

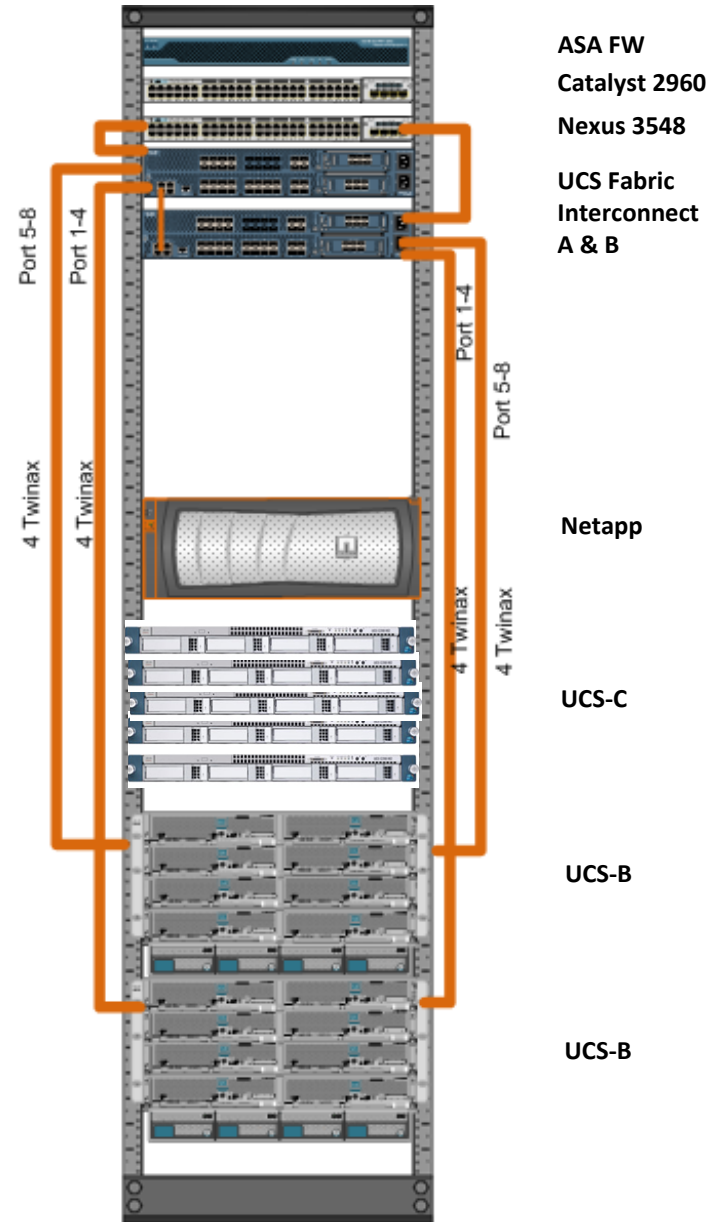
NCSU ExoGENI Rack Networking

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I. Overview

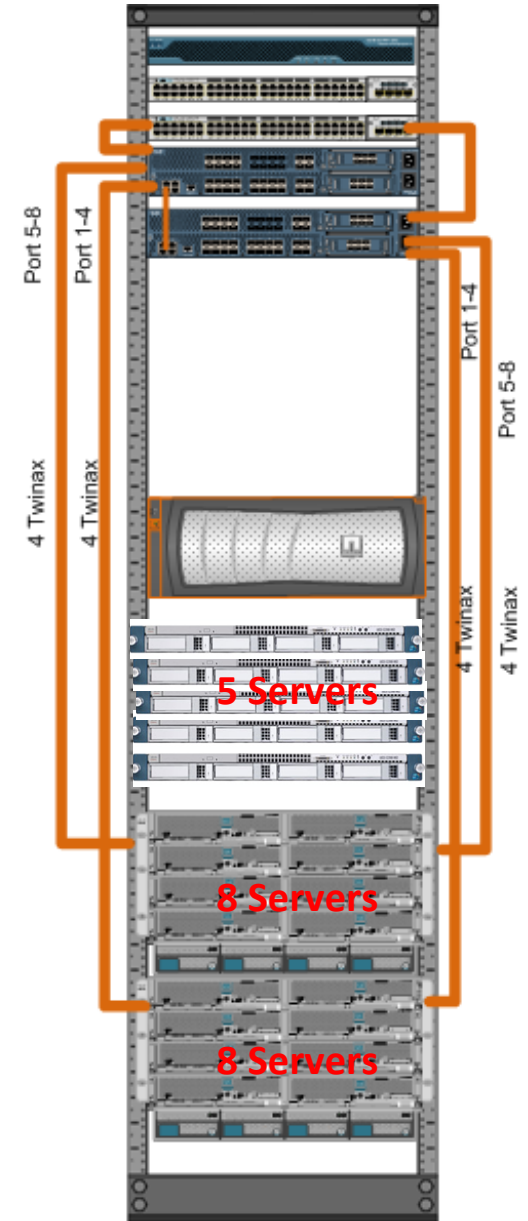
NCSU GENI Rack Overview

- **Compute** – UCS-B and C series servers
- **Network** – Nexus 3548 for data and Catalyst switch for management, ASA FW for IPsec (out-of-band management via RENCI network).
- **Storage** – UCS onboard disks and NetApp FAS 2240 solution
- **Software** – GENI software stack (ORCA) provided by RENCI's ExoGENI project (<http://www.exogeni.net>)



NCSU Computes

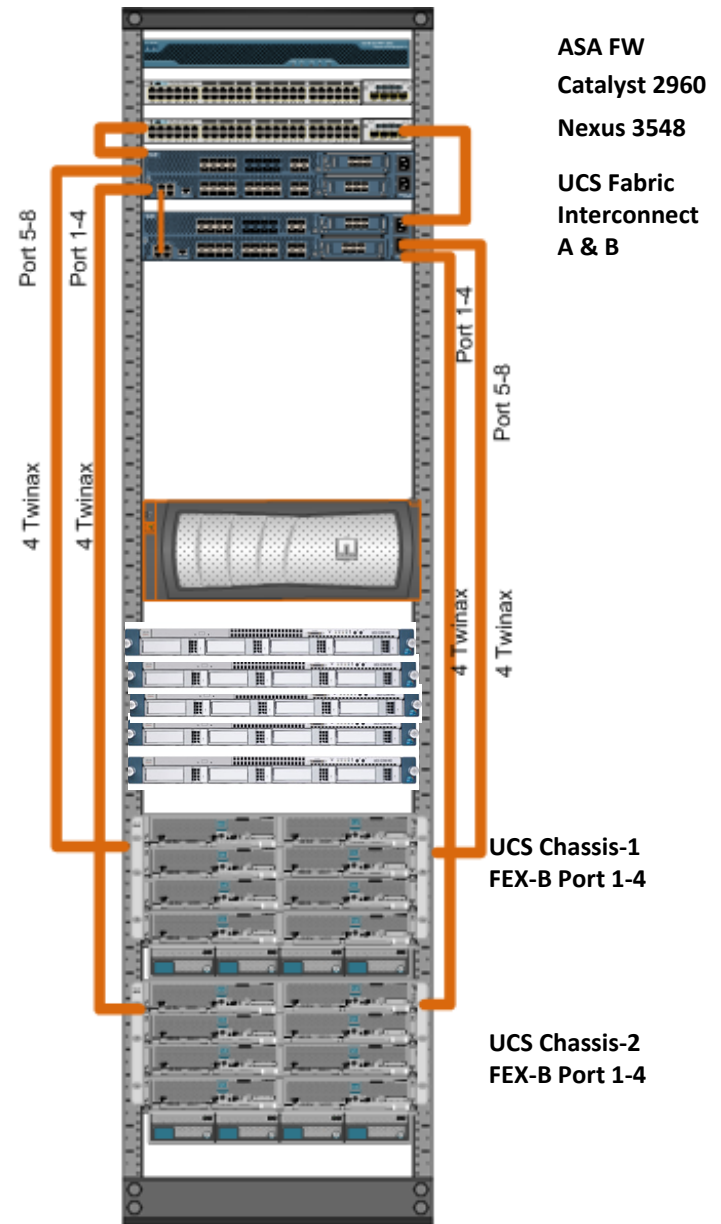
	UCS-C for OpenFlow Experiments	UCS-B for Non-OpenFlow Experiments
# Total Hosts	5	16
# Management/Head Node	1	1
CPU	2 Socket 8 Core E5-2650 2.00GHz (2.8GHz for Turbo)	2 Socket 8 Core E5-2690 2.9GHz
Memory	16GB	24GB
HDD	2x300GB 15K SAS	2x300GB 15K SAS
NIC	2x1 GE, 1 FE	2x10GE - vNIC
# Worker Node	4	15
CPU	2 Socket 8 Core E5-2650 2.00GHz (2.8GHz for turbo)	2 Socket 8 Core E5-2690 2.9GHz
Memory	192GB	192GB
HDD	1x300GB 15K SAS, 1x500GB 7200 SATA	1x300GB 15K SAS, 1x500GB 7200 SATA
NIC	2x1GE, 2x10GE, 1FE	2x10GE - vNIC
Sliverable Storage		FAS2240-4, 24x2TB, Dual 10GE



*BOM is included in the appendix

NCSU Network Components

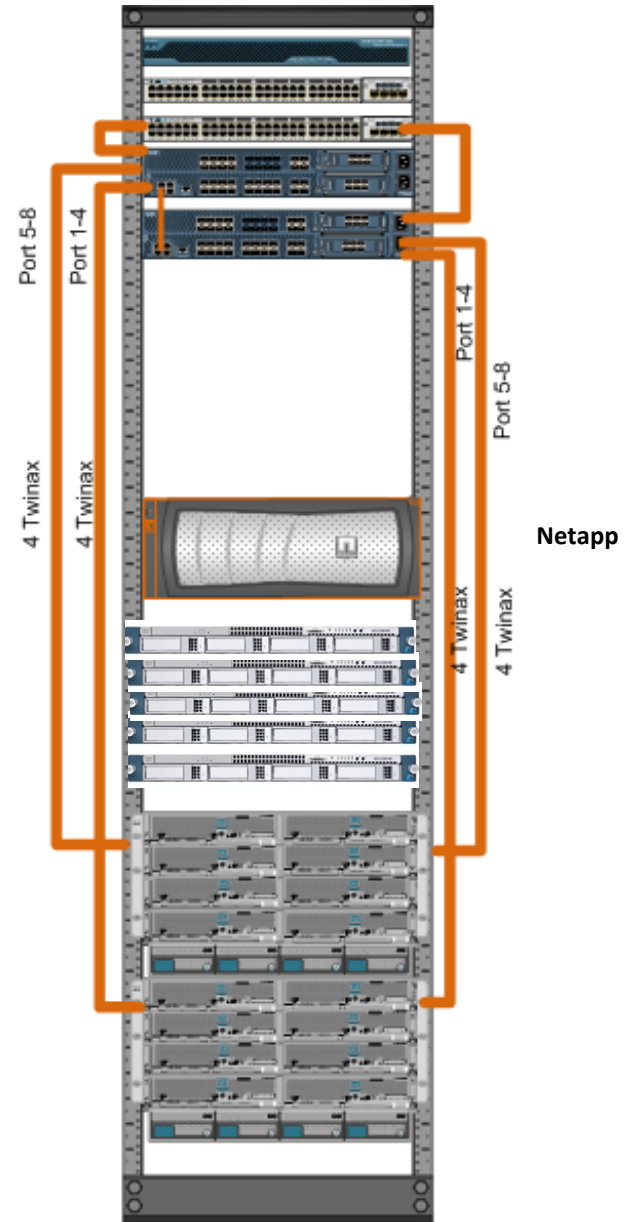
- Nexus 3548 – (48) 10G Ethernet Switch. It supports OpenFlow and provides connectivity to I2 AL2S and to UCS Servers.
- Catalyst 2960 Management Switch – (48) 1G Ethernet switch. It provides management and connects to the Internet.
- ASA 5510 Firewall – It provides IPsec to RENC1 for configuration and management.
- UCS Fabric Interconnects (FI) – UCS FI are part of UCS-B system. It provides L2 Fabric for UCS-B servers and UCS Manager (UCSM) resides in the Fabric.
- UCS Fabric Extender (FEX) – FEX acts as a remote line card to FI. It is installed on the UCS-B chassis.



*UCS-B system employs redundancy - dual FI and dual FEX (A or B).

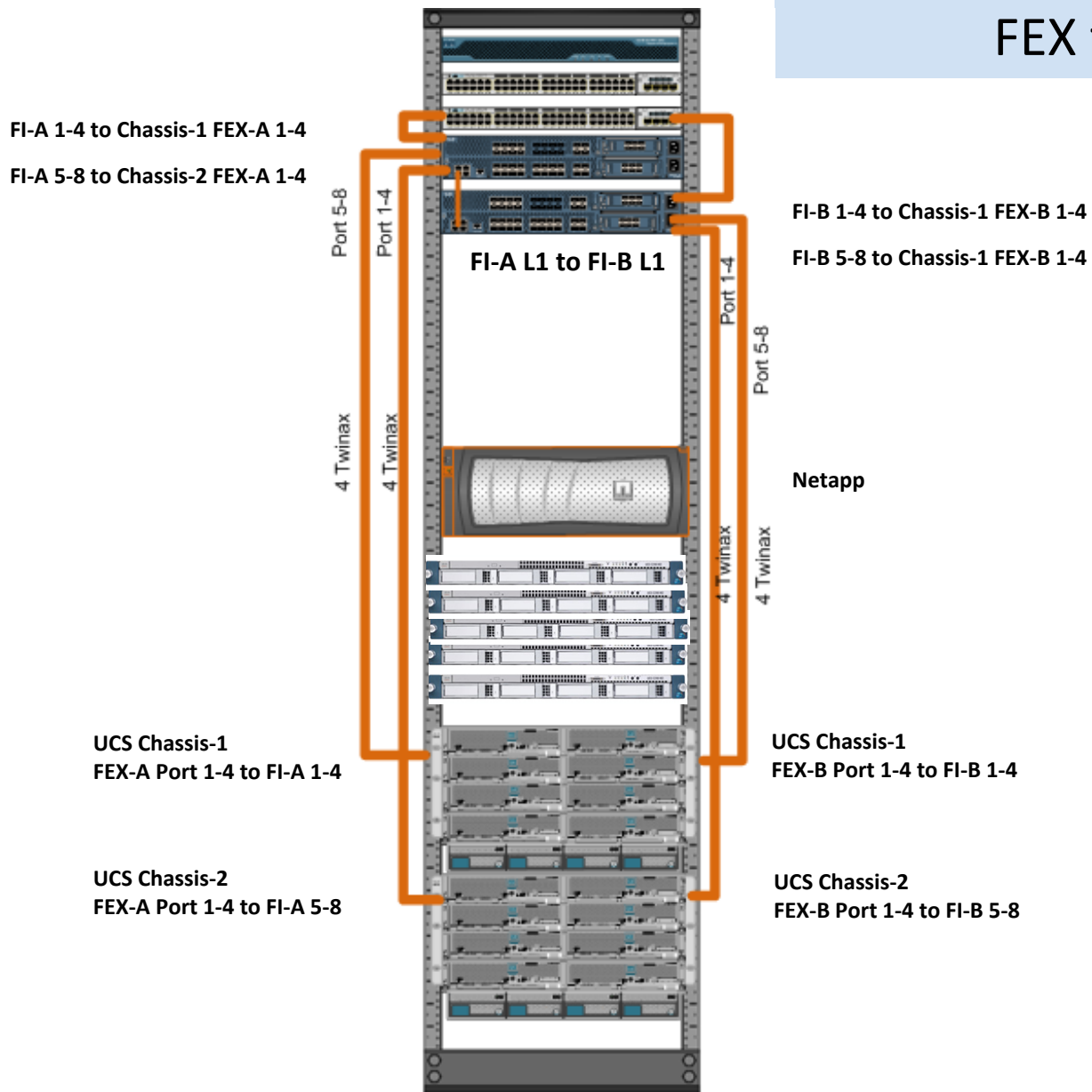
NCSU Storage and Software

- **Storage** – UCS onboard disks and NetApp FAS 2240 solution
- **Software** – GENI software stack (ORCA) provided by RENCI's ExoGENI project (<http://www.exogeni.net>)



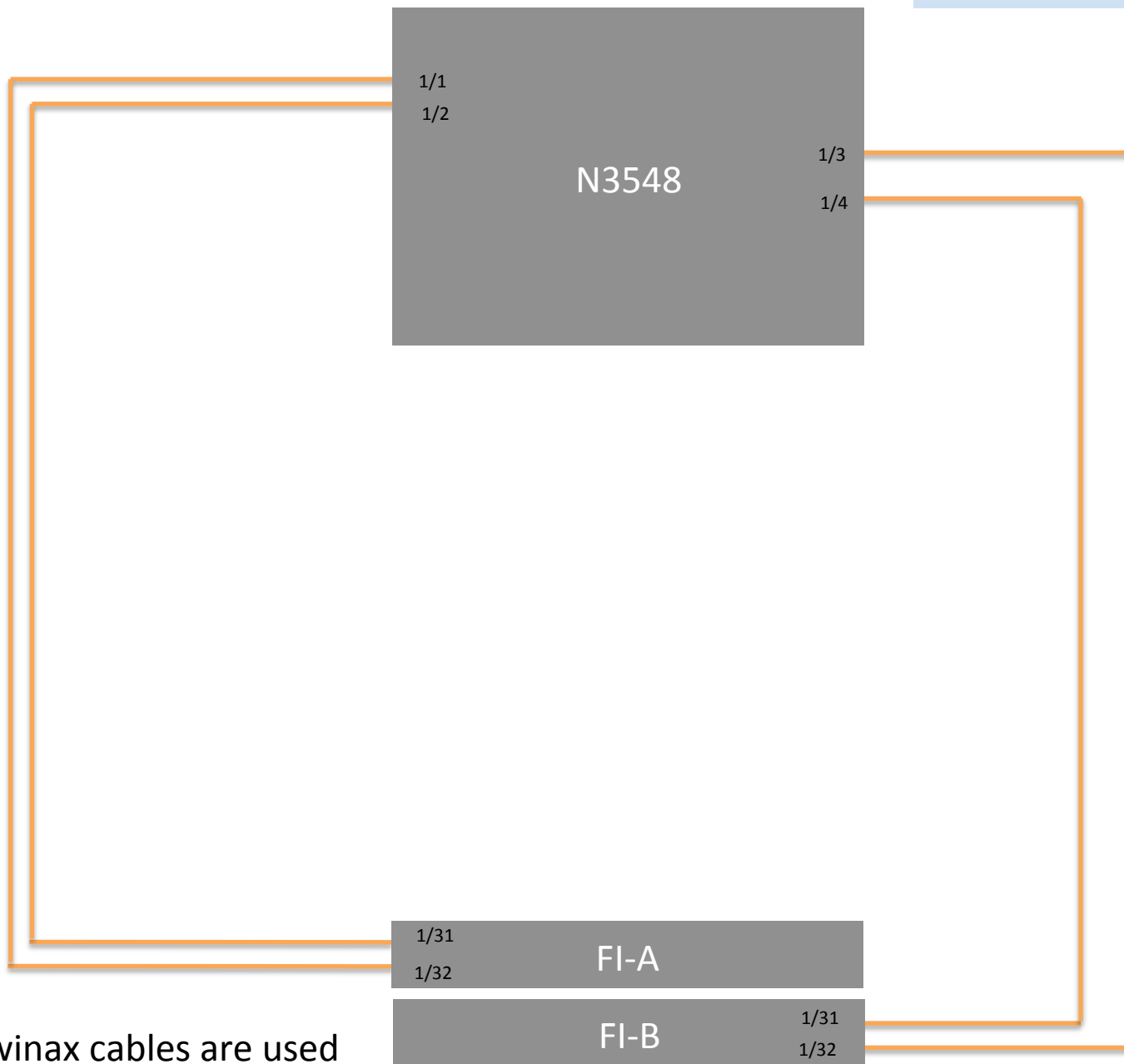
II. Physical Cabling

UCS-B Fabric Connections FEX to FI



10G

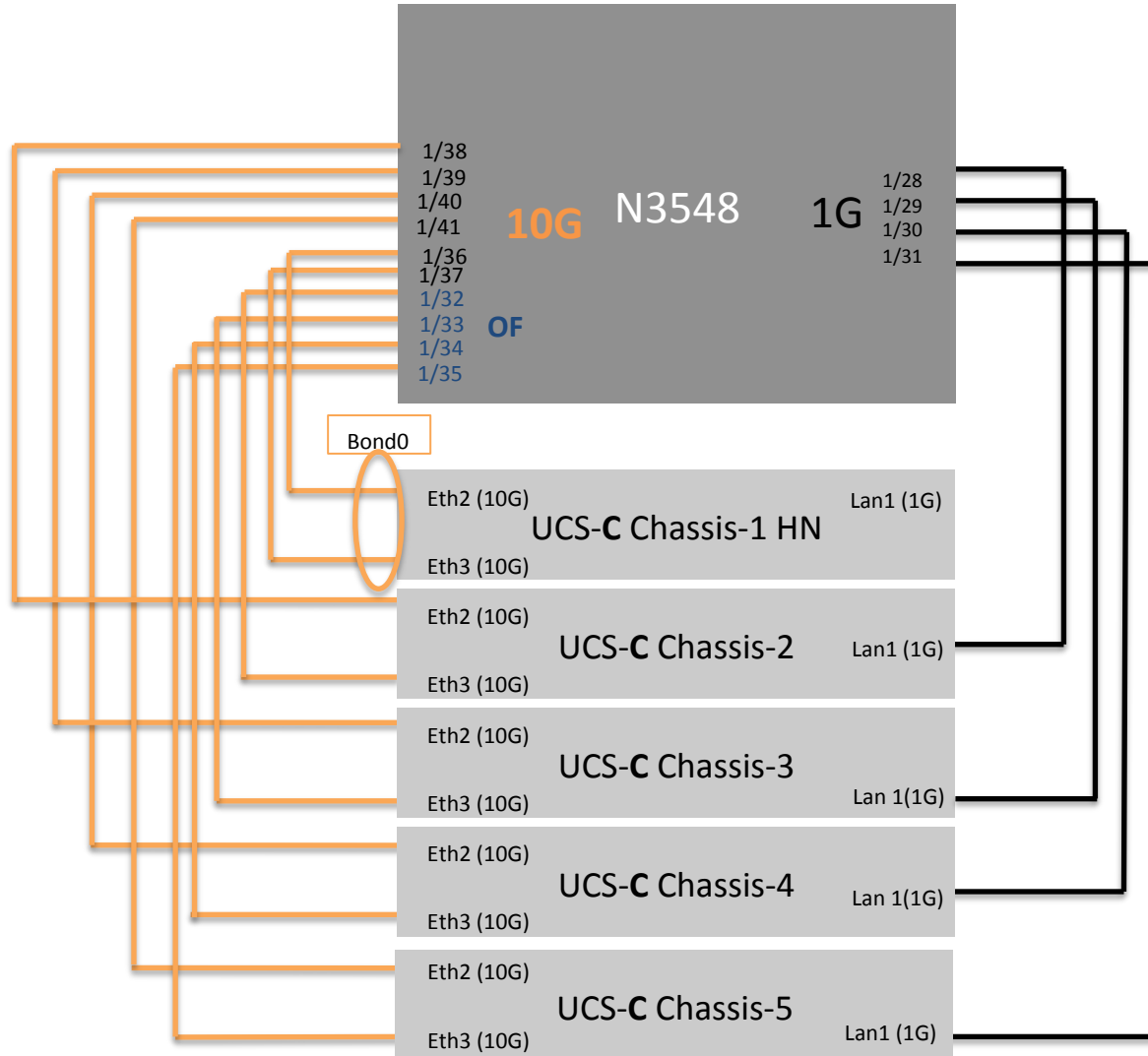
*Cisco Twinax cables are used



10G

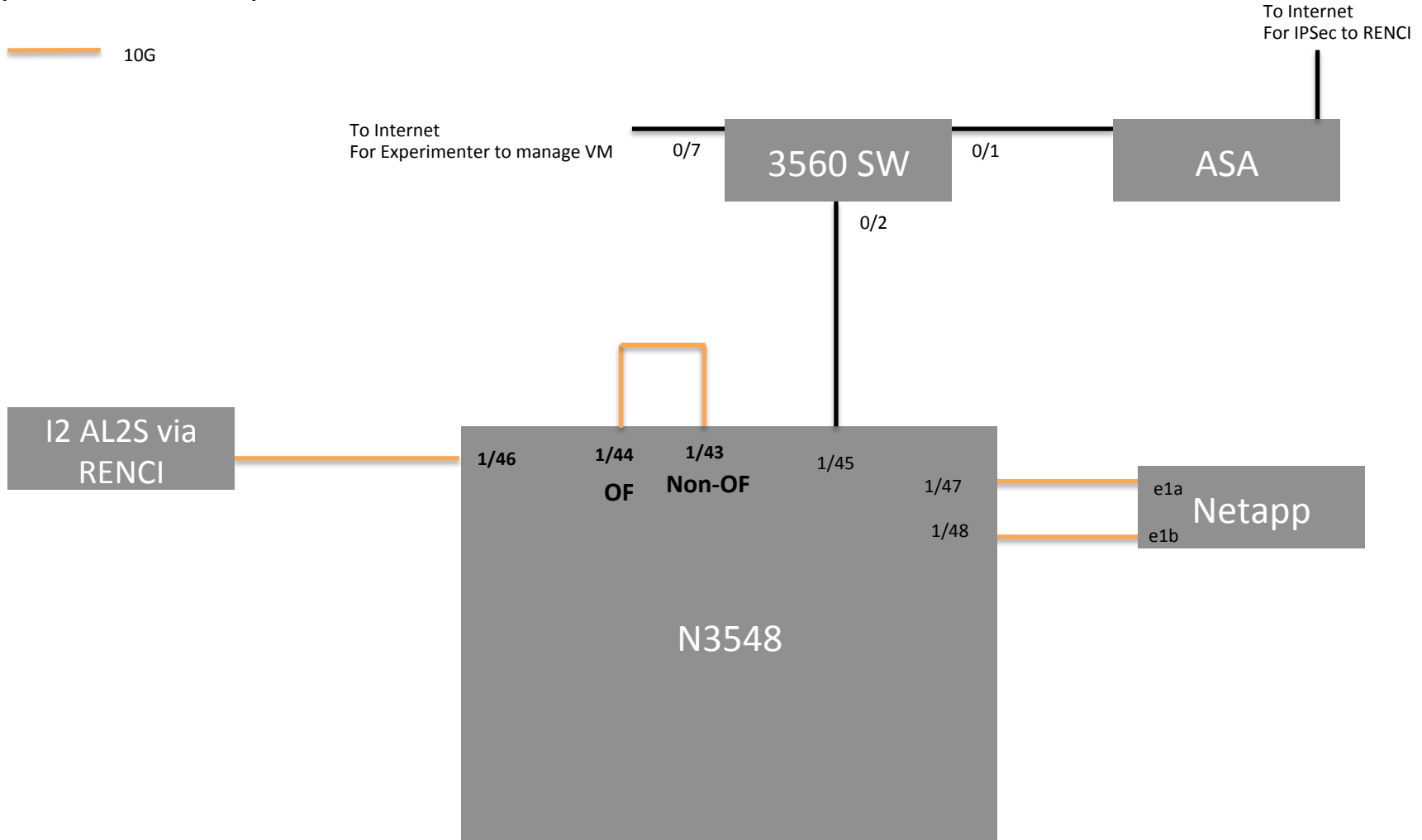
*Cisco Twinax cables are used

10G



*Cisco Twinax cables are used

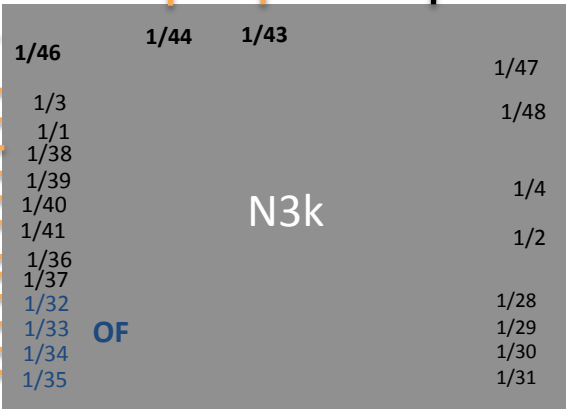
*Shut down the ports 1/44 and 1/45 until VLAN pruning is configured to prevent the loop.



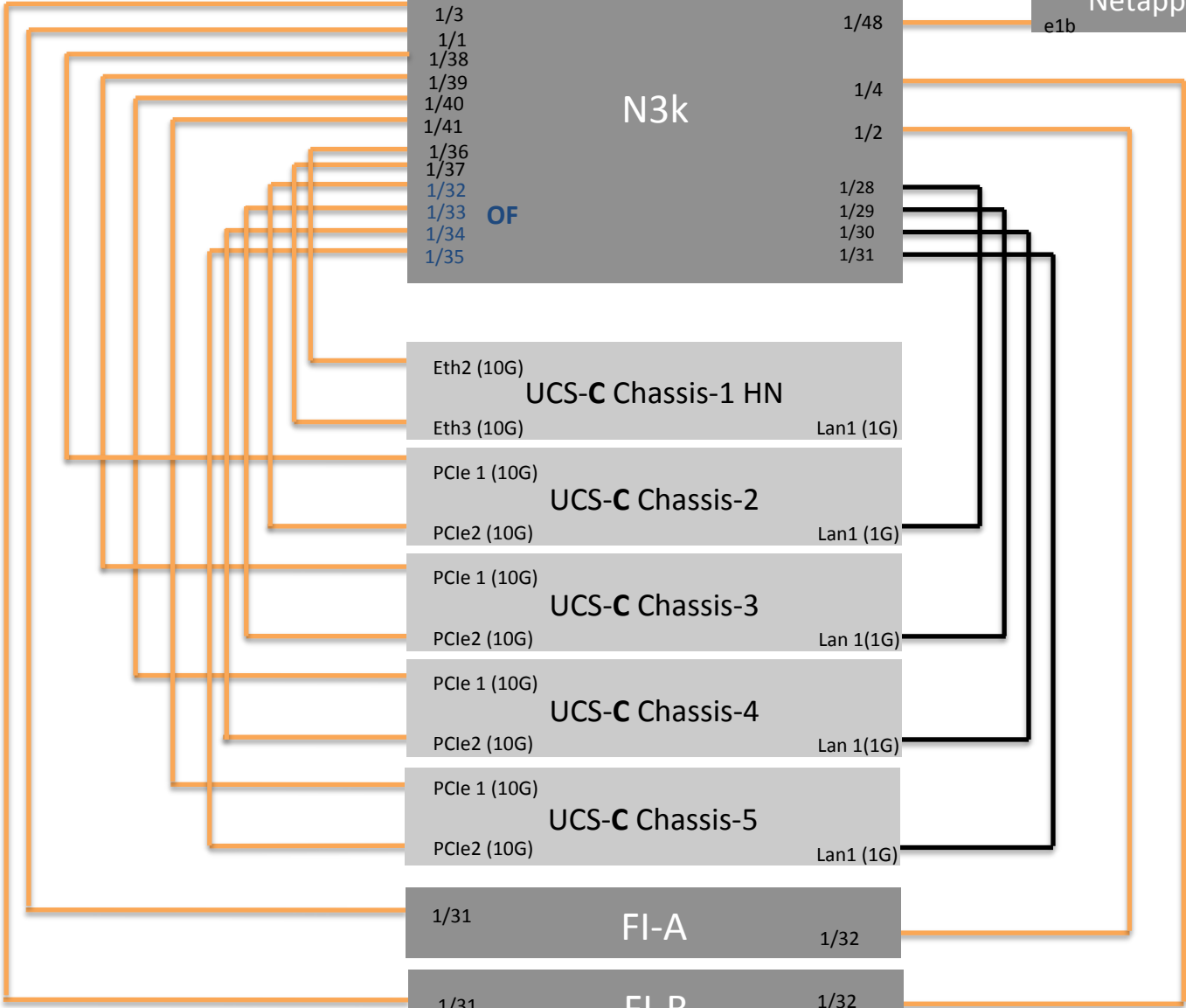
Overall UCS-B and UCS-C Cabling

3560 SW

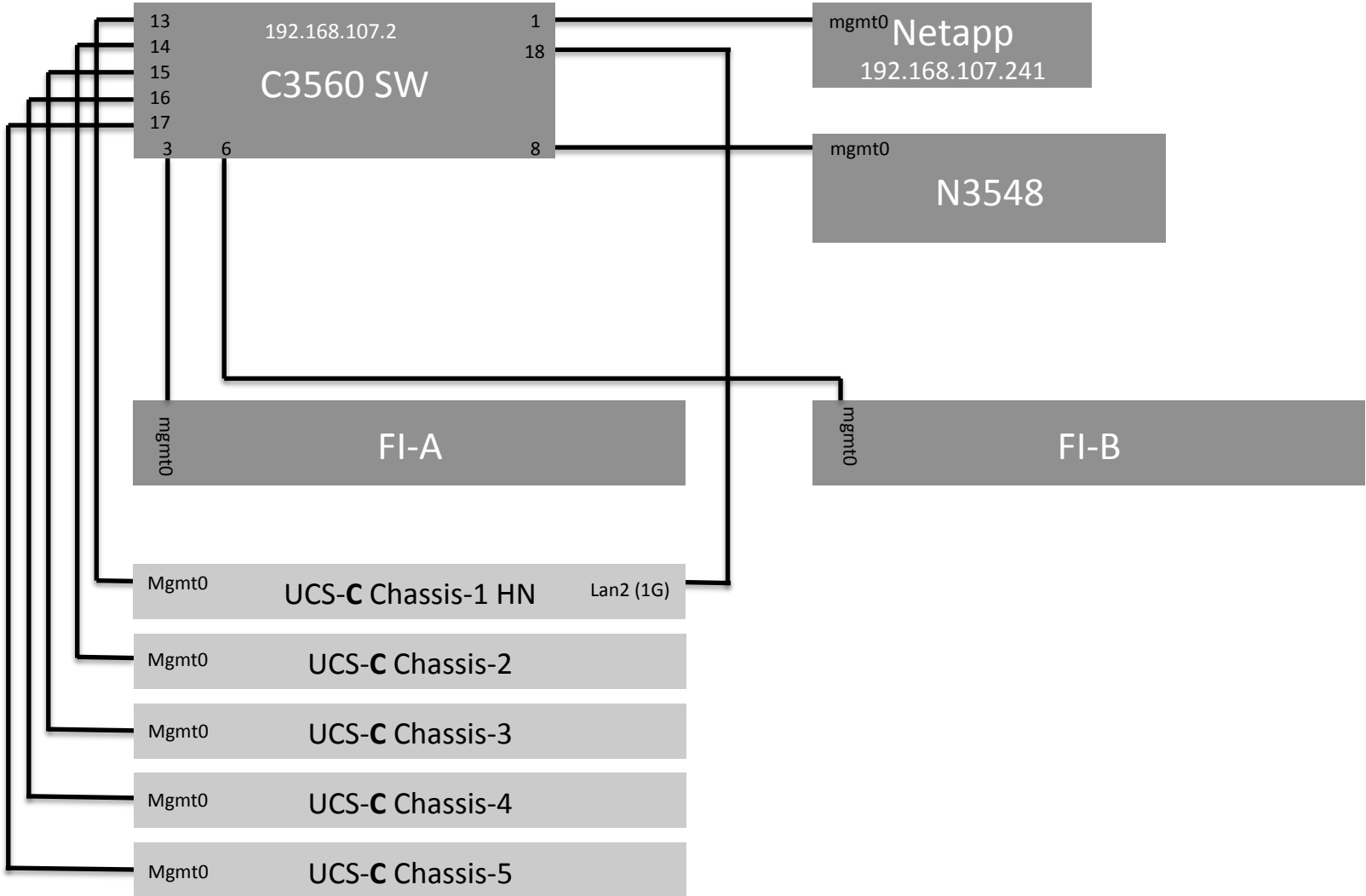
RENCI



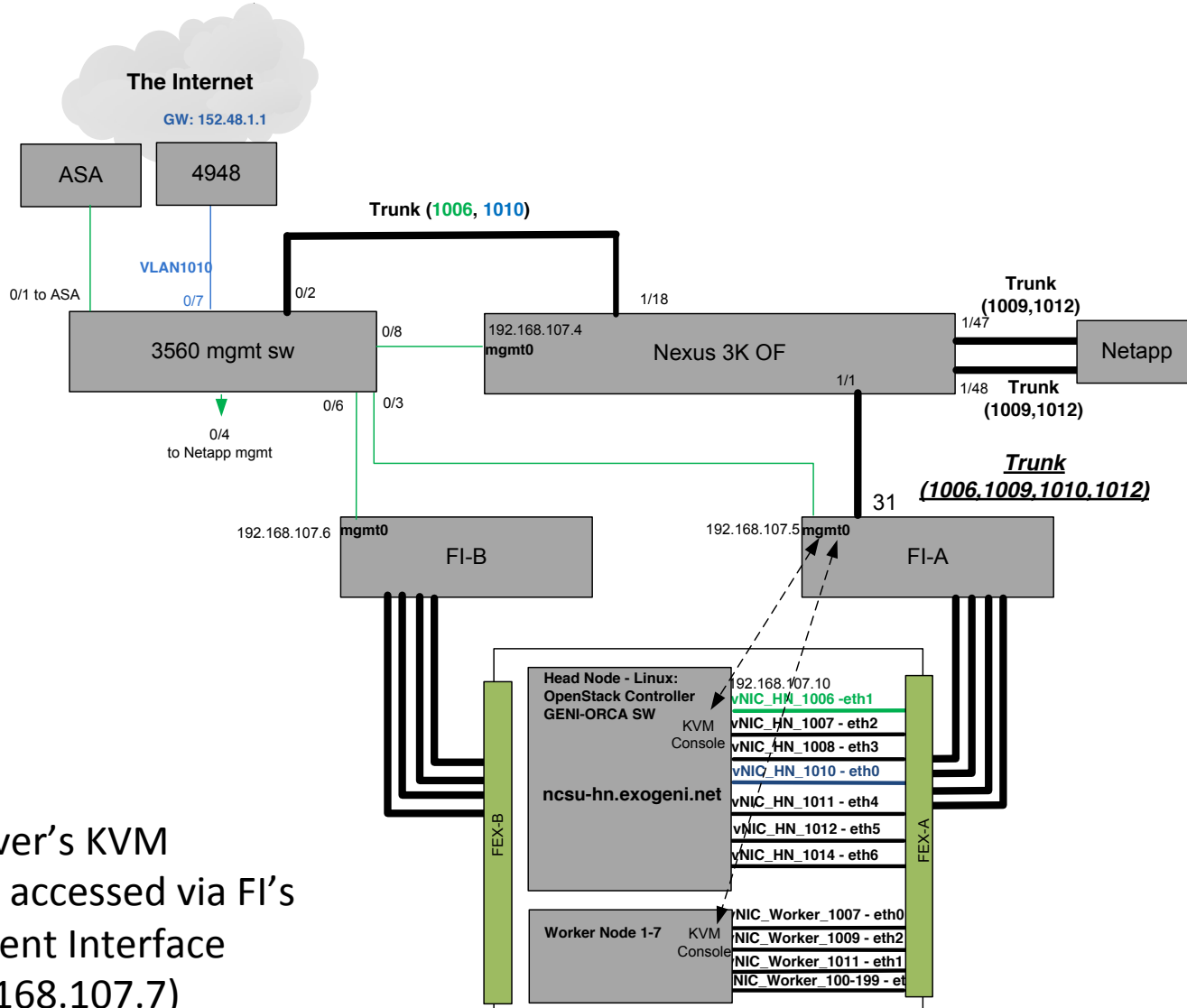
e1a Netapp e1b



Management Cabling Diagram



UCS-B Blade Server KVM Management Diagram



*Each server's KVM Console is accessed via FI's management Interface (VIP, 192.168.107.7)

III. VLAN and IP Addressing

Public IP Assignment

ncsu-hn-exogeni.net (UCS-B) Public IP Address	152.48.13.3
Ncsu-hn2-exogeni.net (UCS-C) Public IP Address	152.48.13.190
Public IP Address Pool for Experimenter VM	152.48.13.0/25

Management IP Assignment

Fabric Interconnect A&B	192.168.107.5 & 6
UCS Manager (via http)	192.168.107.7
N3548	192.168.107.30
C3560	192.168.107.2
Netapp FAS	192.168.107.241

UCS-B:

Headnode	192.168.107.100
WorkerNode1	192.168.107.101
WorkerNode2	192.168.107.102
...	
WorkerNode14	192.168.107.114

UCS-C:

Headnode	192.168.107.115
WorkerNode1	192.168.107.116
...	
WorkerNode4	192.168.107.119

VLAN Information

VLAN 1006	IPMI VLAN 1006
VLAN 1007	OS_Worker VLAN 1007 for communication between HeadNode (HN) and Workernodes (WN)
VLAN 1008	Bare_Worker VLAN 1008 for Baremetal configuration
VLAN 1010	Public VLAN 1010 on HN
VLAN 1011	OS_VM VLAN 1011 for VM (in WN) management via public IP address
VLAN 1012	iSCSI_HeadNode VLAN 1012 for iSCSI communication between HN and Netapp
VLAN 1009	iSCSI_Worker VLAN 2012 for iSCSI communication between WN and Netapp
VLAN100-179	Experimenter's Data Path VLAN on VM or baremetal
VLAN180-199	Inter-rack VLAN between UCS-B and UCS-C
VLAN727-731	Inter-rack VLAN for UCS-B
VLAN732-736	Inter-rack VLAN for UCS-C
VLANYYYY	Mesoscale VLAN not assigned at this time.

***An UCS-B vNIC is presented as a physical NIC to a host OS.**

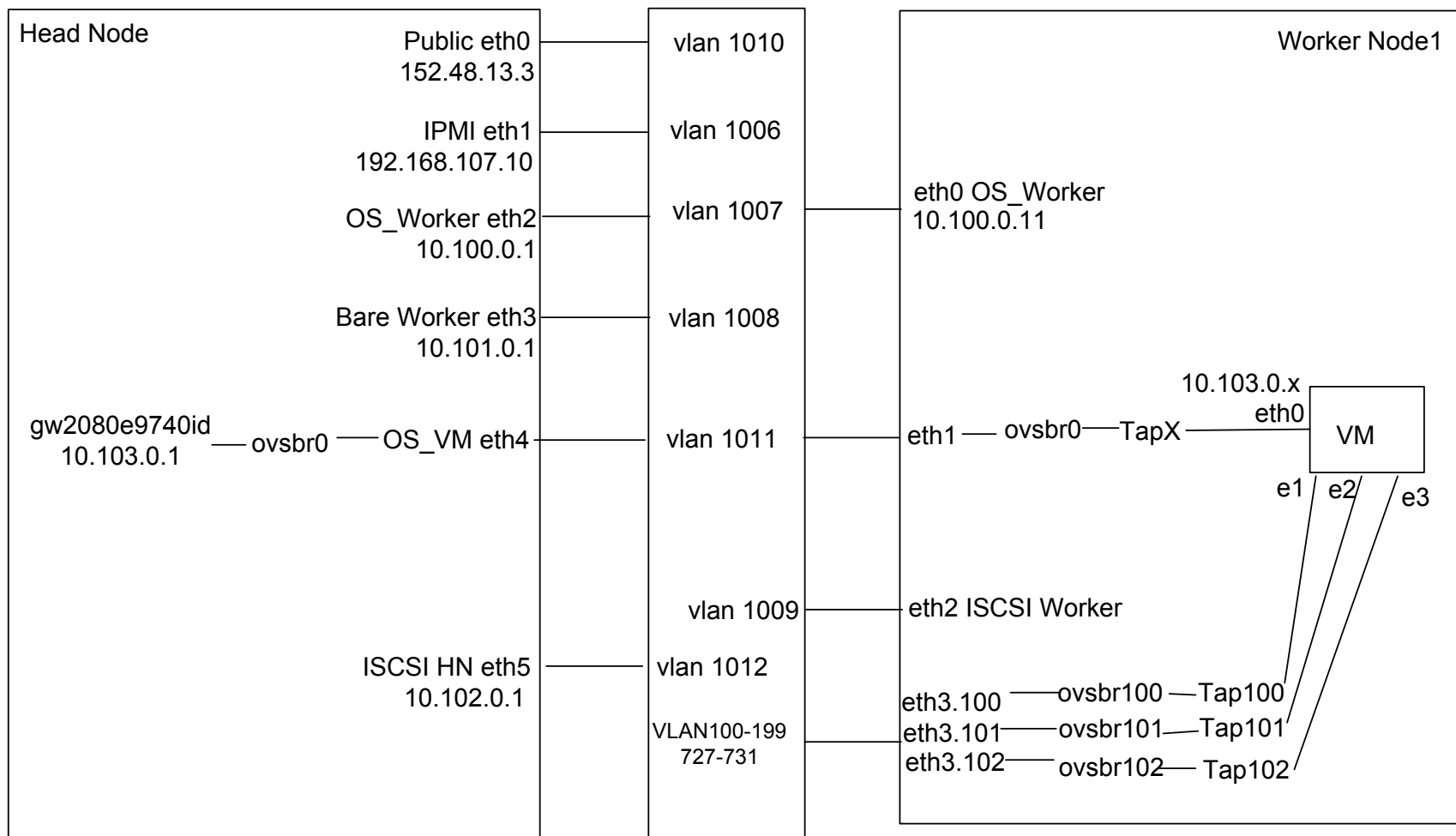
Head Node VLAN (vNIC in UCS) Information

vNIC_HN_1006 - IPMI VLAN 1006 as native	eth1 192.168.107.10
vNIC_HN_1007 - OS_Worker VLAN 1007 as native	eth2 10.100.0.1
vNIC_HN_1008 - Bare_Worker VLAN 1008 as native	eth3 10.101.0.1
vNIC_HN_1010 - Public VLAN 1010 as native	eth0 152.48.13.3
vNIC_HN_1011 - OS_VM VLAN 1011 as native	eth4 no ip address
vNIC_HN_1012 - iSCSI_HN VLAN 1012 as native	eth5 10.102.0.1

Worker Node VLAN Information

vNIC_Worker_1007 OS_Worker	eth0 10.100.0.11-15 (15 WN)
vNIC_HN_1011 - OS_VM	eth1 no ip address (bridging)
vNIC_iSCSI_Worker	eth2 no ip address (future use)
vNIC ORCA100-199, 727-731	eth3.X User definable

UCS-B GENI VLAN Relationship Between HeadNode and WorkerNode



*UCS-C Servers have (4) NICs: Eth0 (1G), Eth1 (1G), Eth2 (10G), Eth3 (10G)

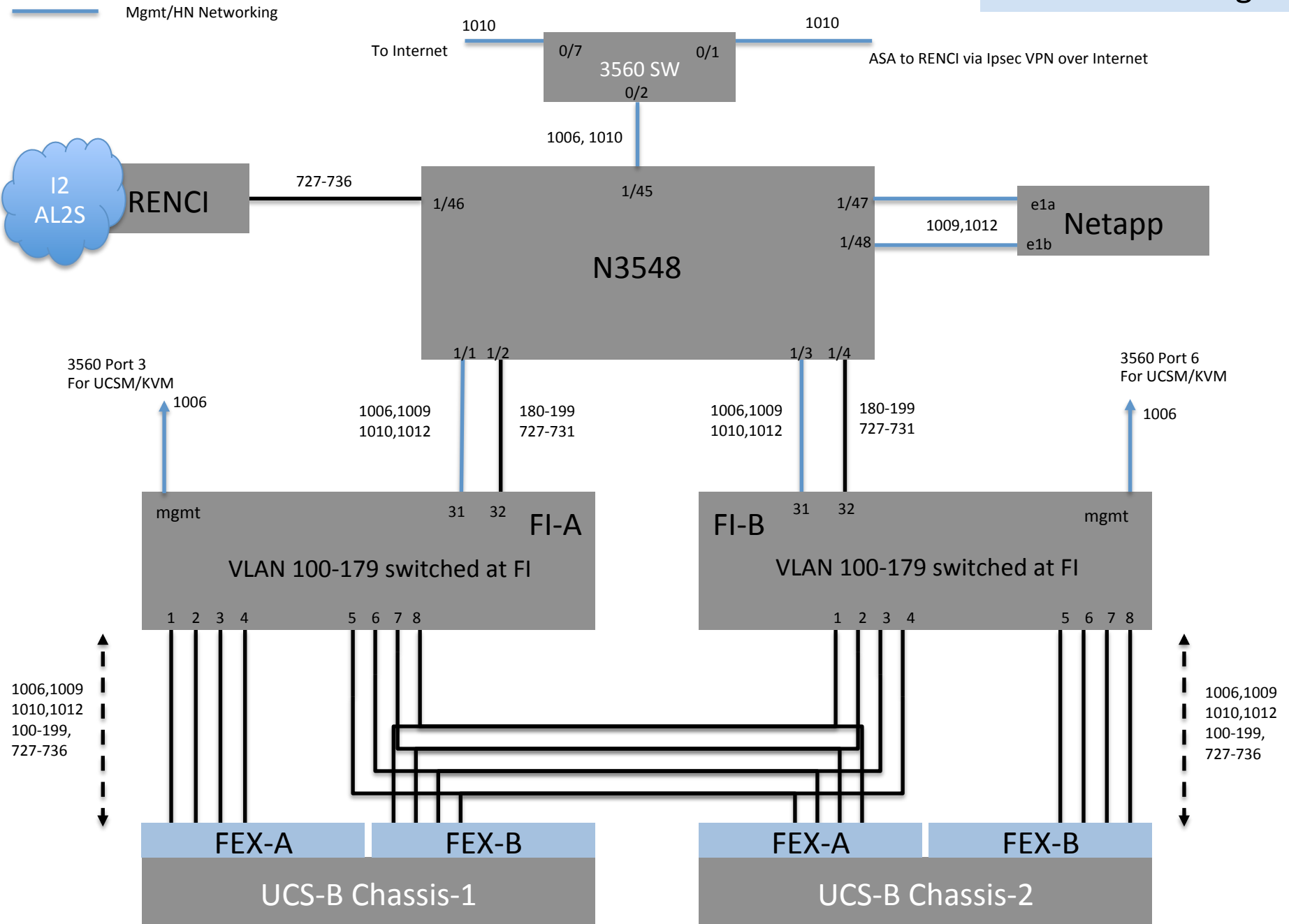
UCS-C HeadNode:

Bond0 (Eth0 and Eth1)	152.48.13.190 (connected to VLAN 1010)
Bond1 (Eth2, Eth3)	
Bond1.1006	192.168.107.20
Bond1.1007	10.100.0.1
Bond1.1011	no ip address
Bond1.1012	10.102.0.21

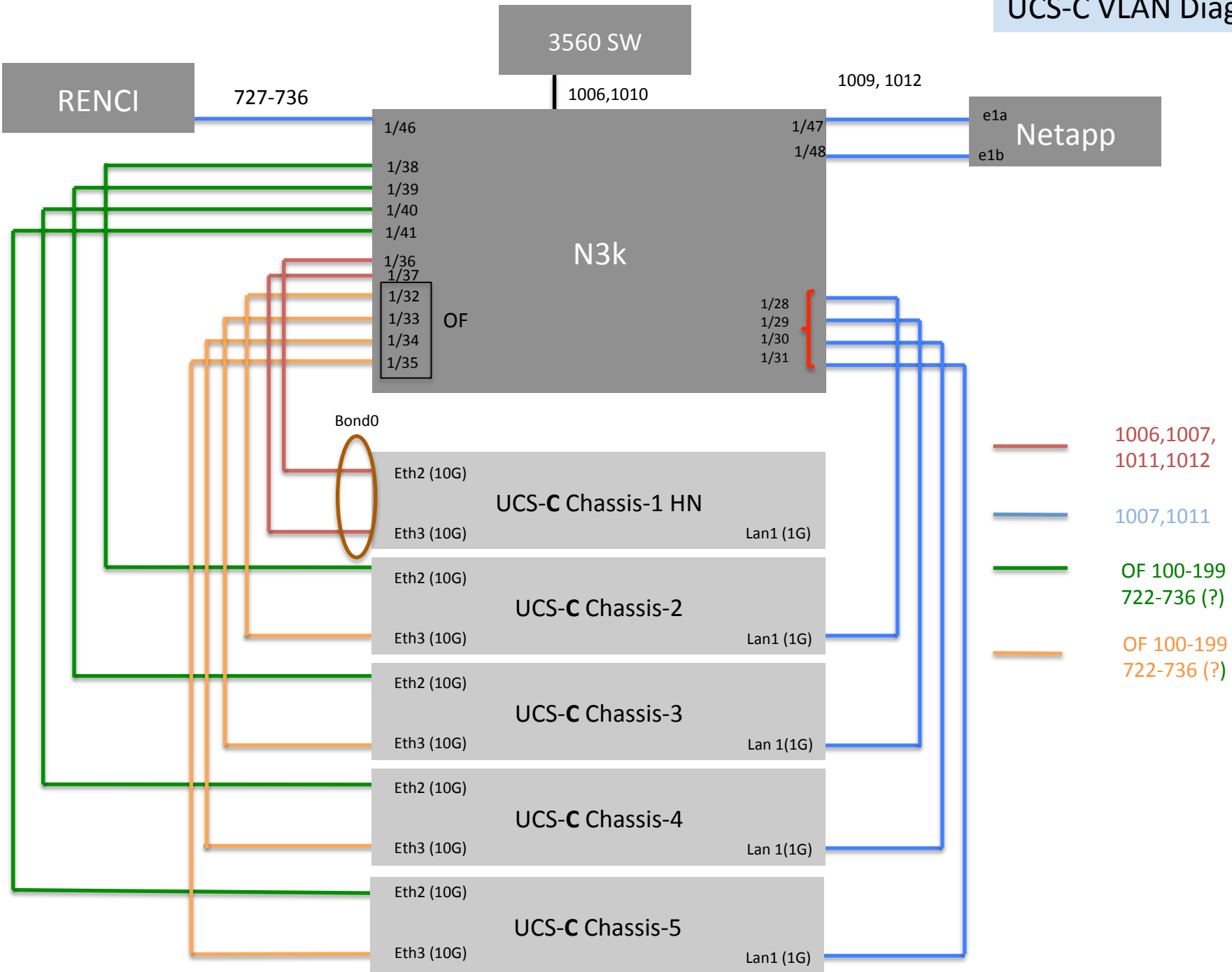
UCS-C WorkerNodes:

Eth0	10.100.0.11-14 (Connected to VLAN 1007)
Eth0.1011	no ip address
Eth1 (Not Used)	no ip address
Eth2 (to Non-OF port on N3548)	no ip address
Eth3 (to OF port on N3548)	no ip address

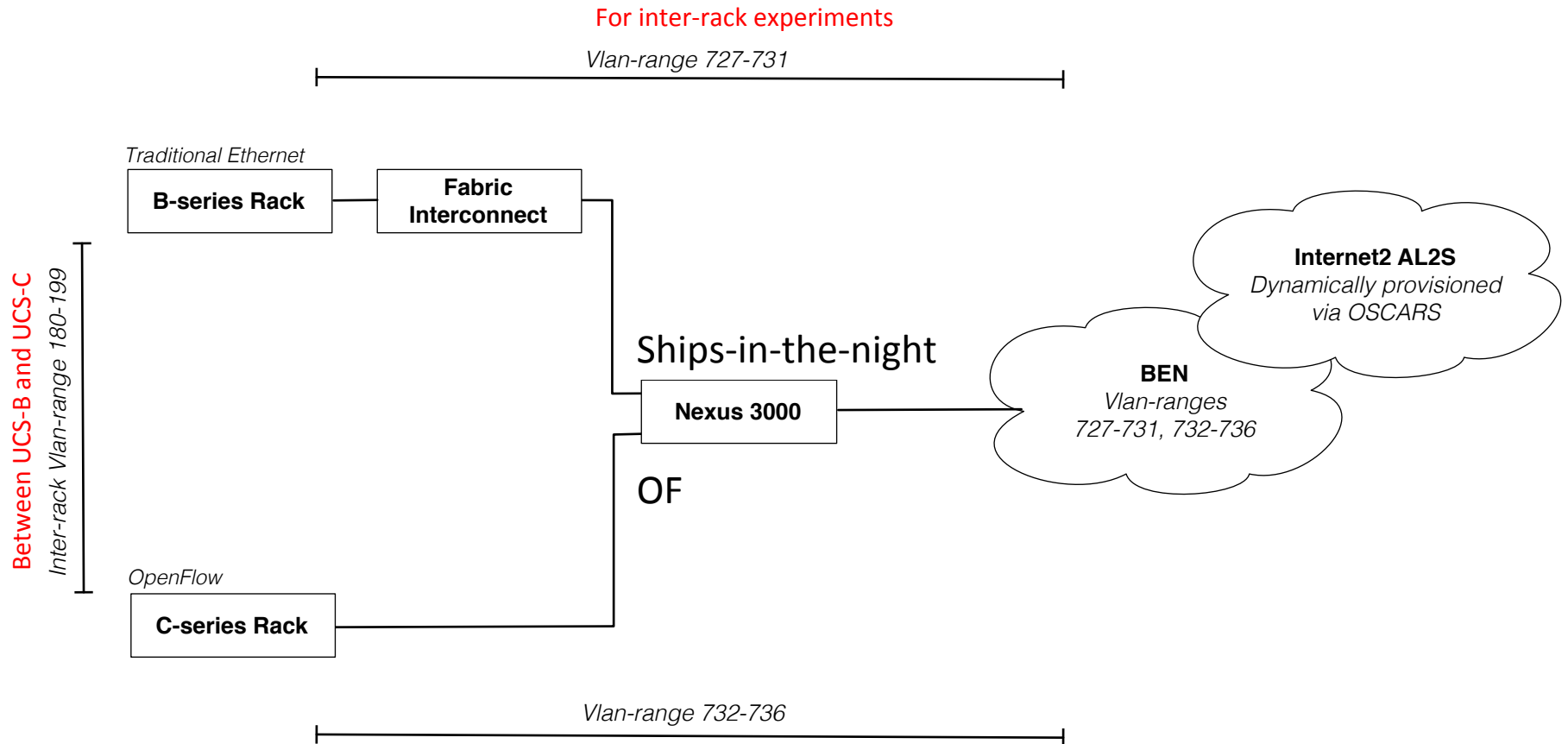
UCS-B VLAN Diagram



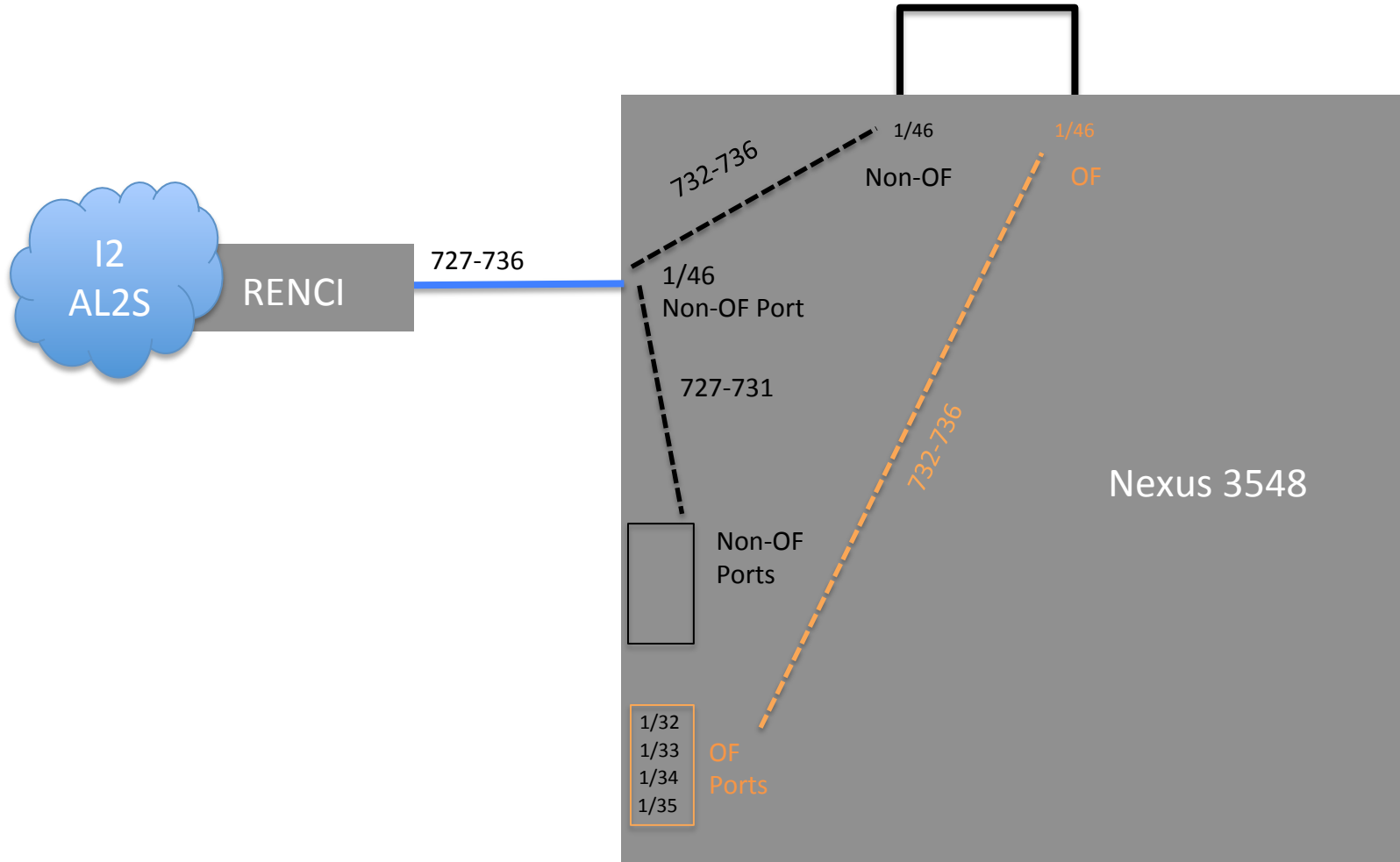
UCS-C VLAN Diagram



NCSU/Cisco ExoGENI B-/C-series Rack Connectivity



OpenFlow and Non-OpenFlow Connectivity For Inter-rack Experiments



IV. BOM

UCS-B BOM

Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity
1.0	N20-20001	Cisco Unified Computing System	N/A	10 days	No	1
1.1	N20-C6508	UCS 5108 Blade Svr AC Chassis/0 PSU/8 fans/0 fabric extender	N/A	10 days	No	1
1.1.0.1	CON-OSP-2C6508	ONSITE 24X7X4 5108 Blade Server Chassis	12 month(s)	N/A	No	1
1.1.1	UCSB-B200-M3	UCS B200 M3 Blade Server w/o CPU, memory, HDD, mLOM/mezz	N/A	10 days	No	8
1.1.1.0.1	CON-OSP-B200M3	ONSITE 24X7X4 UCS B200 M3 Blade Se	12 month(s)	N/A	No	8
1.1.3	UCS-CPU-E5-2690	2.90 GHz E5-2690/135W 8C/20MB Cache/DDR3 1600MHz	N/A	10 days	No	16
1.1.4	UCS-MR-1X082RY-A	8GB DDR3-1600-MHz RDIMM/PC3-12800/dual rank/1.35v	N/A	10 days	No	192
1.1.5	UCS-HDD300GI2F105	300GB 6Gb SAS 15K RPM SFF HDD/hot plug/drive sled mounted	N/A	10 days	No	8
1.1.6	UCSB-MLOM-40G-01	Cisco UCS VIC 1240 modular LOM for M3 blade servers	N/A	10 days	No	8
1.1.7	N20-BBLKD	UCS 2.5 inch HDD blanking panel	N/A	10 days	Yes	8
1.1.8	UCSB-HS-01-EP	CPU Heat Sink for UCS B200 M3 and B420 M3	N/A	10 days	Yes	16
1.1.2	UCSB-PSU-2500ACPL	2500W Platinum AC Hot Plug Power Supply for UCS 5108 Chassis	N/A	10 days	No	4
1.1.9	CAB-C19-CBN	Cabinet Jumper Power Cord, 250 VAC 16A, C20-C19 Connectors	N/A	10 days	No	4
1.1.10	N20-I6584	UCS 2104XP Fabric Extender/4 external 10Gb ports	N/A	10 days	No	2
1.1.11	N01-UAC1	Single phase AC power module for UCS 5108	N/A	10 days	Yes	1
1.1.12	N20-CAK	Access, kit for 5108 Blade Chassis incl Railkit, KVM dongle	N/A	10 days	Yes	1
1.1.13	N20-FAN5	Fan module for UCS 5108	N/A	10 days	Yes	8
1.1.14	N20-FW010	UCS 5108 Blade Server Chassis FW package	N/A	10 days	No	1
1.2	N20-C6508	UCS 5108 Blade Svr AC Chassis/0 PSU/8 fans/0 fabric extender	N/A	10 days	No	1
1.2.0.1	CON-OSP-2C6508	ONSITE 24X7X4 5108 Blade Server Chassis	12 month(s)	N/A	No	1
1.2.1	UCSB-B200-M3	UCS B200 M3 Blade Server w/o CPU, memory, HDD, mLOM/mezz	N/A	10 days	No	2
1.2.1.0.1	CON-OSP-B200M3	ONSITE 24X7X4 UCS B200 M3 Blade Se	12 month(s)	N/A	No	3
1.2.4	UCS-CPU-E5-2690	2.90 GHz E5-2690/135W 8C/20MB Cache/DDR3 1600MHz	N/A	10 days	No	4
1.2.5	UCS-MR-1X082RY-A	8GB DDR3-1600-MHz RDIMM/PC3-12800/dual rank/1.35v	N/A	10 days	No	48
1.2.6	UCS-HDD300GI2F105	300GB 6Gb SAS 15K RPM SFF HDD/hot plug/drive sled mounted	N/A	10 days	No	2
1.2.7	UCSB-MLOM-40G-01	Cisco UCS VIC 1240 modular LOM for M3 blade servers	N/A	10 days	No	2
1.2.8	N20-BBLKD	UCS 2.5 inch HDD blanking panel	N/A	10 days	Yes	2
1.2.9	UCSB-HS-01-EP	CPU Heat Sink for UCS B200 M3 and B420 M3	N/A	10 days	Yes	4
1.2.2	UCSB-B200-M3	UCS B200 M3 Blade Server w/o CPU, memory, HDD, mLOM/mezz	N/A	10 days	No	1
1.2.10	UCS-CPU-E5-2690	2.90 GHz E5-2690/135W 8C/20MB Cache/DDR3 1600MHz	N/A	10 days	No	2
1.2.11	UCS-MR-1X041RY-A	4GB DDR3-1600-MHz RDIMM/PC3-12800/single rank/1.35v	N/A	10 days	No	6
1.2.12	UCS-HDD300GI2F105	300GB 6Gb SAS 15K RPM SFF HDD/hot plug/drive sled mounted	N/A	10 days	No	2
1.2.13	UCSB-MLOM-40G-01	Cisco UCS VIC 1240 modular LOM for M3 blade servers	N/A	10 days	No	1
1.2.14	UCSB-HS-01-EP	CPU Heat Sink for UCS B200 M3 and B420 M3	N/A	10 days	Yes	2
1.2.3	UCSB-PSU-2500ACPL	2500W Platinum AC Hot Plug Power Supply for UCS 5108 Chassis	N/A	10 days	No	4
1.2.15	CAB-C19-CBN	Cabinet Jumper Power Cord, 250 VAC 16A, C20-C19 Connectors	N/A	10 days	No	4
1.2.16	N20-I6584	UCS 2104XP Fabric Extender/4 external 10Gb ports	N/A	10 days	No	2
1.2.17	N01-UAC1	Single phase AC power module for UCS 5108	N/A	10 days	Yes	1
1.2.18	N20-CAK	Access, kit for 5108 Blade Chassis incl Railkit, KVM dongle	N/A	10 days	Yes	1
1.2.19	N20-CBLKB1	Blade slot blanking panel for UCS 5108/single slot	N/A	10 days	Yes	5
1.2.20	N20-FAN5	Fan module for UCS 5108	N/A	10 days	Yes	8
1.2.21	N20-FW010	UCS 5108 Blade Server Chassis FW package	N/A	10 days	No	1
1.3	UCS-FI-6248UP	UCS 6248UP 1RU Fabric Int/No PSU/32 UP/ 12p LIC	N/A	10 days	No	2
1.3.0.1	CON-OSP-FI6248UP	ONSITE 24X7X4 UCS 6248UP 1RU Fabric Interconnect/2 PSU/2	12 month(s)	N/A	No	2
1.3.1	SFP-10G-SR	10GBASE-SR SFP Module	N/A	14 days	No	8
1.3.2	SFP-H10GB-CU3M	10GBASE-CU SFP+ Cable 3 Meter	N/A	14 days	No	8
1.3.3	UCS-ACC-6248UP	UCS 6248UP Chassis Accessory Kit	N/A	10 days	No	2
1.3.4	UCS-PSU-6248UP-AC	UCS 6248UP Power Supply/100-240VAC	N/A	10 days	No	4
1.3.5	N10-MGT010	UCS Manager v2.0	N/A	10 days	No	2
1.3.6	CAB-C13-C14-2M	Power Cord Jumper, C13-C14 Connectors, 2 Meter Length	N/A	10 days	No	4
1.3.7	UCS-BLKE-6200	UCS 6200 Series Expansion Module Blank	N/A	10 days	Yes	2
1.3.8	UCS-FAN-6248UP	UCS 6248UP Fan Module	N/A	10 days	Yes	4
1.3.9	UCS-FI-DL2	UCS 6248 Layer 2 Daughter Card	N/A	10 days	Yes	2

Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity
Products						
1.0	UCSC-C220-M3S	UCS C220 M3 SFF w/o CPU mem HDD PCIe PSU w/ rail kit	N/A	10 days	No	4
1.1	UCS-CPU-E52680B	2.80 GHz E5-2680 v2/115W 10C/25MB Cache/DDR3 1866MHz	N/A	10 days	No	8
1.2	UCS-MR-1X162RZ-A	16GB DDR3-1866-MHz RDIMM/PC3-14900/dual rank/x4/1.5v	N/A	10 days	No	64
1.3	A03-D300GA2	300GB 6Gb SAS 10K RPM SFF HDD/hot plug/drive sled mounted	N/A	10 days	No	8
1.4	UCSC-CMA1	Reversible Cable Management Arm for C220C22C24 servers	N/A	10 days	No	4
1.5	CAB-9K12A-NA	Power Cord 125VAC 13A NEMA 5-15 Plug North America	N/A	8 days	No	8
1.6	UCSC-PSU-650W	650W power supply for C-series rack servers	N/A	10 days	No	8
1.7	UCSC-RAID-MZ-220	Cisco UCS RAID SAS 2008M-8i Mezz Card for C220 (0/10/10)	N/A	10 days	No	4
1.8	UCSC-PCIE-CSC-02	Cisco VIC 1225 Dual Port 10Gb SFP+ CNA	N/A	10 days	No	4
1.9	N20-BBLKD	UCS 2.5 inch HDD blanking panel	N/A	10 days	Yes	24
1.10	UCSC-HS-C220M3	Heat Sink for UCS C220 M3 Rack Server	N/A	10 days	Yes	8
1.11	UCSC-PCIF-01H	Half height PCIe filler for UCS	N/A	10 days	Yes	4
1.12	UCSC-RAIL1	Rail Kit for C220 C22 C24 rack servers	N/A	10 days	Yes	4
2.0	SFP-H10GB-CU3M=	10GBASE-CU SFP+ Cable 3 Meter	N/A	14 days	No	8

