     No Protection  Unprotected  0/0        1/14       Ether
    5900 fc1      Up          Active     No Protection  Unprotected  0/12       0/12       Fc
```





# UCS Internal FC/FCoE Port Channel Hashing

- IOM to FI / FI to IOM
- 220x IO Modules – Port Channels Enabled
- IOM Inherits Load-Balance Hash from FI
- To Display:

**connect IOM x (x designates IOM number)**

**show platform software fwmctrl nifport**

Scroll down a bit to see the hash parameters:

I2\_da: 1 I2\_sa: 1 I2\_vlan: 0

I3\_da: 1 I3\_sa: 1

I4\_da: 1 I4\_sa: 1

**FCoE I2\_da: 1 I2\_sa: 1 I2\_vlan: 0**

**FCoE I3\_did: 1 I3\_sid: 1 I3\_oxid: 1**

## Transmit (I've left MAC addresses of my system as an example)

**Source** = 00:05:73:b8:fa:1d FCF-MAC of FC NP uplink port

**Destination** = 0e:fc:00:7b:09:0f = fpma (0e:fc:00 = FC-MAP , 7b:09:0f = FC\_ID of VFC of FC NP uplink port)

**Did** = FC\_ID of VFC of FC NP Uplink Port

**Sid** = FC Target FC\_ID

**OX\_ID** = Unique Exchange ID

## Receive (I've left MAC addresses of my system as an example)

**Source** = 0e:fc:00:7b:09:0f = fpma (0e:fc:00 = FC-MAP , 7b:09:0f = FC\_ID of VFC of FC NP uplink port)

**Destination** = 00:05:73:b8:fa:1d = FCF-MAC of FC NP uplink port

**Did** = FC Target FC\_ID

**Sid** = FC\_ID of VFC of FC NP Uplink Port

**OX\_ID** = Unique Exchange ID

# UCS Internal FC/FCoE Port Channel Hashing

```
fex-1# show platform software fwmctrl nifport
NIF PORT info for 0x16000403 (port-channel1028)
=====
Module_num: 0, Device: 0; Dev Port Id 0 sup id 0
If-Index 0x16000403, front_port_id: 0
iNif?: N
Link State: Up
C2N in vntag? No; ctrl_vntag: -2147483648; ctrl_vlan: 0 vntag etype:0x8926
nif_flags: 0x2
nc_id: nc_id 0; nif-nc-man: 0xf; hash-params: 0x1bcdc
Hash Parameters:
  12_da: 1 12_sa: 1 12_vlan: 0
  13_da: 1 13_sa: 1
  14_da: 1 14_sa: 1
  FCoE 12_da: 1 12_sa: 1 12_vlan: 0
  FCoE 13_did: 1 13_sid: 1 13_oxid: 1
```

# FC NPV Mode. Are vHBAs Logging in and Where, Which FC Uplink?

```
ucstestFI-A(nxos)# show npv flogi-table
```

						Which WWPN In Service Profile			Which FC Uplink
SERVER						EXTERNAL			
INTERFACE	VSAN	FCID	PORT NAME		NODE NAME	INTERFACE			
vfc922	80	0x01000e	20:00:00:25:b5:01:00:bf	20:00:00:25:b5:0a:00:8f	fc2/5				
vfc924	80	0x01000f	20:00:00:25:b5:01:00:df	20:00:00:25:b5:0a:00:8f	fc3/5				
vfc946	80	0x01000c	20:00:00:25:b5:01:00:9f	20:00:00:25:b5:0a:00:9f	fc2/5				
vfc948	80	0x01000d	20:00:00:25:b5:01:00:af	20:00:00:25:b5:0a:00:9f	fc3/5				
vfc1018	80	0x010014	20:00:00:25:b5:01:00:1f	20:00:00:25:b5:0a:00:7f	fc2/5				
vfc1020	80	0x010015	20:00:00:25:b5:01:00:3f	20:00:00:25:b5:0a:00:7f	fc3/5				
vfc1030	80	0x010010	20:00:00:25:b5:01:00:be	20:00:00:25:b5:0a:00:4f	fc2/5				



# Useful Troubleshooting CLI in FC Switch Mode

```
SJ2-151-B26-A(nxos)# show flogi database
```

INTERFACE	VSAN	FCID	PORT NAME	NODE NAME
fc2/1	1	0x1601ef	50:06:01:60:3c:e0:66:90	50:06:01:60:bc:e0:66:90
vfc732	1	0x160001	20:00:00:25:b5:00:00:ab	20:00:00:25:b5:00:00:aa
vfc761	1	0x160000	20:00:00:25:b5:92:0a:0f	20:00:00:25:b5:94:00:0f

```
Total number of flogi = 3.
```

```
SJ2-151-B26-A(nxos)# show fcns database
```

```
VSAN 1:
```

FCID	TYPE	PWWN	(VENDOR)	FC4-TYPE:FEATURE
0x160000	N	20:00:00:25:b5:92:0a:0f		scsi-fcp:init
0x160001	N	20:00:00:25:b5:00:00:ab		scsi-fcp:init
0x1601ef	N	50:06:01:60:3c:e0:66:90	(Clariion)	scsi-fcp:both

All devices logged into the 6100

All Devices in Fabric

# Check on Zoneset Merge (Hybrid Topology)

- Checking that the zoning configuration has been merged
- There is no GUI equivalent to `sh zoneset active`. You need to run an NXOS CLI:

```
Panther-A(nxos)# show zoneset active vsan 300
zoneset name fabric-a-panther vsan 300
  zone name ls1-netapp1-4b vsan 300
    pwnn 50:0a:09:83:97:b9:4c:e4
    pwnn 20:01:00:25:b5:71:a0:01

  zone name ls1-netapp2-4b vsan 300
    * fcid 0x170001 [pwnn 50:0a:09:83:87:b9:4c:e4]
    pwnn 20:01:00:25:b5:71:a0:01

  zone name ls2-netapp1-4b vsan 300
    pwnn 50:0a:09:83:97:b9:4c:e4
    * fcid 0x170004 [pwnn 20:01:00:25:b5:71:a0:02]
...

```

# Troubleshooting CLI Zoneset Merge

- How to verify that switches were merged in the same fabric
- Principal vs. Local in domain context

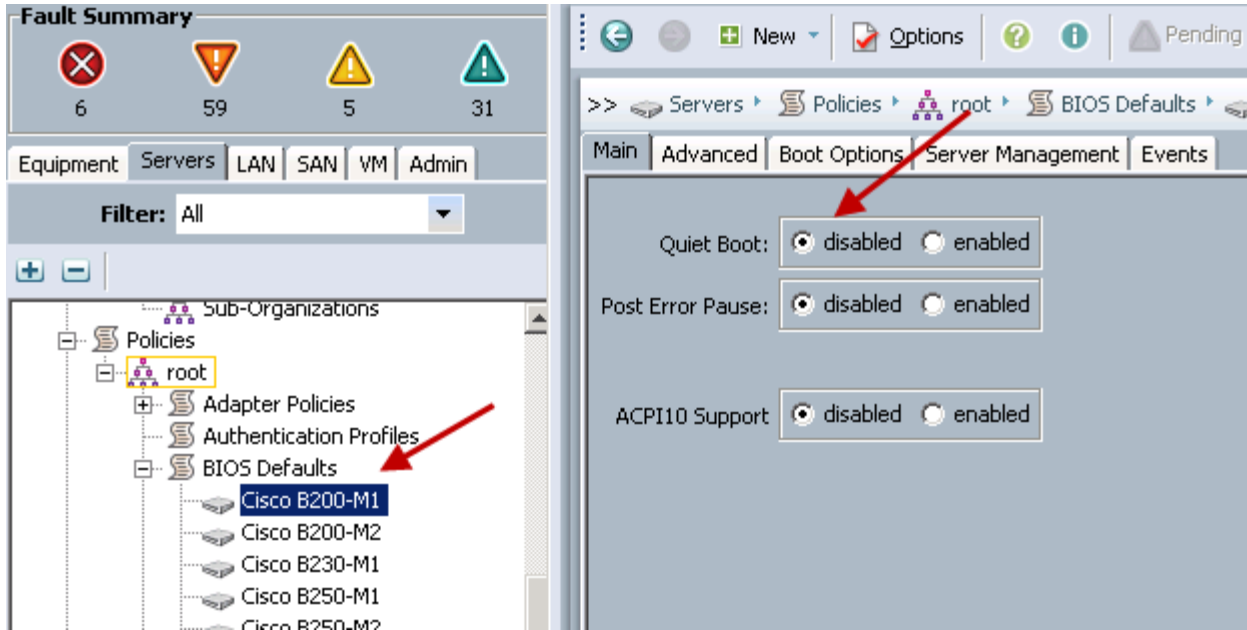
```
Panther-A(nxos)# show fcdomain domain-list vsan 300
```

```
Number of domains: 3
```

Domain ID	WWN	
0x45 (69)	21:2c:00:0d:ec:a3:9c:01	[Principal]
0x17 (23)	21:2c:00:0d:ec:d2:ce:01	[Local]
0x7f (127)	21:2c:00:0d:ec:d0:9c:81	

# iSCSI Boot Troubleshooting – Cisco VIC

- Disable quiet boot for your blade models, This makes troubleshooting much easier



- If your SP and iSCSI config is correct, you will see this during POST

```
Cisco VIC iSCSI, Boot Driver Version 2.0(0.239)
(C) 2010 Cisco Systems, Inc.
0025b530300e iSCSI NETAPP :000
Option ROM installed successfully
```

- Cisco VIC
- Initialisation

```
cae-sj-ca1-A# conn adapter 1/8/1
adapter 1/8/1 # connect
adapter 1/8/1 (top):1# attach-mcp
adapter 1/8/1 (mcp):1# iscsi_get_config
vnic iSCSI Configuration:

-----
vnic_id: 5
  link_state: Up
  Initiator Cfg:
    initiator_state: ISCSI_INITIATOR_READY
    initiator_error_code: ISCSI_BOOT_NIC_NO_ERROR
    vlan: 0
    dhcp status: false
    IQN: eui.87654321abcdabcd
    IP Addr: 172.25.183.142
    Subnet Mask: 255.255.255.0
    Gateway: 172.25.183.1
  Target Cfg:
    Target Idx: 0
    State: ISCSI_TARGET_READY
    Prev State: ISCSI_TARGET_DISABLED
    Target Error: ISCSI_TARGET_NO_ERROR
    IQN:iqn.199208.com.netapp:sn.101202278
    IP Addr: 172.25.183.49
    Port: 3260
    Boot Lun: 0
    Ping Stats: Success (9.698ms)
  Session Info:
    session_id: 0
    host_number: 0
    bus_number: 0
    target_id: 0
```



# FC Boot Troubleshooting – Cisco VIC

## Using LUNLIST to Troubleshoot

Looking Good – Assigned Service Policy  
can see Target LUN on Boot

```
Cisco VIC FC, Boot Driver Version 2.0(1w)
(C) 2010 Cisco Systems, Inc.
  Promise 2602000155350f0e:0001
Option ROM installed successfully
```

```
FIELD-TME# connect adapter 3/1/1
adapter 3/1/1 # connect
adapter 3/1/1 (top):1# attach-fls

adapter 3/1/1 (fls):1# vnic
-----
vnic ecpu type state  lif
-----
7  1  fc  active 4
8  2  fc  active 5

adapter 3/1/1 (fls):2# lunlist 7
vnic : 7 lifid: 4
- FLOGI State : flogi est (fc_id 0x050a02)
- PLOGI Sessions
  - WWNN 26:02:00:01:55:35:0f:0e WWPN 26:02:00:01:55:35:0f:0e
fc_id 0x050500
  - LUN's configured (SCSI Type, Version, Vendor, Serial No.)
    LUN ID : 0x0001000000000000 (0x0, 0x5, Promise ,
49534520000000000000 000043B2D58130F35E1)
  - REPORT LUNs Query Response
    LUN ID : 0x0001000000000000
  - Nameserver Query Response
  - WWPN : 26:02:00:01:55:35:0f:0e
```



# Storage Vendor Support

- Different Levels of Storage Vendor Qualifications
  - Cisco tests the majority of the leading array vendors in a collaborative fashion with their own labs.
  - Self-cert program is in place for remainder of the market.
  - Cross Postings on HCL's – Everyone Except IBM
- UCS 2.1.1 Direct Connect – EMC, HDS, and NetApp for all Topologies (FC, FCoE, NAS)
- iSCSI Boot – EMC, HDS, NetApp, Nimble
- Switch Interoperability – Brocade – Cisco Testing (All)
- **Please** Consult these Resources
  - [http://www.cisco.com/en/US/products/ps10477/prod\\_technical\\_reference\\_list.html](http://www.cisco.com/en/US/products/ps10477/prod_technical_reference_list.html)
  - [http://www.cisco.com/en/US/docs/unified\\_computing/ucs/interoperability/matrix/r\\_hcl\\_B\\_2.11.pdf](http://www.cisco.com/en/US/docs/unified_computing/ucs/interoperability/matrix/r_hcl_B_2.11.pdf)

# Q & A



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