Ultra M Solutions Guide, Release 5.8

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CONTENTS

About This Guide

This preface describes the *Ultra M Solution Guide*, how it is organized, and its document conventions.

Ultra M is a pre-packaged and validated virtualized mobile packet core solution designed to simplify the deployment of virtual network functions (VNFs).

Conventions Used

The following tables describe the conventions used throughout this documentation.

Notice Type	Description
Information Note	Provides information about important features or instructions.
Caution	Alerts you of potential damage to a program, device, or system.
Warning	Alerts you of potential personal injury or fatality. May also alert you of potential electrical hazards.

Typeface Conventions	Description
Text represented as a `screen display`	This typeface represents displays that appear on your terminal screen, for example: `Login:`
Text represented as **commands**	This typeface represents commands that you enter, for example: **show ip access-list** This document always gives the full form of a command in lowercase letters. Commands are not case sensitive.

Typeface Conventions	Description
Text represented as a **command** *variable*	This typeface represents a variable that is part of a command, for example: **show card** *slot_number* *slot_number* is a variable representing the desired chassis slot number.
Text represented as menu or sub-menu names	This typeface represents menus and sub-menus that you access within a software application, for example: Click the **File** menu, then click **New**

Supported Documents and Resources

Related Documentation

The most up-to-date information for the UWS is available in the product *Release Notes* provided with each product release.

The following common documents are available:

- *Ultra Gateway Platform System Administration Guide*
- *Ultra-M Deployment Guide*
- *Ultra Services Platform Deployment Automation Guide*
- *VPC-DI System Administration Guide*
- **StarOS Product-specific and Feature-specific Administration Guides**

Obtaining Documentation

Nephelo Documentation

The most current Nephelo documentation is available on the following website: http://nephelo.cisco.com/page_vPC.html

StarOS Documentation

The most current Cisco documentation is available on the following website: http://www.cisco.com/cisco/web/psa/default.html

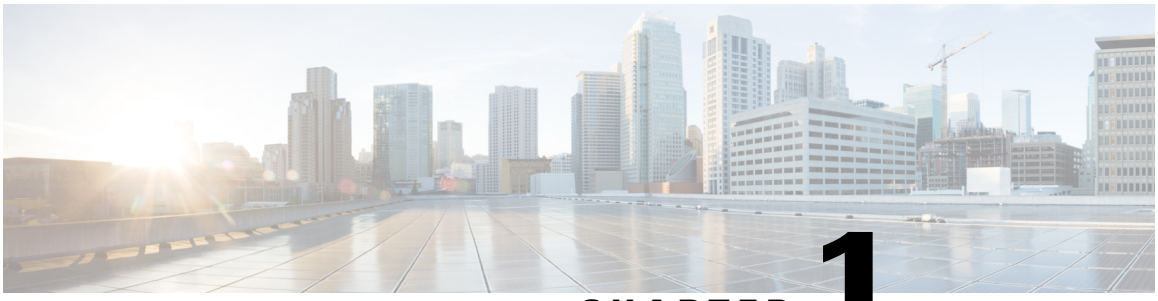
Use the following path selections to access the StarOS documentation:

Products > Wireless > Mobile Internet > Platforms > Cisco ASR 5000 Series > Configure > Configuration Guides

Contacting Customer Support

Use the information in this section to contact customer support.

Refer to the support area of http://www.cisco.com for up-to-date product documentation or to submit a service request. A valid username and password are required to access this site. Please contact your Cisco sales or service representative for additional information.



CHAPTER 1

Ultra M Overview

Ultra M is a pre-packaged and validated virtualized mobile packet core solution designed to simplify the deployment of virtual network functions (VNFs).

The solution combines the Cisco Ultra Service Platform (USP) architecture, Cisco Validated OpenStack infrastructure, and Cisco networking and computing hardware platforms into a fully integrated and scalable stack. As such, Ultra M provides the tools to instantiate and provide basic lifecycle management for VNF components on a complete OpenStack virtual infrastructure manager.

VNF Support

In this release, Ultra M supports the Ultra Gateway Platform (UGP) VNF.

The UGP currently provides virtualized instances of the various 3G and 4G mobile packet core (MPC) gateways that enable mobile operators to offer enhanced mobile data services to their subscribers. The UGP addresses the scaling and redundancy limitations of VPC-SI (Single Instance) by extending the StarOS boundaries beyond a single VM. UGP allows multiple VMs to act as a single StarOS instance with shared interfaces, shared service addresses, load balancing, redundancy, and a single point of management.

Ultra M Model(s)

The Ultra M Extra Small (XS) model is currently available. It is based on OpenStack 10 and implements a Hyper-Converged architecture that combines the Ceph Storage and Compute node. The converged node is referred to as an OSD compute node.

This model includes 6 Active Service Functions (SFs) per VNF and is supported in deployments from 1 to 4 VNFs.

Functional Components

As described in Hardware Specifications, on page 5, the Ultra M solution consists of multiple hardware components including multiple servers that function as controller, compute, and storage nodes. The various functional components that comprise the Ultra M are deployed on this hardware:

- **OpenStack Controller**: Serves as the Virtual Infrastructure Manager (VIM).

  Note In this release, all VNFs in a multi-VNF Ultra M are deployed as a single "site" leveraging a single VIM.

- **Ultra Automation Services (UAS)**: A suite of tools provided to simplify the deployment process:
  - **AutoIT-NFVI**: Automates the VIM Orchestrator and VIM installation processes.
  - **AutoIT-VNF**: Provides storage and management for system ISOs.
  - **AutoDeploy**: Initiates the deployment of the VNFM and VNF components through a single deployment script.
  - **AutoVNF**: Initiated by AutoDeploy, AutoVNF is directly responsible for deploying the VNFM and VNF components based on inputs received from AutoDeploy.
  - **Ultra Web Service (UWS)**: The Ultra Web Service (UWS) provides a web-based graphical user interface (GUI) and a set of functional modules that enable users to manage and interact with the USP VNF.

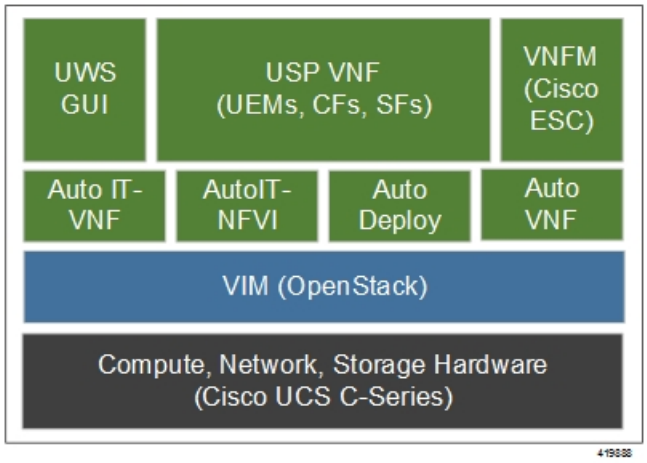
- **Cisco Elastic Services Controller (ESC)**: Serves as the Virtual Network Function Manager (VNFM).

  Note ESC is the only VNFM supported in this release.

- **VNF Components**: USP-based VNFs are comprised of multiple components providing different functions:
  - **Ultra Element Manager (UEM)**: Serves as the Element Management System (EMS, also known as the VNF-EM); it manages all of the major components of the USP-based VNF architecture.
  - **Control Function (CF)**: A central sub-system of the UGP VNF, the CF works with the UEM to perform lifecycle events and monitoring for the UGP VNF.

- **Service Function (SF)**: Provides service context (user I/O ports), handles protocol signaling, session processing tasks, and flow control (demux).

Figure 1: Ultra M Components



Virtual Machine Allocations

Each of the Ultra M functional components are deployed on one or more virtual machines (VMs) based on their redundancy requirements as identified in Table 1: Function VM Requirements per Ultra M Model, on page 3. Some of these component VMs are deployed on a single compute node as described in VM Deployment per Node Type, on page 9. All deployment models use three OpenStack controllers to provide VIM layer redundancy and upgradability.

Table 1: Function VM Requirements per Ultra M Model

	Hyper-Converged	
Function(s)	**XS Single VNF**	**XS Multi VNF**
OSP-D*	1	1
AutoIT-NFVI	1	1
AutoIT-VNF	1	1
AutoDeploy	1	1
AutoVNF	3	3 per VNF
ESC (VNFM)	2	2 per VNF
UEM	3	3 per VNF

	Hyper-Converged	
Function(s)	**XS Single VNF**	**XS Multi VNF**
CF	2	2 per VNF
* OSP-D is deployed as a VM for Hyper-Converged Ultra M models.		

VM Requirements

The CF, SF, UEM, and ESC VMs require the resource allocations identified in Table 2: VM Resource Allocation, on page 4. The host resources are included in these numbers.

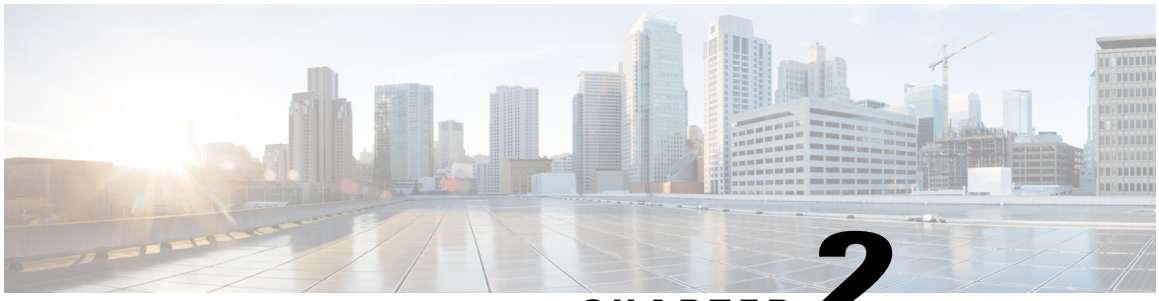
Table 2: VM Resource Allocation

Virtual Machine	vCPU	RAM (GB)	Root Disk (GB)
OSP-D*	16	32	200
AutoIT-NFVI **	2	8	80
AutoIT-VNF	2	8	80
AutoDeploy**	2	8	80
AutoVNF	2	4	40
ESC	2	4	40
UEM	2	4	40
CF	8	16	6
SF	24	96	4

Note 4 vCPUs, 2 GB RAM, and 54 GB root disks are reserved for host reservation.

* OSP-D is deployed as a VM for Hyper-Converged Ultra M models. Though the recommended root disk size is 200GB, additional space can be allocated if available.

** AutoIT-NFVI is used to deploy the VIM Orchestrator (Undercloud) and VIM (Overcloud) for Hyper-Converged Ultra M models. AutoIT-NFVI, AutoDeploy, and OSP-D are installed as VMs on the same physical server in this scenario.



CHAPTER 2

Hardware Specifications

Ultra M deployments use the following hardware:

Note The specific component software and firmware versions identified in the sections that follow have been validated in this Ultra M solution release.

Cisco Catalyst Switches

Cisco Catalyst Switches provide as physical layer 1 switching for Ultra M components to the management and provisioning networks. One of two switch models is used based on the Ultra M model being deployed:

Catalyst C2960XR-48TD-I Switch

The Catalyst C2960XR-48TD-I has 48 10/100/1000 ports.

Table 3: Catalyst 2960-XR Switch Information

Ultra M Model(s)	Quantity	Software Version	Firmware Version
Ultra M XS Single VNF	2	IOS 15.2.(2) E5	Boot Loader: 15.2(3r)E1
Ultra M XS Multi-VNF	1 per rack	IOS 15.2.(2) E5	Boot Loader: 15.2(3r)E1

Catalyst 3850-48T-S Switch

The Catalyst 3850 48T-S has 48 10/100/1000 ports.

Table 4: Catalyst 3850-48T-S Switch Information

Ultra M Models	Quantity	Software Version	Firmware Version
Ultra M XS Single VNF	2	IOS: 03.06.06E	Boot Loader: 3.58
Ultra M XS Multi-VNF	1 per Rack	IOS: 03.06.06E	Boot Loader: 3.58

Cisco Nexus Switches

Cisco Nexus Switches serve as top-of-rack (TOR) leaf and end-of-rack (EOR) spine switches provide out-of-band (OOB) network connectivity between Ultra M components. Two switch models are used for the various Ultra M models:

- Nexus 93180-YC-EX, on page 6
- Nexus 9236C , on page 6

Nexus 93180-YC-EX

Nexus 93180 switches serve as network leafs within the Ultra M solution. Each switch has 48 10/25-Gbps Small Form Pluggable Plus (SFP+) ports and 6 40/100-Gbps Quad SFP+ (QSFP+) uplink ports.

Table 5: Nexus 93180-YC-EX

Ultra M Model(s)	Quantity	Software Version	Firmware Version
Ultra M XS Single VNF	2	NX-OS: 7.0(3)I5(2)	BIOS: 7.59
Ultra M XS Multi-VNF	2 per Rack	NX-OS: 7.0(3)I5(2)	BIOS: 7.59

Nexus 9236C

Nexus 9236 switches serve as network spines within the Ultra M solution. Each switch provides 36 10/25/40/50/100 Gbps ports.

Table 6: Nexus 9236C

Ultra M Model(s)	Quantity	Software Version	Firmware Version
Ultra M XS Single VNF	2	NX-OS: 7.0(3)I5(2)	BIOS: 7.59
Ultra M XS Multi-VNF	2	NX-OS: 7.0(3)I5(2)	BIOS: 7.59

UCS C-Series Servers

Cisco UCS C240 M4S SFF servers host the functions and virtual machines (VMs) required by Ultra M.

Server Functions and Quantities

Server functions and quantity differ depending on the Ultra M model you are deploying:

- **Ultra M Manager Node**: Required only for Ultra M models based on the Hyper-Converged architecture, this server hosts the following:
  - AutoIT-NFVI VM
  - AutoDeploy VM
  - OSP-D VM
- **OpenStack Controller Nodes**: These servers host the high availability (HA) cluster that serves as the VIM within the Ultra M solution. In addition, they facilitate the Ceph storage monitor function required by the Ceph Storage Nodes and/or OSD Compute Nodes.
- **OSD Compute Nodes**: Required only for Hyper-converged Ultra M models, these servers provide Ceph storage functionality in addition to hosting VMs for the following:
  - AutoIT-VNF VM
  - AutoVNF HA cluster VMs
  - Elastic Services Controller (ESC) Virtual Network Function Manager (VNFM) active and standby VMs
  - Ultra Element Manager (UEM) VM HA cluster
  - Ultra Service Platform (USP) Control Function (CF) active and standby VMs
-

Table 7: Ultra M Server Quantities by Model and Function, on page 8 provides information on server quantity requirements per function for each Ultra M model.

Table 7: Ultra M Server Quantities by Model and Function

Ultra M Model(s)	Server Quantity (max)	Ultra M Manager Node	Controller Nodes	OSD Compute Nodes	Compute Nodes (max)	Additional Specifications
Ultra M XS Single VNF	15	1	3	3	8	Based on node type as described in Table 8: Hyper-Converged Ultra M Single and Multi-VNF UCS C240 Server Specifications by Node Type, on page 11.
Ultra M XS Multi-VNF	45	1	3	3*	38**	Based on node type as described in Table 8: Hyper-Converged Ultra M Single and Multi-VNF UCS C240 Server Specifications by Node Type, on page 11.

* 3 for the first VNF, 2 per each additional VNF.

** Supports a maximum of 4 VNFs.

VM Deployment per Node Type

Figure 2: VM Distribution on Server Nodes for Hyper-converged Ultra M Single VNF Models

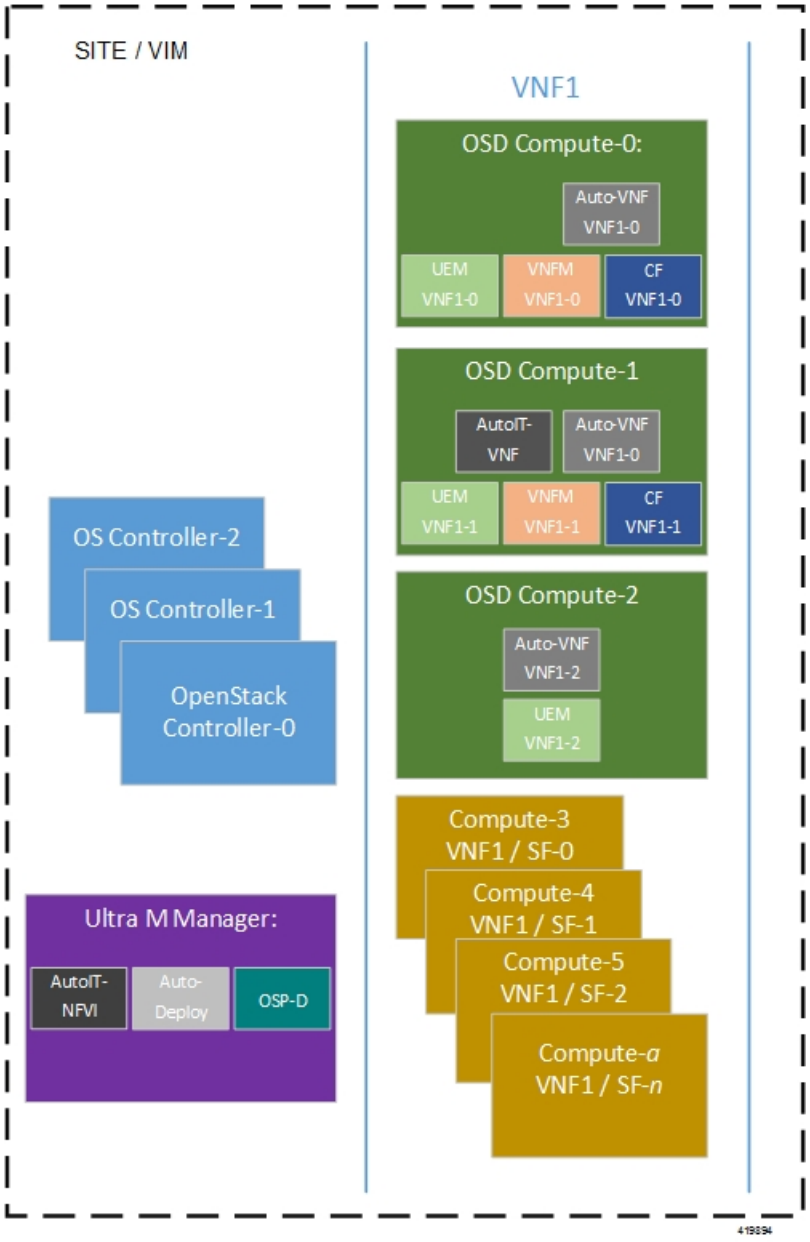
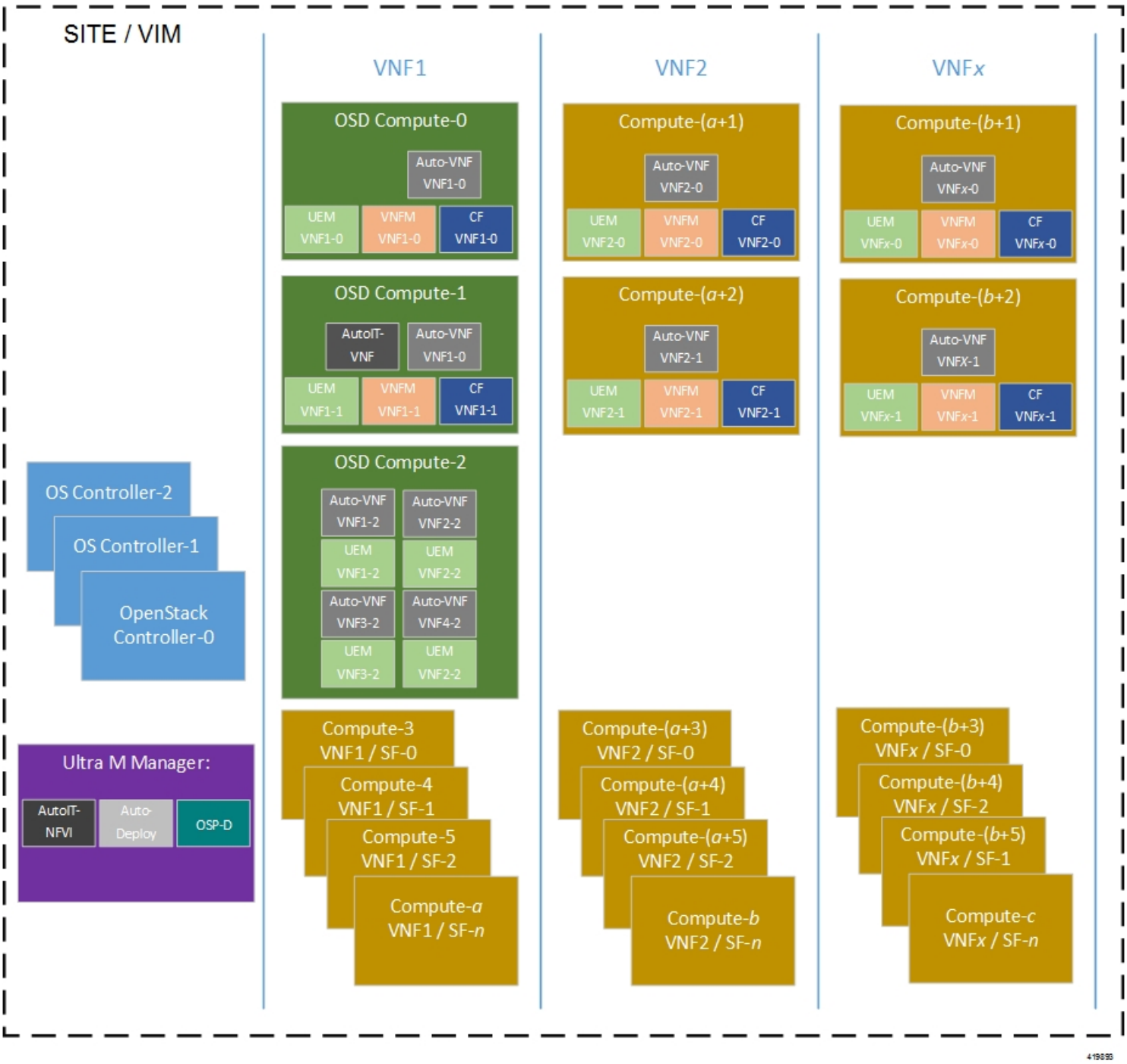


Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models


SITE / VIM
VNF1
VNF2
VNFx
OSD Compute-0
Auto-VNF VNF1-0
UEM VNF1-0
VNFM VNF1-0
CF VNF1-0
OSD Compute-1
AutoIT-VNF
Auto-VNF VNF1-0
UEM VNF1-1
VNFM VNF1-1
CF VNF1-1
OSD Compute-2
Auto-VNF VNF1-2
Auto-VNF VNF2-2
UEM VNF1-2
UEM VNF2-2
Auto-VNF VNF3-2
Auto-VNF VNF4-2
UEM VNF3-2
UEM VNF2-2
Compute-(a+1)
Auto-VNF VNF2-0
UEM VNF2-0
VNFM VNF2-0
CF VNF2-0
Compute-(a+2)
Auto-VNF VNF2-1
UEM VNF2-1
VNFM VNF2-1
CF VNF2-1
Compute-(b+1)
Auto-VNF VNFx-0
UEM VNFx-0
VNFM VNFx-0
CF VNFx-0
Compute-(b+2)
Auto-VNF VNFX-1
UEM VNFx-1
VNFM VNFx-1
CF VNFx-1
OS Controller-2
OS Controller-1
OpenStack Controller-0
Ultra M Manager:
AutoIT-NFVI
Auto-Deploy
OSP-D
Compute-3 VNF1 / SF-0
Compute-4 VNF1 / SF-1
Compute-5 VNF1 / SF-2
Compute-a VNF1 / SF-n
Compute-(a+3) VNF2 / SF-0
Compute-(a+4) VNF2 / SF-1
Compute-(a+5) VNF2 / SF-2
Compute-b VNF2 / SF-n
Compute-(b+3) VNFx / SF-0
Compute-(b+4) VNFx / SF-2
Compute-(b+5) VNFx / SF-1
Compute-c VNFx / SF-n
419893

Server Configurations

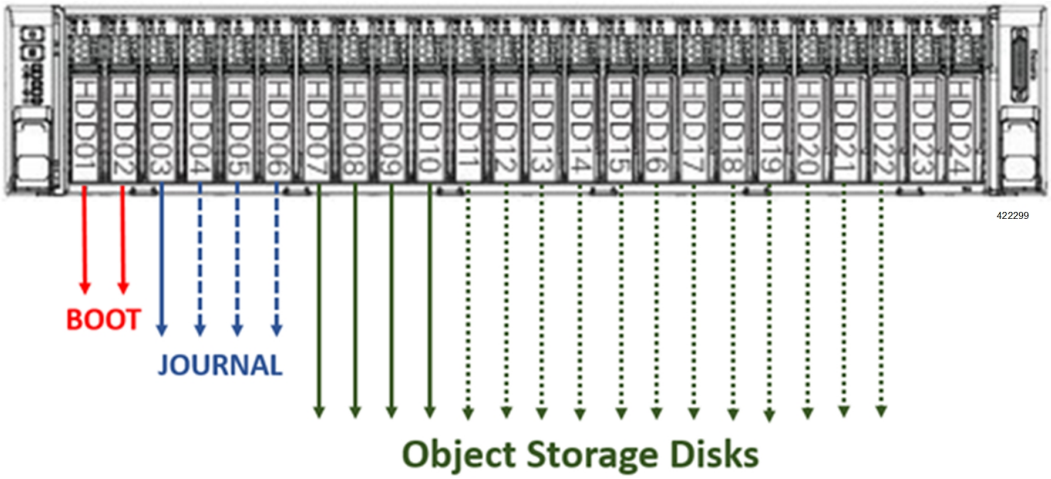
Table 8: Hyper-Converged Ultra M Single and Multi-VNF UCS C240 Server Specifications by Node Type

Node Type	CPU	RAM	Storage	Software Version	Firmware Version
Ultra M Manager Node*	2x 2.60 GHz	4x 32GB DDR4-2400-MHz RDIMM/PC4	2x 1.2 TB 12G SAS HDD	MLOM: 4.1(3a)	CIMC: 3.0(3e) System BIOS: C240M4.3.0.3c.0.0831170228
Controller	2x 2.60 GHz	4x 32GB DDR4-2400-MHz RDIMM/PC4	2x 1.2 TB 12G SAS HDD	MLOM: 4.1(3a)	CIMC: 3.0(3e) System BIOS: C240M4.3.0.3c.0.0831170228
Compute	2x 2.60 GHz	8x 32GB DDR4-2400-MHz RDIMM/PC4	2x 1.2 TB 12G SAS HDD	MLOM: 4.1(3a)	CIMC: 3.0(3e) System BIOS: C240M4.3.0.3c.0.0831170228
OSD Compute	2x 2.60 GHz	8x 32GB DDR4-2400-MHz RDIMM/PC4	4x 1.2 TB 12G SAS HDD 2x 300G 12G SAS HDD HDD 1x 480G 6G SAS SATA SSD	MLOM: 4.1(3a)	CIMC: 3.0(3e) System BIOS: C240M4.3.0.3c.0.0831170228
* OSP-D is deployed as a VM on the Ultra M Manager Node for Hyper-Converged Ultra M model(s).					

Storage

Figure 4: UCS C240 Front-Plane, on page 12 displays the storage disk layout for the UCS C240 series servers used in the Ultra M solution.

Figure 4: UCS C240 Front-Plane



NOTES:

- The Boot disks contain the operating system (OS) image with which to boot the server.
- The Journal disks contain the Ceph journal file(s) used to repair any inconsistencies that may occur in the Object Storage Disks.
- The Object Storage Disks store object data for USP-based VNFs.
- Ensure that the HDD and SSD used for the Boot Disk, Journal Disk, and object storage devices (OSDs) are available as per the Ultra M BoM and installed in the appropriate slots as identified in Table 9: UCS C240 M4S SFF Storage Specifications by Node Type, on page 12.

Table 9: UCS C240 M4S SFF Storage Specifications by Node Type

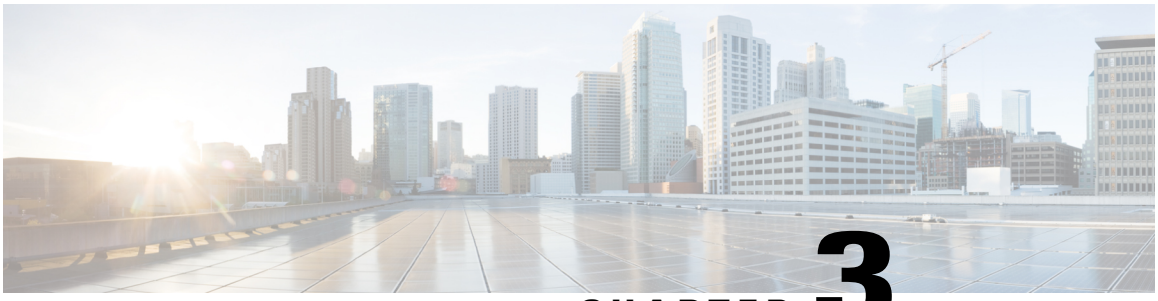
Ultra M Manager Node and Staging Server:	2 x 1.2 TB HDD – For Boot OS configured as Virtual Drive in RAID1 – placed on Slots 1 & 2
Controllers, Computes:	2 x 1.2 TB HDD – For Boot OS configured as Virtual Drive in RAID1 – placed on Slots 1 & 2

OSD Computes:	2 x 300 GB HDD – For Boot OS configured as Virtual Drive in RAID1 – placed on Slots 1 & 2 1 x 480 GB SSD – For Journal Disk as Virtual Drive in RAID0 – Slot 3 (Reserve for SSD Slot 3,4,5,6 future scaling needs) 4 x 1.2 TB HDD – For OSD's configured as Virtual Drive in RAID0 each – Slot 7,8,9,10 (Reserve for OSD 7,8,9,10….,24)

- Ensure that the RAIDs are sized such that:

  Boot Disks < Journal Disk(s) < OSDs

- Ensure that FlexFlash is disabled on each UCS-C240 M4 (default Factory).
- Ensure that all nodes are in *Unconfigured Good* state under **Cisco SAS RAID Controllers** (factory default).

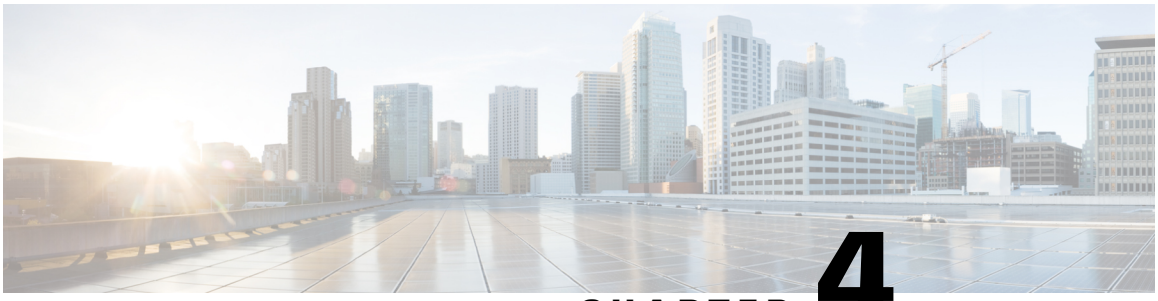


CHAPTER 3

Software Specifications

Table 10: Required Software

Software	Value/Description
Operating System	Red Hat Enterprise Linux 7.3
Hypervisor	Qemu (KVM)
VIM	**Hyper-converged Ultra M Single and Multi-VNF Models:** Red Hat OpenStack Platform 10 (OSP 10 - Newton)
VNF	21.4
VNFM	ESC 3.1.0.116
UEM	UEM 5.7
USP	USP 5.7



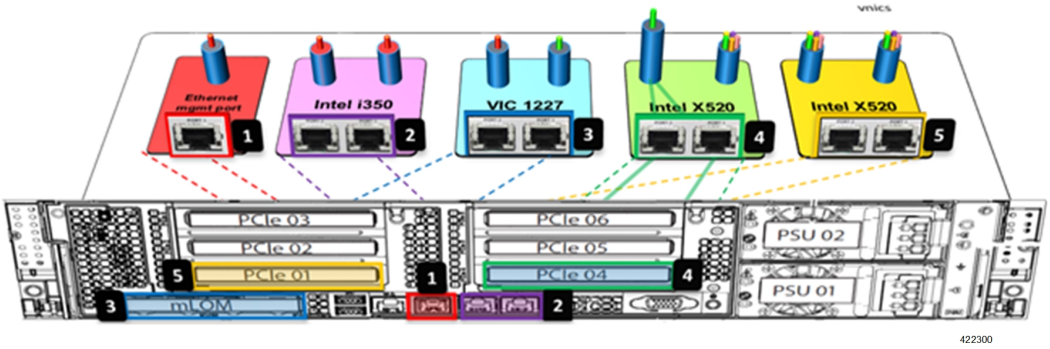
CHAPTER 4

Networking Overview

This section provides information on Ultra M networking requirements and considerations.

UCS-C240 Network Interfaces

Figure 5: UCS-C240 Back-Plane



Number	Designation	Description	Applicable Node Types
1	CIMC/IPMI/M	The server's *Management* network interface used for accessing the UCS Cisco Integrated Management Controller (CIMC) application, performing Intelligent Platform Management Interface (IPMI) operations.	All
2	Intel Onboard	Port 1: VIM Orchestration (Undercloud) *Provisioning* network interface.	All
		Port 2: *External* network interface for Internet access. It must also be routable to External floating IP addresses on other nodes.	Ultra M Manager Node Staging Server

Number	Designation	Description	Applicable Node Types
3	Modular LAN on Motherboard (mLOM)	VIM networking interfaces used for:	
		• External floating IP network.	Controller
		• Internal API network	Controller
		• Storage network	Controller Compute OSD Compute Ceph
		• Storage Management network	Controller Compute OSD Compute Ceph
		• Tenant network (virtio only – VIM provisioning, VNF Management, and VNF Orchestration)	Controller Compute OSD Compute
4	PCIe 4	Port 1: With NIC bonding enabled, this port provides the active Service network interfaces for VNF ingress and egress connections.	Compute
		Port 2: With NIC bonding enabled, this port provides the standby *Di-internal* network interface for inter-VNF component communication.	Compute OSD Compute

Number	Designation	Description	Applicable Node Types
5	PCIe 1	Port 1: With NIC bonding enabled, this port provides the active *Di-internal* network interface for inter-VNF component communication.	Compute OSD Compute
		Port 2: With NIC bonding enabled, this port provides the standby Service network interfaces for VNF ingress and egress connections.	Compute

VIM Network Topology

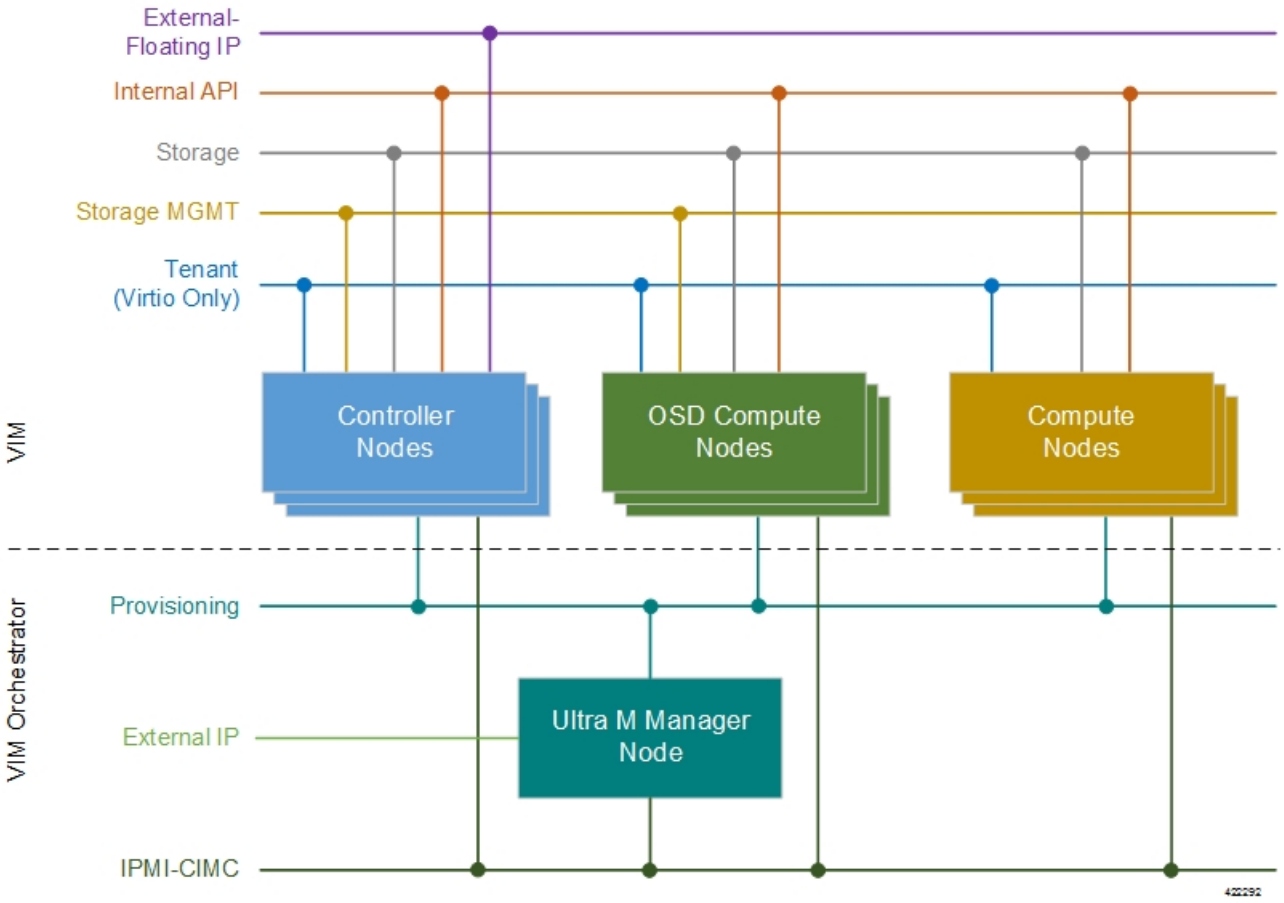
Ultra M's VIM is based on the OpenStack project TripleO ("OpenStack-On-OpenStack") which is the core of the OpenStack Platform Director (OSP-D). TripleO allows OpenStack components to install a fully operational OpenStack environment.

Two cloud concepts are introduced through TripleO:

- **VIM Orchestrator (Undercloud)**: The VIM Orchestrator is used to bring up and manage the VIM. Though OSP-D and Undercloud are sometimes referred to synonymously, the OSP-D bootstraps the Undercloud deployment and provides the underlying components (e.g. Ironic, Nova, Glance, Neutron, etc.) leveraged by the Undercloud to deploy the VIM. Within the Ultra M Solution, OSP-D and the Undercloud are hosted on the same server.

- **VIM (Overcloud)**: The VIM consists of the compute, controller, and storage nodes on which the VNFs are deployed.

Figure 6: Hyper-converged Ultra M Single and Multi-VNF Model OpenStack VIM Network Topology



Some considerations for VIM Orchestrator and VIM deployment are as follows:

- External network access (e.g. Internet access) can be configured in one of the following ways:
  - Across all node types: A single subnet is configured on the Controller HA, VIP address, floating IP addresses and OSP-D/Staging server's external interface provided that this network is data-center routable as well as it is able to reach the internet.
  - Limited to OSP-D: The *External IP* network is used by Controllers for HA and Horizon dashboard as well as later on for Tenant Floating IP address requirements. This network must be data-center routable. In addition, the *External IP* network is used only by OSP-D/Staging Server node's external interface that has a single IP address. The *External IP* network must be lab/data-center routable must also have internet access to Red Hat cloud. It is used by OSP-D/Staging Server for subscription purposes and also acts as an external gateway for all controllers, computes and Ceph-storage nodes.
- IPMI must be enabled on all nodes.
- Two networks are needed to deploy the VIM Orchestrator:

- IPMI/CIMC Network
- Provisioning Network

- The OSP-D/Staging Server must have reachability to both IPMI/CIMC and Provisioning Networks. (VIM Orchestrator networks need to be routable between each other or have to be in one subnet.)
- DHCP-based IP address assignment for Introspection PXE from Provisioning Network (Range A)
- DHCP based IP address assignment for VIM PXE from Provisioning Network (Range B) must be separate from Introspection.
- The Ultra M Manager Node/Staging Server acts as a gateway for Controller, Ceph and Computes. Therefore, the external interface of this node/server needs to be able to access the Internet. In addition, this interface needs to be routable with the Data-center network. This allows the External interface IP-address of the Ultra M Manager Node/Staging Server to reach Data-center routable Floating IP addresses as well as the VIP addresses of Controllers in HA Mode.
- Prior to assigning floating and virtual IP addresses, make sure that they are not already allocated through OpenStack. If the addresses are already allocated, then they must be freed up for use or you must assign a new IP address that is available in the VIM.
- Multiple VLANs are required in order to deploy OpenStack VIM:
  - 1 for the Management and Provisioning networks interconnecting all the nodes regardless of type
  - 1 for the Staging Server/OSP-D Node external network
  - 1 for Compute, Controller, and Ceph Storage or OSD Compute Nodes
  - 1 for Management network interconnecting the Leafs and Spines
- Login to individual Compute nodes will be from OSP-D/Staging Server using heat user login credentials.

  The OSP-D/Staging Server acts as a “jump server” where the br-ctlplane interface address is used to login to the Controller, Ceph or OSD Computes, and Computes post VIM deployment using heat-admin credentials.

Layer 1 networking guidelines for the VIM network are provided in Layer 1 Leaf and Spine Topology, on page 25. In addition, a template is provided in Network Definitions (Layer 2 and 3), on page 75 to assist you with your Layer 2 and Layer 3 network planning.

Openstack Tenant Networking

The interfaces used by the VNF are based on the PCIe architecture. Single root input/output virtualization (SR-IOV) is used on these interfaces to allow multiple VMs on a single server node to use the same network interface as shown in Figure 7: Physical NIC to Bridge Mappings, on page 23. SR-IOV Networking is network

type *Flat* under OpenStack configuration. NIC Bonding is used to ensure port level redundancy for PCIe Cards involved in SR-IOV Tenant Networks as shown in Figure 8: NIC Bonding, on page 23.

Figure 7: Physical NIC to Bridge Mappings

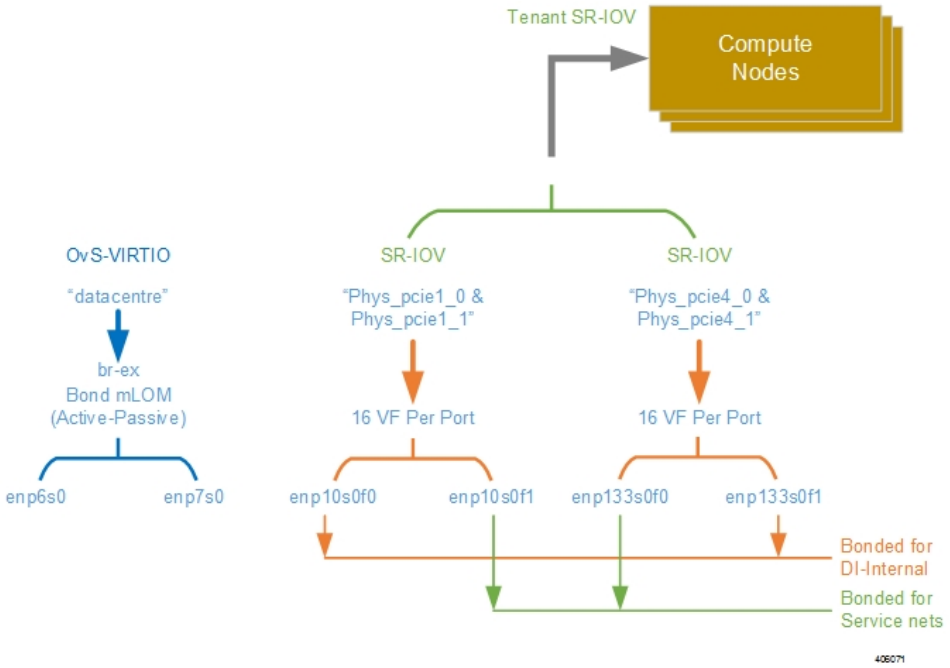
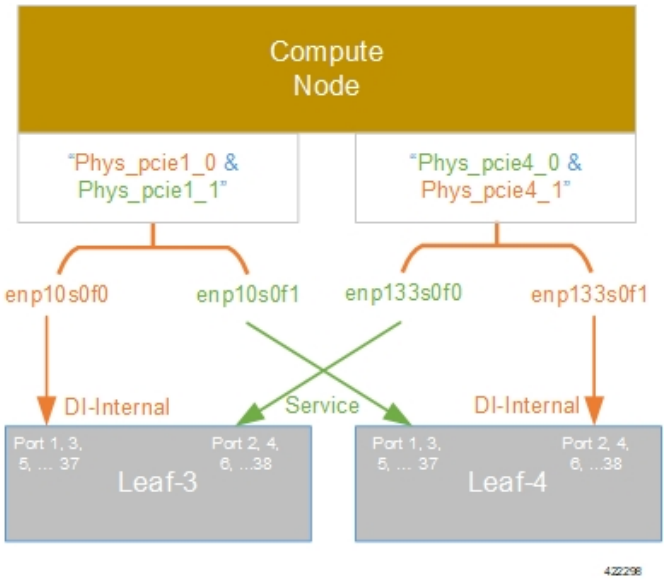


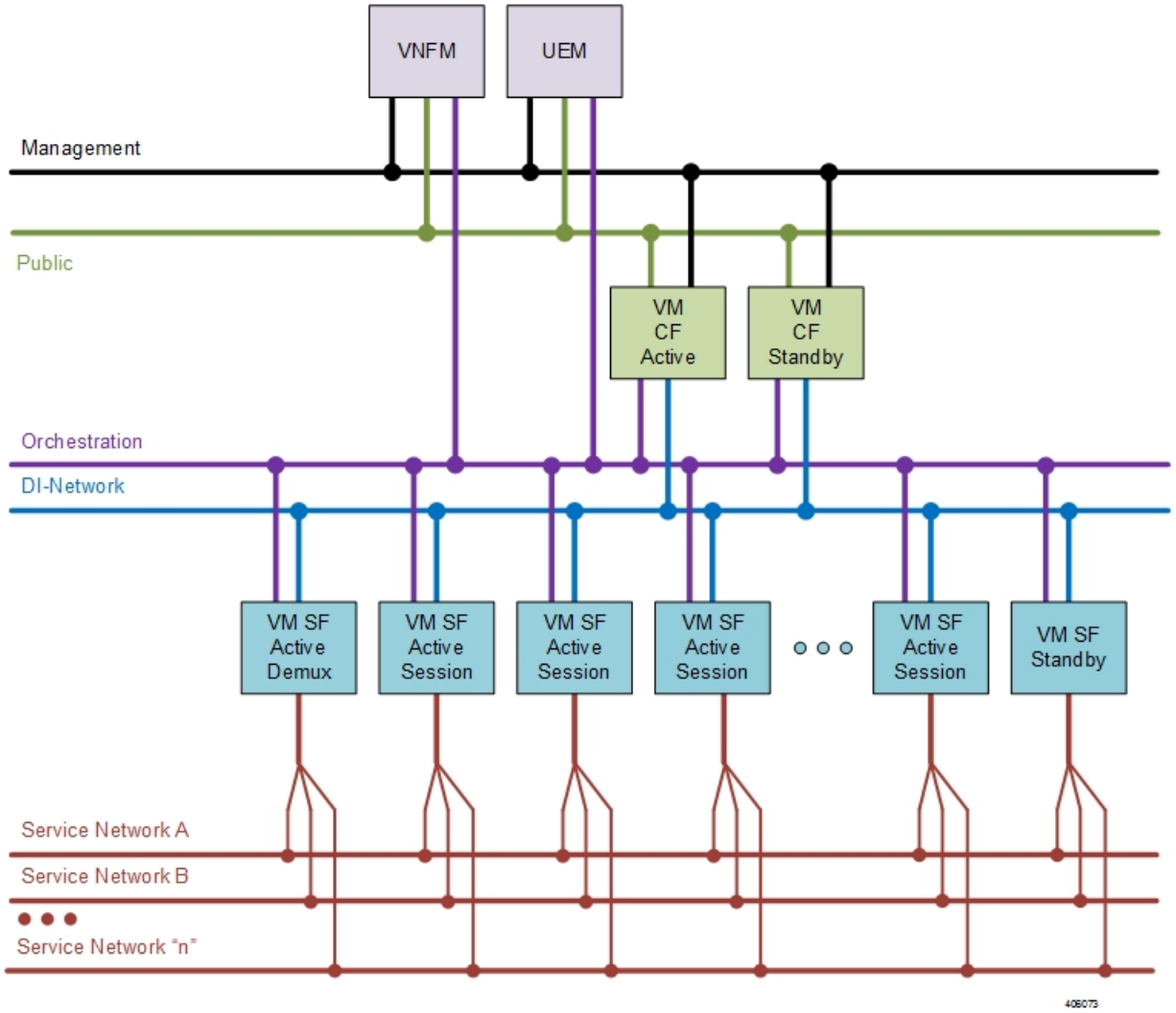
Figure 8: NIC Bonding



VNF Tenant Networks

While specific VNF network requirements are described in the documentation corresponding to the VNF, Figure 9: Typical USP-based VNF Networks, on page 24 displays the types of networks typically required by USP-based VNFs.

Figure 9: Typical USP-based VNF Networks



The USP-based VNF networking requirements and the specific roles are described here:

- **Public**: *External public network*. The router has an external gateway to the public network. All other networks (except DI-Internal and ServiceA-*n*) have an internal gateway pointing to the router. And the router performs secure network address translation (SNAT).
- **DI-Internal**: This is the DI-internal network which serves as a 'backplane' for CF-SF and CF-CF communications. Since this network is internal to the UGP, it does not have a gateway interface to the

router in the OpenStack network topology. A unique DI internal network must be created for each instance of the UGP. The interfaces attached to these networks use performance optimizations.

- **Management**: This is the local management network between the CFs and other management elements like the UEM and VNFM. This network is also used by OSP-D to deploy the VNFM and AutoVNF. To allow external access, an OpenStack floating IP address from the Public network must be associated with the UGP VIP (CF) address.

  You can ensure that the same floating IP address can assigned to the CF, UEM, and VNFM after a VM restart by configuring parameters in the AutoDeploy configuration file or the UWS service delivery configuration file.

  Note Prior to assigning floating and virtual IP addresses, make sure that they are not already allocated through OpenStack. If the addresses are already allocated, then they must be freed up for use or you must assign a new IP address that is available in the VIM.

- **Orchestration**: This is the network used for VNF deployment and monitoring. It is used by the VNFM to onboard the USP-based VNF.
- **ServiceA-*n***: These are the service interfaces to the SF. Up to 12 service interfaces can be provisioned for the SF with this release. The interfaces attached to these networks use performance optimizations.

  Layer 1 networking guidelines for the VNF network are provided in Layer 1 Leaf and Spine Topology, on page 25. In addition, a template is provided in Network Definitions (Layer 2 and 3), on page 75 to assist you with your Layer 2 and Layer 3 network planning.

Supporting Trunking on VNF Service ports

Service ports within USP-based VNFs are configured as trunk ports and traffic is tagged using the VLAN command. In This configuration is supported by trunking to the uplink switch via the *sriovnicswitch mechanism* driver.

This driver supports Flat network types in OpenStack, enabling the guest OS to tag the packets.

Flat networks are untagged networks in OpenStack. Typically, these networks are previously existing infrastructure, where OpenStack guests can be directly applied.

Layer 1 Leaf and Spine Topology

Ultra M implements a Leaf and Spine network topology. Topology details differ between Ultra M models based on the scale and number of nodes.

Note When connecting component network ports, ensure that the destination ports are rated at the same speed as the source port (e.g. connect a 10G port to a 10G port). Additionally, the source and destination ports must support the same physical medium (e.g. Ethernet) for interconnectivity.

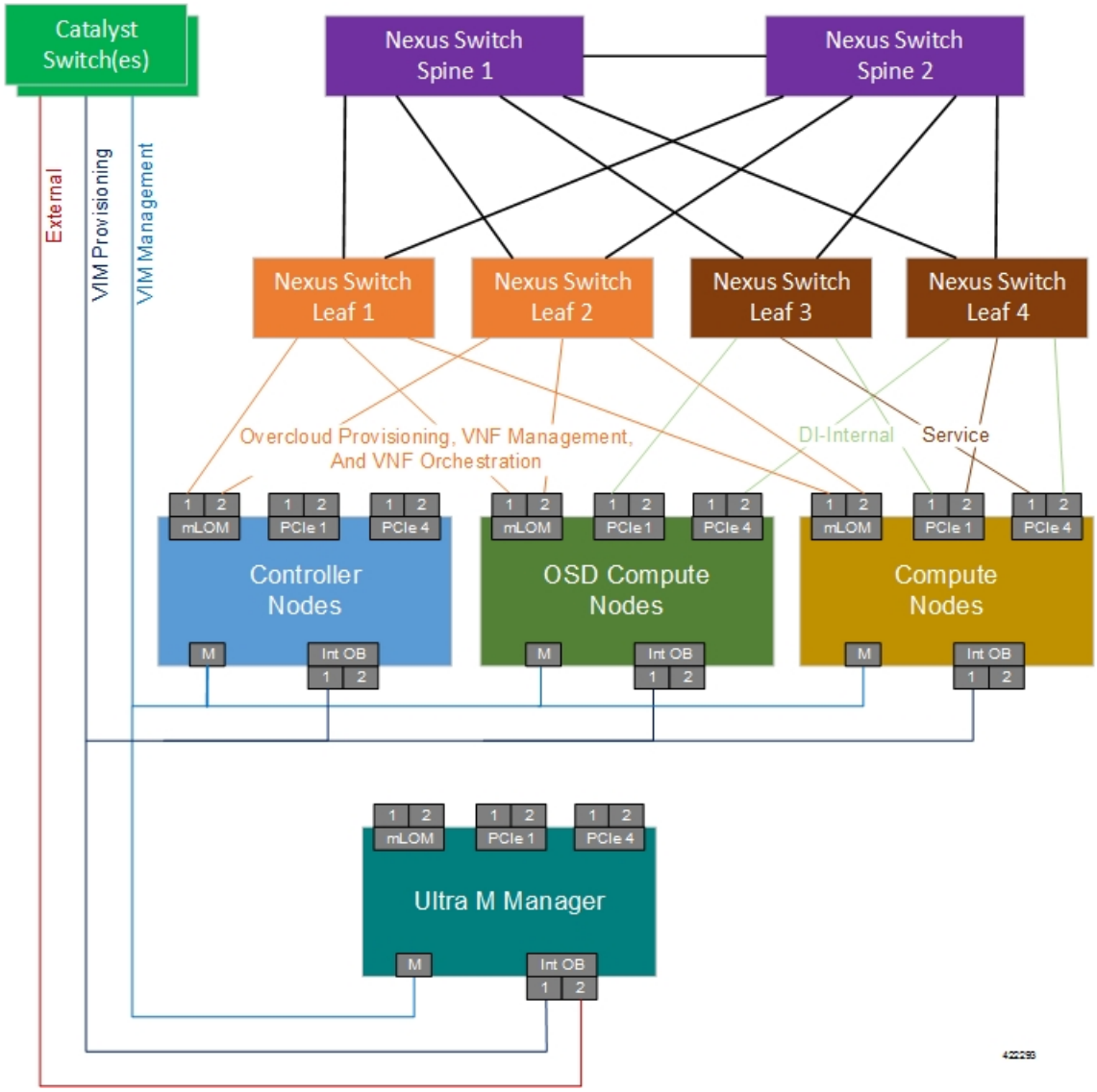
Hyper-converged Ultra M Single and Multi-VNF Model Network Topology

Figure 10: Hyper-converged Ultra M Single and Multi-VNF Leaf and Spine Topology, on page 26 illustrates the logical leaf and spine topology for the various networks required for the Hyper-converged Ultra M models.

In this figure, two VNFs are supported. (Leafs 1 and 2 pertain to VNF1, Leafs 3 and 4 pertain to VNF 2). If additional VNFs are supported, additional Leafs are required (e.g. Leafs 5 and 6 are needed for VNF 3, Leafs 7 and 8 for VNF4). Each set of additional Leafs would have the same meshed network interconnects with the Spines and with the Controller, OSD Compute, and Compute Nodes.

For single VNF models, Leaf 1 and Leaf 2 facilitate all of the network interconnects from the server nodes and from the Spines.

Figure 10: Hyper-converged Ultra M Single and Multi-VNF Leaf and Spine Topology



As identified in Cisco Nexus Switches, on page 6, the number of leaf and spine switches differ between the Ultra M models. Similarly, the specific leaf and spine ports used also depend on the Ultra M solution model being deployed. That said, general guidelines for interconnecting the leaf and spine switches in an Ultra M XS multi-VNF deployment are provided in Table 11: Catalyst Management Switch 1 (Rack 1) Port Interconnects, on page 27 through Table 20: Spine 2 Port Interconnect Guidelines, on page 38. Using the information in these tables, you can make appropriate adjustments to your network topology based on your deployment scenario (e.g. number of VNFs and number of Compute Nodes).

Table 11: Catalyst Management Switch 1 (Rack 1) Port Interconnects

From Switch Port(s)	To			Notes
	Device	Network	Port(s)	
1, 2, 11	OSD Compute Nodes	Management	CIMC	3 non-sequential ports - 1 per OSD Compute Node
3-10	Compute Nodes	Management	CIMC	6 sequential ports - 1 per Compute Node
12	Ultra M Manager Node	Management	CIMC	Management Switch 1 only
13	Controller 0	Management	CIMC	
21, 22, 31	OSD Compute Nodes	Provisioning	Mgmt	3 non-sequential ports - 1 per OSD Compute Node
23-30	Compute Nodes	Provisioning	Mgmt	6 sequential ports - 1 per Compute Node
32-33	Ultra M Manager Node	Provisioning	Mgmt	2 sequential ports
34	Controller 0	Management	CIMC	
47	Leaf 1	Management	48	Switch port 47 connects with Leaf 1 port 48
48	Leaf 2	Management	48	Switch port 48 connects with Leaf 2 port 48

Table 12: Catalyst Management Switch 2 (Rack 2) Port Interconnects

From Switch Port(s)	To			Notes
	Device	Network	Port(s)	
1-10	Compute Nodes	Management	CIMC	10 sequential ports - 1 per Compute Node

From Switch Port(s)	To			Notes
	Device	Network	Port(s)	
14	Controller 1	Management	CIMC	
15	Controller 2	Management	CIMC	
21-30	Compute Nodes	Provisioning	Mgmt	10 sequential ports - 1 per Compute Node
35	Controller 1	Provisioning	Mgmt	
36	Controller 2	Provisioning	Mgmt	
47	Leaf 3	Management	48	Switch port 47 connects with Leaf 3 port 48
48	Leaf 4	Management	48	Switch port 48 connects with Leaf 4 port 48

Table 13: Catalyst Management Switch 3 (Rack 3) Port Interconnects

From Switch Port(s)	To			Notes
	Device	Network	Port(s)	
1-10	Compute Nodes	Management	CIMC	10 sequential ports - 1 per Compute Node
21-30	Compute Nodes	Provisioning	Mgmt	10 sequential ports - 1 per Compute Node
47	Leaf 5	Management	48	Switch port 47 connects with Leaf 5 port 48
48	Leaf 6	Management	48	Switch port 48 connects with Leaf 6 port 48

Table 14: Catalyst Management Switch 4 (Rack 4) Port Interconnects

From Switch Port(s)	To			Notes
	Device	Network	Port(s)	
1-10	Compute Nodes	Management	CIMC	10 sequential ports - 1 per Compute Node

From Switch Port(s)	To			Notes
	Device	Network	Port(s)	
21-30	Compute Nodes	Provisioning	Mgmt	10 sequential ports - 1 per Compute Node
47	Leaf 7	Management	48	Switch port 47 connects with Leaf 7 port 48
48	Leaf 8	Management	48	Switch port 48 connects with Leaf 8 port 48

Table 15: Leaf 1 and 2 (Rack 1) Port Interconnects*

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
Leaf 1				
1, 2, 11	OSD Compute Nodes	Management & Orchestration (active)	MLOM P1	3 non-sequential ports - 1 per OSD Compute Node
12	Controller 0 Node	Management & Orchestration (active)	MLOM P1	
17, 18, 27	OSD Compute Nodes	Di-internal (active)	PCIe01 P1	3 non-sequential ports - 1 per OSD Compute Node
3 - 10 (inclusive)	Compute Nodes	Management & Orchestration (active)	MLOM P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
19-26 (inclusive)	Compute Nodes	Di-internal (active)	PCIe01 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
33-42 (inclusive)	Compute Nodes / OSD Compute Nodes	Service (active)	PCIe04 P1	Sequential ports based on the number of Compute Nodes and/or OSD Compute Nodes - 1 per OSD Compute Node and/or Compute Node **Note** Though the OSD Compute Nodes do not use the Service Networks, they are provided to ensure compatibility within the OpenStack Overcloud (VIM) deployment.

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
48	Catalyst Management Switches	Management	47	Leaf 1 connects to Switch 1
49-50	Spine 1	Downlink	1-2	Leaf 1 port 49 connects to Spine 1 port 1 Leaf 1 port 50 connects to Spine 1 port 2
51-52	Spine 2	Downlink	3-4	Leaf 1 port 51 connects to Spine 2 port 3 Leaf 1 port 52 connects to Spine 2 port 4
Leaf 2				
1, 2, 11	OSD Compute Nodes	Management & Orchestration (redundant)	MLOM P2	3 non-sequential ports - 1 per OSD Compute Node
12	Controller 0 Node	Management & Orchestration (redundant)	MLOM P2	
17, 18, 27	OSD Compute Nodes	Di-internal (redundant)	PCIe04 P2	3 non-sequential ports - 1 per OSD Compute Node
3 - 10 (inclusive)	Compute Nodes	Management & Orchestration (redundant)	MLOM P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
19-26 (inclusive)	Compute Nodes	Di-internal (redundant)	PCIe04 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
33-42 (inclusive)	Compute Nodes / OSD Compute Nodes	Service (redundant)	PCIe01 P2	Sequential ports based on the number of Compute Nodes and/or OSD Compute Nodes - 1 per OSD Compute Node and/or Compute Node **Note** Though the OSD Compute Nodes do not use the Service Networks, they are provided to ensure compatibility within the OpenStack Overcloud (VIM) deployment.
48	Catalyst Management Switches	Management	48	Leaf 2 connects to Switch 1

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
49-50	Spine 1	Downlink	1-2	Leaf 2 port 49 connects to Spine 1 port 1 Leaf 2 port 50 connects to Spine 1 port 2
51-52	Spine 2	Downlink	3-4, 7-8, 11-12, 15-16	Leaf 2 port 51 connects to Spine 2 port 3 Leaf 2 port 52 connects to Spine 2 port 4

Table 16: Leaf 3 and 4 (Rack 2) Port Interconnects

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
Leaf 3				
1 - 10 (inclusive)	Compute Nodes	Management & Orchestration (active)	MLOM P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 1 and 2 are used for the first two Compute Nodes on VNFs other than VNF1 (Rack 1). These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
13-14 (inclusive)	Controller Nodes	Management & Orchestration (active)	MLOM P1	Leaf 3 port 13 connects to Controller 1 MLOM P1 port Leaf 3 port 14 connects to Controller 1 MLOM P1 port
17-26 (inclusive)	Compute Nodes	Di-internal (active)	PCIe01 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 17 and 18 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
33-42 (inclusive)	Compute Nodes	Service (active)	PCIe04 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
48	Catalyst Management Switches	Management	47	Leaf 3 connects to Switch 2
49-50	Spine 1	Downlink	5-6	Leaf 3 port 49 connects to Spine 1 port 5 Leaf 3 port 50 connects to Spine 1 port 6
51-52	Spine 2	Downlink	7-8	Leaf 3 port 51 connects to Spine 2 port 7 Leaf 3 port 52 connects to Spine 2 port 8
Leaf 4				
1 - 10 (inclusive)	Compute Nodes	Management & Orchestration (redundant)	MLOM P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 1 and 2 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
13-14 (inclusive)	Controller Nodes	Management & Orchestration (redundant)	MLOM P2	Leaf 4 port 13 connects to Controller 1 MLOM P2 port Leaf 4 port 14 connects to Controller 1 MLOM P2 port
17-26 (inclusive)	Compute Nodes	Di-internal (redundant)	PCIe04 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 17 and 18 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
33-42 (inclusive)	Compute Nodes	Service (redundant)	PCIe01 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
48	Catalyst Management Switches	Management	48	Leaf 4 connects to Switch 2
49-50	Spine 1	Downlink	5-6	Leaf 4 port 49 connects to Spine 1 port 5 Leaf 4 port 50 connects to Spine 1 port 6
51-52	Spine 2	Downlink	7-8	Leaf 4 port 51 connects to Spine 2 port 7 Leaf 4 port 52 connects to Spine 2 port 8

Table 17: Leaf 5 and 6 (Rack 3) Port Interconnects

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
Leaf 5				
1 - 10 (inclusive)	Compute Nodes	Management & Orchestration (active)	MLOM P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 1 and 2 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
17-26 (inclusive)	Compute Nodes	Di-internal (active)	PCIe01 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 17 and 18 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
33-42 (inclusive)	Compute Nodes	Service (active)	PCIe04 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
48	Catalyst Management Switches	Management	47	Leaf 5 connects to Switch 3
49-50	Spine 1	Downlink	9-10	Leaf 5 port 49 connects to Spine 1 port 9 Leaf 5 port 50 connects to Spine 1 port 10
51-52	Spine 2	Downlink	3-4, 7-8, 11-12, 15-16	Leaf 5 port 51 connects to Spine 2 port 11 Leaf 5 port 52 connects to Spine 2 port 12
Leaf 6				
1 - 10 (inclusive)	Compute Nodes	Management & Orchestration (redundant)	MLOM P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 1 and 2 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
17-26 (inclusive)	Compute Nodes	Di-internal (redundant)	PCIe04 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 17 and 18 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
33-42 (inclusive)	Compute Nodes	Service (redundant)	PCIe01 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
48	Catalyst Management Switches	Management	48	Leaf 6 connects to Switch 3
49-50	Spine 1	Downlink	9-10	Leaf 6 port 49 connects to Spine 1 port 9 Leaf 6 port 50 connects to Spine 1 port 10

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
51-52	Spine 2	Downlink	11-12	Leaf 6 port 51 connects to Spine 2 port 11 Leaf 6 port 52 connects to Spine 2 port 12

Table 18: Leaf 7 and 8 (Rack 4) Port Interconnects

From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
Leaf 7				
1 - 10 (inclusive)	Compute Nodes	Management & Orchestration (active)	MLOM P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 1 and 2 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
17-26 (inclusive)	Compute Nodes	Di-internal (active)	PCIe01 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 17 and 18 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
33-42 (inclusive)	Compute Nodes	Service (active)	PCIe04 P1	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
48	Catalyst Management Switches	Management	47	Leaf 7 connects to Switch 4
49-50	Spine 1	Downlink	13-14	Leaf 7 port 49 connects to Spine 1 port 13 Leaf 7 port 50 connects to Spine 1 port 14

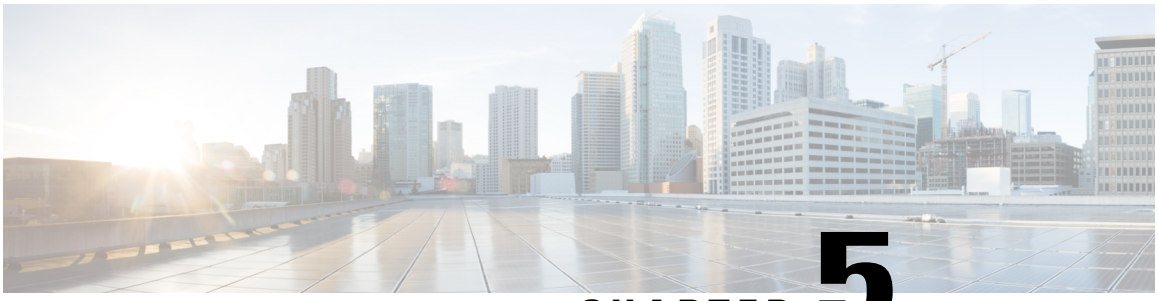
From Leaf Port(s)	To			Notes
	Device	Network	Port(s)	
51-52	Spine 2	Downlink	15-16	Leaf 7 port 51 connects to Spine 2 port 15 Leaf 7 port 52 connects to Spine 2 port 16
Leaf 8				
1 - 10 (inclusive)	Compute Nodes	Management & Orchestration (redundant)	MLOM P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 1 and 2 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
17-26 (inclusive)	Compute Nodes	Di-internal (redundant)	PCIe04 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node **Note** Leaf Ports 17 and 18 are used for the first two Compute Nodes on VNFs other than VNF1. These are used to host management-related VMs as shown in Figure 3: VM Distribution on Server Nodes for Hyper-converged Ultra M Multi-VNF Models, on page 9.
33-42 (inclusive)	Compute Nodes	Service (redundant)	PCIe01 P2	Sequential ports based on the number of Compute Nodes - 1 per Compute Node
48	Catalyst Management Switches	Management	48	Leaf 8 connects to Switch 4
49-50	Spine 1	Downlink	13-14	Leaf 8 port 49 connects to Spine 1 port 13 Leaf 8 port 50 connects to Spine 1 port 14
51-52	Spine 2	Downlink	15-16	Leaf 8 port 51 connects to Spine 2 port 15 Leaf 8 port 52 connects to Spine 2 port 16

Table 19: Spine 1 Port Interconnect Guidelines

From Spine Port(s)	To			Notes
	Device	Network	Port(s)	
1-2, 5-6, 9-10, 13-14	Leaf 1, 3, 5, 7	Downlink	49-50	Spine 1 ports 1 and 2 connect to Leaf 1 ports 49 and 50 Spine 1 ports 5 and 6 connect to Leaf 3 ports 49 and 50 Spine 1 ports 9 and 10 connect to Leaf 5 ports 49 and 50 Spine 1 ports 13 and 14 connect to Leaf 7 ports 49 and 50
3-4, 7-8, 11-12, 15-16	Leaf 2, 4, 6, 8	Downlink	49-50	Spine 1 ports 3 and 4 connect to Leaf 2 ports 49 and 50 Spine 1 ports 7 and 8 connect to Leaf 4 ports 49 and 50 Spine 1 ports 11 and 12 connect to Leaf 6 ports 49 and 50 Spine 1 ports 15 and 16 connect to Leaf 8 ports 49 and 50
29-30, 31, 32, 33-34	Spine 2	Interlink	29-30, 31, 32, 33-34	Spine 1 ports 29-30 connect to Spine 2 ports 29-30 Spine 1 port 31 connects to Spine 2 port 31 Spine 1 port 32 connects to Spine 2 port 32 Spine 1 ports 33-34 connect to Spine 2 ports 33-34
21-22, 23-24, 25-26	Router	Uplink	-	

Table 20: Spine 2 Port Interconnect Guidelines

From Spine Port(s)	To			Notes
	Device	Network	Port(s)	
1-2, 5-6, 9-10, 13-14	Leaf 1, 3, 5, 7	Downlink	51-52	Spine 1 ports 1 and 2 connect to Leaf 1 ports 51 and 52 Spine 1 ports 5 and 6 connect to Leaf 3 ports 51 and 52 Spine 1 ports 9 and 10 connect to Leaf 5 ports 51 and 52 Spine 1 ports 13 and 14 connect to Leaf 7 ports 51 and 52
3-4, 7-8, 11-12, 15-16	Leaf 2, 4, 6, 8	Downlink	51-52	Spine 1 ports 3 and 4 connect to Leaf 2 ports 51 and 52 Spine 1 ports 7 and 8 connect to Leaf 4 ports 51 and 52 Spine 1 ports 11 and 12 connect to Leaf 6 ports 51 and 52 Spine 1 ports 15 and 16 connect to Leaf 8 ports 51 and 52
29-30, 31, 32, 33-34	Spine 1	Interconnect	29-30, 31, 32, 33-34	Spine 2 ports 29-30 connect to Spine 1 ports 29-30 Spine 2 port 31 connects to Spine 1 port 31 Spine 2 port 32 connects to Spine 1 port 32 Spine 2 ports 33-34 connect to Spine 1 ports 33-34
21-22, 23-24, 25-26	Router	Uplink	-	



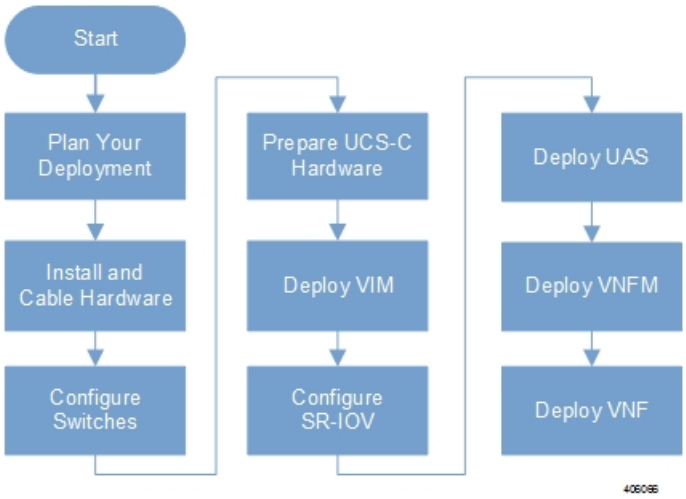
CHAPTER 5

Deploying the Ultra M Solution

Ultra M is a multi-product solution. Detailed instructions for installing each of these products is beyond the scope of this document. Instead, the sections that follow identify the specific, non-default parameters that must be configured through the installation and deployment of those products in order to deploy the entire solution.

Deployment Workflow

Figure 11: Ultra M Deployment Workflow



Plan Your Deployment

Before deploying the Ultra M solution, it is very important to develop and plan your deployment.

Network Planning

Networking Overview, on page 17 provides a general overview and identifies basic requirements for networking the Ultra M solution.

With this background, use the tables in Network Definitions (Layer 2 and 3), on page 75 to help plan the details of your network configuration.

Install and Cable the Hardware

This section describes the procedure to install all the components included in the Ultra M Solution.

Related Documentation

To ensure hardware components of the Ultra M solution are installed properly, refer to the installation guides for the respective hardware components.

- **Catalyst 2960-XR Switch —** http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst2960xr/hardware/installation/guide/b_c2960xr_hig.html

- **Catalyst 3850 48T-S Switch —** http://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3850/hardware/installation/guide/b_c3850_hig.html
- **Nexus 93180-YC 48 Port —** http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/hw/n93180ycex_hig/guide/b_n93180ycex_nxos_mode_hardware_install_guide.html
- **Nexus 9236C 36 Port —** http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/hw/n9236c_hig/guide/b_c9236c_nxos_mode_hardware_install_guide.html
- **UCS C240 M4SX Server —** http://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/hw/C240M4/install/C240M4.html

Rack Layout

Hyper-converged Ultra M XS Single VNF Deployment

Table 21: Hyper-converged Ultra M XS Single VNF Deployment Rack Layout, on page 41 provides details for the recommended rack layout for the Hyper-converged Ultra M XS Single VNF deployment model.

Table 21: Hyper-converged Ultra M XS Single VNF Deployment Rack Layout

	Rack #1	Rack #2
RU-1	Empty	Empty
RU-2	Spine EOR Switch A: Nexus 9236C	Spine EOR Switch B: Nexus 9236C
RU-3	Empty	Empty
RU-4	VNF Mgmt Switch: Catalyst C3850-48T-S OR C2960XR-48TD	Empty
RU-5	VNF Leaf TOR Switch A: Nexus 93180YC-EX	Empty
RU-6	VNF Leaf TOR Switch B: Nexus 93180YC-EX	Empty
RU-7/8	Ultra VNF-EM 1A: UCS C240 M4 SFF	Empty
RU-9/10	Ultra VNF-EM 1B: UCS C240 M4 SFF	Empty
RU-11/12	Empty	Empty
RU-13/14	Demux SF: UCS C240 M4 SFF	Empty
RU-15/16	Standby SF: UCS C240 M4 SFF	Empty
RU-17/18	Active SF 1: UCS C240 M4 SFF	Empty

	Rack #1	Rack #2
RU-19/20	Active SF 2: UCS C240 M4 SFF	Empty
RU-21/22	Active SF 3: UCS C240 M4 SFF	Empty
RU-23/24	Active SF 4: UCS C240 M4 SFF	Empty
RU-25/26	Active SF 5: UCS C240 M4 SFF	Empty
RU-27/28	Active SF 6: UCS C240 M4 SFF	Empty
RU-29/30	Empty	Empty
RU-31/32	Empty	Empty
RU-33/34	Empty	Empty
RU-35/36	Ultra VNF-EM 1C	OpenStack Control C: UCS C240 M4 SFF
RU-37/38	Ultra M Manager: UCS C240 M4 SFF	Empty
RU-39/40	OpenStack Control A: UCS C240 M4 SFF	OpenStack Control B: UCS C240 M4 SFF
RU-41/42	Empty	Empty
Cables	Controller Rack Cables	Controller Rack Cables
Cables	Spine Uplink/Interconnect Cables	Spine Uplink/Interconnect Cables
Cables	Leaf TOR To Spine Uplink Cables	Empty
Cables	VNF Rack Cables	Empty

Hyper-converged Ultra M XS Multi-VNF Deployment

Table 22: Hyper-converged Ultra M XS Multi-VNF Deployment Rack Layout, on page 42 provides details for the recommended rack layout for the Hyper-converged Ultra M XS Multi-VNF deployment model.

Table 22: Hyper-converged Ultra M XS Multi-VNF Deployment Rack Layout

	Rack #1	Rack #2	Rack #3	Rack #4
RU-1	Empty	Empty	Empty	Empty

	Rack #1	Rack #2	Rack #3	Rack #4
RU-2	Spine EOR Switch A: Nexus 9236C	Spine EOR Switch B: Nexus 9236C	Empty	Empty
RU-3	Empty	Empty	Empty	Empty
RU-4	VNF Mgmt Switch: Catalyst C3850-48T-S OR C2960XR-48TD	VNF Mgmt Switch: Catalyst C3850-48T-S OR C2960XR-48TD	VNF Mgmt Switch: Catalyst C3850-48T-S OR C2960XR-48TD	VNF Mgmt Switch: Catalyst C3850-48T-S OR C2960XR-48TD
RU-5	VNF Leaf TOR Switch A: Nexus 93180YC-EX	VNF Leaf TOR Switch A: Nexus 93180YC-EX	VNF Leaf TOR Switch A: Nexus 93180YC-EX	VNF Leaf TOR Switch A: Nexus 93180YC-EX
RU-6	VNF Leaf TOR Switch B: Nexus 93180YC-EX	VNF Leaf TOR Switch B: Nexus 93180YC-EX	VNF Leaf TOR Switch B: Nexus 93180YC-EX	VNF Leaf TOR Switch B: Nexus 93180YC-EX
RU-7/8	Ultra VNF-EM 1A: UCS C240 M4 SFF	Ultra VNF-EM 2A: UCS C240 M4 SFF	Ultra VNF-EM 3A: UCS C240 M4 SFF	Ultra VNF-EM 4A: UCS C240 M4 SFF
RU-9/10	Ultra VNF-EM 1B: UCS C240 M4 SFF	Ultra VNF-EM 2B: UCS C240 M4 SFF	Ultra VNF-EM 3B: UCS C240 M4 SFF	Ultra VNF-EM 4B: UCS C240 M4 SFF
RU-11/12	Empty	Empty	Empty	Empty
RU-13/14	Demux SF: UCS C240 M4 SFF	Demux SF: UCS C240 M4 SFF	Demux SF: UCS C240 M4 SFF	Demux SF: UCS C240 M4 SFF
RU-15/16	Standby SF: UCS C240 M4 SFF	Standby SF: UCS C240 M4 SFF	Standby SF: UCS C240 M4 SFF	Standby SF: UCS C240 M4 SFF
RU-17/18	Active SF 1: UCS C240 M4 SFF	Active SF 1: UCS C240 M4 SFF	Active SF 1: UCS C240 M4 SFF	Active SF 1: UCS C240 M4 SFF
RU-19/20	Active SF 2: UCS C240 M4 SFF	Active SF 2: UCS C240 M4 SFF	Active SF 2: UCS C240 M4 SFF	Active SF 2: UCS C240 M4 SFF
RU-21/22	Active SF 3: UCS C240 M4 SFF	Active SF 3: UCS C240 M4 SFF	Active SF 3: UCS C240 M4 SFF	Active SF 3: UCS C240 M4 SFF
RU-23/24	Active SF 4: UCS C240 M4 SFF	Active SF 4: UCS C240 M4 SFF	Active SF 4: UCS C240 M4 SFF	Active SF 4: UCS C240 M4 SFF
RU-25/26	Active SF 5: UCS C240 M4 SFF	Active SF 5: UCS C240 M4 SFF	Active SF 5: UCS C240 M4 SFF	Active SF 5: UCS C240 M4 SFF

	Rack #1	Rack #2	Rack #3	Rack #4
RU-27/28	Active SF 6: UCS C240 M4 SFF	Active SF 6: UCS C240 M4 SFF	Active SF 6: UCS C240 M4 SFF	Active SF 6: UCS C240 M4 SFF
RU-29/30	Empty	Empty	Empty	Empty
RU-31/32	Empty	Empty	Empty	Empty
RU-33/34	Empty	Empty	Empty	Empty
RU-35/36	Ultra VNF-EM 1C,2C,3C,4C	OpenStack Control C: UCS C240 M4 SFF	Empty	Empty
RU-37/38	Ultra M Manager: UCS C240 M4 SFF	Empty	Empty	Empty
RU-39/40	OpenStack Control A: UCS C240 M4 SFF	OpenStack Control B: UCS C240 M4 SFF	Empty	Empty
RU-41/42	Empty	Empty	Empty	Empty
Cables	Controller Rack Cables	Controller Rack Cables	Controller Rack Cables	Empty
Cables	Spine Uplink/Interconnect Cables	Spine Uplink/Interconnect Cables	Empty	Empty
Cables	Leaf TOR To Spine Uplink Cables	Leaf TOR To Spine Uplink Cables	Leaf TOR To Spine Uplink Cables	Leaf TOR To Spine Uplink Cables
Cables	VNF Rack Cables	VNF Rack Cables	VNF Rack Cables	VNF Rack Cables

Cable the Hardware

After the hardware has been installed, install all power and network cabling for the hardware using the information and instructions in the documentation for the specific hardware product. Refer to Related Documentation, on page 40 for links to the hardware product documentation. Ensure that you install your network cables according to your network plan.

Configure the Switches

All of the switches must be configured according to your planned network specifications.

Note Refer to Network Planning, on page 40 for information and consideration for planning your network.

Refer to the user documentation for each of the switches for configuration information and instructions:

- **Catalyst C2960XR-48TD-I:** http://www.cisco.com/c/en/us/support/switches/catalyst-2960xr-48td-i-switch/model.html
- **Catalyst 3850 48T-S:** http://www.cisco.com/c/en/us/support/switches/catalyst-3850-48t-s-switch/model.html
- **Nexus 93180-YC-EX:** http://www.cisco.com/c/en/us/support/switches/nexus-93180yc-fx-switch/model.html
- **Nexus 9236C:** http://www.cisco.com/c/en/us/support/switches/nexus-9236c-switch/model.html

Prepare the UCS C-Series Hardware

UCS-C hardware preparation is performed through the Cisco Integrated Management Controller (CIMC). The tables in the following sections list the non-default parameters that must be configured per server type:

- Prepare the Staging Server/Ultra M Manager Node, on page 46
- Prepare the Controller Nodes, on page 46
- Prepare the Compute Nodes, on page 48
- Prepare the OSD Compute Nodes, on page 49

Refer to the UCS C-series product documentation for more information:

- **UCS C-Series Hardware —** https://www.cisco.com/c/en/us/support/servers-unified-computing/ucs-c240-m4-rack-server/model.html
- **CIMC Software —** https://www.cisco.com/c/en/us/support/servers-unified-computing/ucs-c-series-integrated-management-controller/tsd-products-support-series-home.html

Note Part of the UCS server preparation is the configuration of virtual drives. If there are virtual drives present which need to be deleted, select the **Virtual Drive Info** tab, select the virtual drive you wish to delete, then click **Delete Virtual Drive**. Refer to the CIMC documentation for more information.

Note The information in this section assumes that the server hardware was properly installed per the information and instructions in Install and Cable the Hardware, on page 40.

Prepare the Staging Server/Ultra M Manager Node

Table 23: Staging Server/Ultra M Manager Node Parameters

Parameters and Settings	Description
CIMC Utility Setup	
Enable IPV4 Dedicated No redundancy IP address Subnet mask Gateway address DNS address	Configures parameters for the dedicated management port.
Admin > User Management	
Username Password	Configures administrative user credentials for accessing the CIMC utility.
Admin > Communication Services	
IPMI over LAN Properties = Enabled	Enables the use of Intelligent Platform Management Interface capabilities over the management port.
Server > BIOS > Configure BIOS > Advanced	
Intel(R) Hyper-Threading Technology = Disabled	Disable hyper-threading on server CPUs to optimize Ultra M system performance.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Info	
Status = *Unconfigured Good*	Ensures that the hardware is ready for use.

Prepare the Controller Nodes

Table 24: Controller Node Parameters

Parameters and Settings	Description
CIMC Utility Setup	

Parameters and Settings	Description
Enable IPV4 Dedicated No redundancy IP address Subnet mask Gateway address DNS address	Configures parameters for the dedicated management port.
Admin > User Management	
Username Password	Configures administrative user credentials for accessing the CIMC utility.
Admin > Communication Services	
IPMI over LAN Properties = Enabled	Enables the use of Intelligent Platform Management Interface capabilities over the management port.
Admin > Communication Services	
IPMI over LAN Properties = Enabled	Enables the use of Intelligent Platform Management Interface capabilities over the management port.
Server > BIOS > Configure BIOS > Advanced	
Intel(R) Hyper-Threading Technology = Disabled	Intel(R) Hyper-Threading Technology = Disabled
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Info	
Status = *Unconfigured Good*	Ensures that the hardware is ready for use.
Storage > Cisco 12G SAS Modular RAID Controller > Controller Info	

Parameters and Settings	Description
Virtual Drive Name = OS Read Policy = No Read Ahead RAID Level = RAID 1 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 1143455 MB Write Policy: Write Through	Creates the virtual drives required for use by the operating system (OS).
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.

Prepare the Compute Nodes

Table 25: Compute Node Parameters

Parameters and Settings	Description
CIMC Utility Setup	
Enable IPV4 Dedicated No redundancy IP address Subnet mask Gateway address DNS address	Configures parameters for the dedicated management port.
Admin > User Management	
Username Password	Configures administrative user credentials for accessing the CIMC utility.
Admin > Communication Services	

Parameters and Settings	Description
IPMI over LAN Properties = Enabled	Enables the use of Intelligent Platform Management Interface capabilities over the management port.
Server > BIOS > Configure BIOS > Advanced	
Intel(R) Hyper-Threading Technology = Disabled	Intel(R) Hyper-Threading Technology = Disabled
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Info	
Status = *Unconfigured Good*	Ensures that the hardware is ready for use.
Storage > Cisco 12G SAS Modular RAID Controller > Controller Info	
Virtual Drive Name = BOOTOS Read Policy = No Read Ahead RAID Level = RAID 1 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 1143455 MB Write Policy: Write Through	Creates the virtual drives required for use by the operating system (OS).
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, BOOTOS	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Set as Boot Drive	Sets the BOOTOS virtual drive as the system boot drive.

Prepare the OSD Compute Nodes

Note OSD Compute Nodes are only used in Hyper-converged Ultra M models as described in UCS C-Series Servers, on page 7.

Table 26: OSD Compute Node Parameters

Parameters and Settings	Description
CIMC Utility Setup	
Enable IPV4 Dedicated No redundancy IP address Subnet mask Gateway address DNS address	Configures parameters for the dedicated management port.
Admin > User Management	
Username Password	Configures administrative user credentials for accessing the CIMC utility.
Admin > Communication Services	
IPMI over LAN Properties = Enabled	Enables the use of Intelligent Platform Management Interface capabilities over the management port.
Server > BIOS > Configure BIOS > Advanced	
Intel(R) Hyper-Threading Technology = Disabled	Intel(R) Hyper-Threading Technology = Disabled
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Info	
Status = *Unconfigured Good*	Ensures that the hardware is ready for use.
SLOT-HBA Physical Drive Numbers = 1 2 3 7 8 9 10	Ensure the UCS slot host-bus adapter for the drives are configured accordingly.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 1	

Parameters and Settings	Description
Virtual Drive Name = BOOTOS Read Policy = No Read Ahead RAID Level = RAID 1 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 285148 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 1. **Note** Ensure that the size of this virtual drive is less than the size of the designated journal and storage drives.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, BOOTOS, Physical Drive Number = 1	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Set as Boot Drive	Sets the BOOTOS virtual drive as the system boot drive.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 2	
Virtual Drive Name = BOOTOS Read Policy = No Read Ahead RAID Level = RAID 1 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 285148 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 2. **Note** Ensure that the size of this virtual drive is less than the size of the designated journal and storage drives.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, BOOTOS, Physical Drive Number = 2	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Set as Boot Drive	Sets the BOOTOS virtual drive as the system boot drive.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 3	

Parameters and Settings	Description
Virtual Drive Name = JOURNAL Read Policy = No Read Ahead RAID Level = RAID 0 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 456809 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 3.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, JOURNAL, Physical Drive Number = 3	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 7	
Virtual Drive Name = OSD1 Read Policy = No Read Ahead RAID Level = RAID 0 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 1143455 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 7.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, OSD1, Physical Drive Number = 7	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 8	

Parameters and Settings	Description
Virtual Drive Name = OSD2 Read Policy = No Read Ahead RAID Level = RAID 0 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 1143455 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 8.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, OSD2, Physical Drive Number = 8	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 9	
Virtual Drive Name = OSD3 Read Policy = No Read Ahead RAID Level = RAID 0 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 1143455 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 9.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, OSD3, Physical Drive Number = 9	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.
Storage > Cisco 12G SAS Modular RAID Controller > Physical Drive Number = 10	

Parameters and Settings	Description
Virtual Drive Name = OSD4 Read Policy = No Read Ahead RAID Level = RAID 0 Cache Policy: Direct IO Strip Size: 64KB Disk Cache Policy: Unchanged Access Policy: Read Write Size: 1143455 MB Write Policy: Write Through	Creates a virtual drive leveraging the storage space available to physical drive number 10.
Storage > Cisco 12G SAS Modular RAID Controller > Virtual Drive Info, OSD4, Physical Drive Number = 10	
Initialize Type = Fast Initialize	Initializes this virtual drive. A fast initialization quickly writes zeroes to the first and last 10-MB regions of the new virtual drive and completes the initialization in the background.

Deploy the Virtual Infrastructure Manager

Within the Ultra M solution, OpenStack Platform Director (OSP-D) functions as the virtual infrastructure manager (VIM).

The method by which the VIM is deployed depends on the architecture of your Ultra M model. Refer to the following section for information related to your deployment scenario:

- Deploy the VIM for Hyper-Converged Ultra M Models, on page 54

Deploy the VIM for Hyper-Converged Ultra M Models

Deploying the VIM for Hyper-Converged Ultra M Models is performed using an automated workflow enabled through software modules within Ultra Automation Services (UAS). These services leverage user-provided configuration information to automatically deploy the VIM Orchestrator (Undercloud) and the VIM (Overcloud).

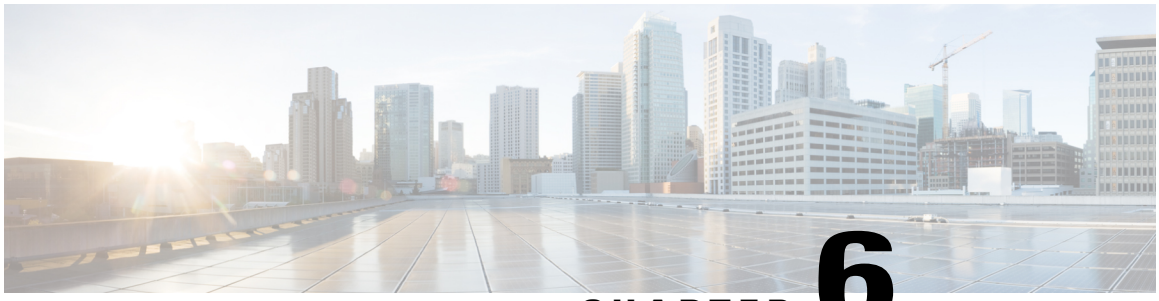
For information on using this automated process, in the *USP Deployment Automation Guide*, refer to the *Virtual Infrastructure Manager Installation Automation* section.

Deploy the USP-Based VNF

After the OpenStack Undercloud (VIM Orchestrator) and Overcloud (VIM) have been successfully deployed on the Ultra M hardware, you must deploy the USP-based VNF.

This process is performed through the Ultra Automation Services (UAS). UAS is an automation framework consisting of a set of software modules used to automate the USP-based VNF deployment and related components such as the VNFM.

For detailed information on the automation workflow, refer to the *Ultra Service Platform Deployment Automation Guide*.

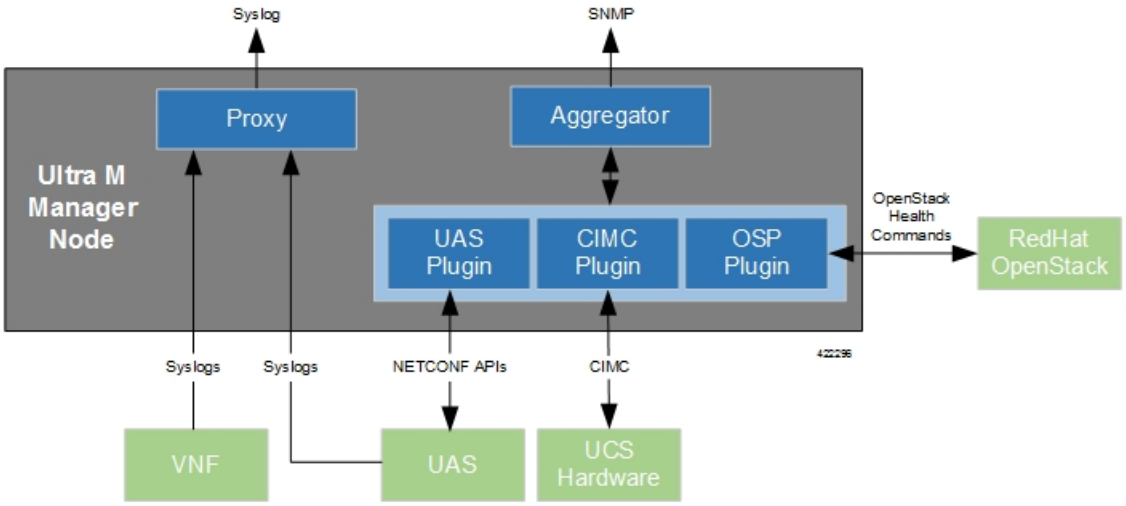


CHAPTER 6

Event and Syslog Management Within the Ultra M Solution

Hyper-Converged Ultra M solution models support a centralized monitor and management function. This function provides a central aggregation point for events (faults and alarms) and a proxy point for syslogs generated by the different components within the solution as identified in Table 27: Component Event Sources, on page 62. This monitor and management function runs on the Ultra M Manager Node.

Figure 12: Ultra M Manager Node Event and Syslog Functions



The software to enable this functionality is distributed as a both a stand-alone RPM and as part of the Ultra Services Platform (USP) release ISO as described in Install the Ultra M Manager RPM, on page 68. Once installed, additional configuration is required based on the desired functionality as described in the following sections:

- Syslog Proxy, page 58
- Event Aggregation , page 61
- Install the Ultra M Manager RPM, page 68

- Restarting the Ultra M Manager Service, page 69
- Uninstalling the Ultra M Manager, page 71
- Encrypting Passwords in the ultram_cfg.yaml File, page 72

Syslog Proxy

The Ultra M Manager Node can be configured as a proxy server for syslogs received from UCS servers and/or OpenStack. As a proxy, the Ultra M Manager Node acts a single logging collection point for syslog messages from these components and relays them to a remote collection server.

NOTES:

- This functionality is currently supported only with Ultra M deployments based on OSP 10 and that leverage the Hyper-Converged architecture.

  .

- You must configure a remote collection server to receive and filter log files sent by the Ultra M Manager Node.
- Though you can configure syslogging at any severity level your deployment scenario requires, it is recommended that you only configure syslog levels with severity levels 0 (emergency) through 4 (warning).

Once the Ultra M Manager RPM is installed, a script provided with this release allows you to quickly enable syslog on the nodes and set the Ultra M Manager as the proxy. Leveraging inputs from a YAML-based configuration file, the script:

- Inspects the nodes within the Undercloud and Overcloud
- Logs on to each node
- Enables syslogging at the specified level or both the UCS hardware and for OpenStack
- Sets the Ultra M Manager Node's address as the syslog proxy

Note The use of this script assumes that all of the nodes use the same login credentials.

To enable this functionality:

1. Install the Ultra M Manager bundle RPM using the instructions in Install the Ultra M Manager RPM, on page 68.

Note This step is not needed if the Ultra M Manager bundle was previously installed.

2. Become the root user.

   sudo -i
3. Verify that there are no previously existing configuration files for logging information messages in /etc/rsyslog.d.

a. Navigate to */etc/rsyslog.d*.

cd /etc/rsyslog.d
ls -al
Example output:

```
total 24
drwxr-xr-x.   2 root root  4096 Sep  3 23:17 .
drwxr-xr-x. 152 root root 12288 Sep  3 23:05 ..
-rw-r--r--.   1 root root    49 Apr 21 00:03 listen.conf
-rw-r--r--.   1 root root   280 Jan 12  2017 openstack-swift.conf
```

b. Check the *listen.conf* file.

cat listen.conf
Example output:

```
$SystemLogSocketName /run/systemd/journal/syslog
```

c. Check the configuration of the *openstack-swift.conf*.

cat openstack-swift.conf
Example configuration:

```
# LOCAL0 is the upstream default and LOCAL2 is what Swift gets in
# RHOS and RDO if installed with Packstack (also, in docs).
# The breakout action prevents logging into /var/log/messages, bz#997983.
local0.*;local2.* /var/log/swift/swift.log
& stop
```

4. Enable syslogging to the external server by configuring the */etc/rsyslog.conf* file.

vi /etc/rsyslog.conf

a. Enable TCP/UDP reception.

```
# provides UDP syslog reception
```
$ModLoad imudp
$UDPServerRun 514

```
# provides TCP syslog reception
```
$ModLoad imtcp
$InputTCPServerRun 514

b. Disable logging for private authentication messages.

```
# Don't log private authentication messages!
```
#*.info;mail.none;authpriv.none;cron.none /var/log/messages

c. Configure the desired log severity levels.

```
# log 0-4 severity logs to external server 172.21.201.53
```
***.4,3,2,1,0** `@<external_syslog_server_ipv4_address>`**:514**
This enables the collection and reporting of logs with severity levels 0 (emergency) through 4 (warning).

Caution Though it is possible to configure the system to locally store syslogs on the Ultra M Manager, it is highly recommended that you avoid doing so to avoid the risk of data loss and to preserve disk space.

5. Restart the syslog server.

service rsyslog restart

6. Navigate to */etc*.

cd /etc

7. Create and edit the *syslogs.yaml* file based your VIM Orchestrator and VIM configuration. A sample of this configuration file is provided in Example ultram_cfg.yaml File, on page 81.

Note The *ultram_cfg.yaml* file pertains to both the syslog proxy and event aggregation functionality. Some parts of this file's configuration overlap and may have been configured in relation to the other function.

vi ultram_cfg.yaml

a *Optional*. Configure your Undercloud settings if they are not already configured.

```
under-cloud:
  OS_AUTH_URL: <auth_url>
  OS_USERNAME: admin
  OS_TENANT_NAME: <tenant_name>
  OS_PASSWORD: <admin_user_password>
  ssh-key: /opt/cisco/heat_admin_ssh_key
```

b *Optional.* Configure your Overcloud settings if they are not already configured.

```
over-cloud:
  enabled: true
  environment:
    OS_AUTH_URL: <auth_url>
    OS_TENANT_NAME: <tenant_name>
    OS_USERNAME: <user_name>
    OS_PASSWORD: <user_password>
    OS_ENDPOINT_TYPE: publicURL
    OS_IDENTITY_API_VERSION: 2
    OS_REGION_NAME: regionOne
```

c Specify the IP address of the Ultra M Manager Node to be the proxy server.

```
<-- SNIP -->
rsyslog:
  level: 4,3,2,1,0
  proxy-rsyslog: <ultram_manager_address>
```

Note

- You can modify the syslog levels to report according to your requirements using the **level** parameter as shown above.
- <*ultram_manager_address*> is the internal IP address of the Ultra M Manager Node reachable by OpenStack and the UCS servers.
- If you are copying the above information from an older configuration, make sure the **proxy-rsyslog** IP address does not contain a port number.

d *Optional*. Configure the CIMC login information for each of the nodes on which syslogging is to be enabled.

```
ucs-cluster:
  enabled: true
  user: <username>
  password: <password>
```

Note The use of this script assumes that all of the nodes use the same login credentials.

8 Navigate to */opt/cisco/usp/ultram-health*.

cd /opt/cisco/usp/ultram-health

9 *Optional*. Disable rsyslog if it was previously configured on the UCS servers.

./ultram_syslogs.py --cfg /etc/ultram_cfg.yaml –u -d

10 Execute the *ultram_syslogs.py* script to load the configuration on the various nodes.

./ultram_syslogs.py --cfg /etc/ultram_cfg.yaml -o –u

Note Additional command line options for the *ultram_syslogs.py* script can be seen by entering **ultram_syslogs.py –help** at the command prompt. An example of the output of this command is below:

```
usage: ultram_syslogs.py [-h] -c CFG [-d] [-u] [-o]

optional arguments:
  -h, --help            show this help message and exit
  -c CFG, --cfg CFG     Configuration file
  -d, --disable-syslog  Disable Syslog
  -u, --ucs             Apply syslog configuration on UCS servers
  -o, --openstack       Apply syslog configuration on OpenStack
```

Example output:

```
2017-09-13 15:24:23,305 - Configuring Syslog server 192.200.0.1:514 on UCS cluster
2017-09-13 15:24:23,305 - Get information about all the nodes from under-cloud
2017-09-13 15:24:37,178 - Enabling syslog configuration on 192.100.3.5
2017-09-13 15:24:54,686 - Connected.
2017-09-13 15:25:00,546 - syslog configuration success.
2017-09-13 15:25:00,547 - Enabling syslog configuration on 192.100.3.6
2017-09-13 15:25:19,003 - Connected.
2017-09-13 15:25:24,808 - syslog configuration success.
<---SNIP--->

<---SNIP--->
2017-09-13 15:46:08,715 - Enabling syslog configuration on vnf1-osd-compute-1
[192.200.0.104]
2017-09-13 15:46:08,817 - Connected
2017-09-13 15:46:09,046 - - /etc/rsyslog.conf
2017-09-13 15:46:09,047 -  Enabling syslog ...
2017-09-13 15:46:09,130 -  Restarting rsyslog
2017-09-13 15:46:09,237 -  Restarted
2017-09-13 15:46:09,321 - - /etc/nova/nova.conf
2017-09-13 15:46:09,321 -  Enabling syslog ...
2017-09-13 15:46:09,487 -  Restarting Services 'openstack-nova-compute.service'
```

11 Ensure that client log messages are being received by the server and are uniquely identifiable.

NOTES:

- If necessary, configure a unique tag and hostname as part of the syslog configuration/template for each client.
- Syslogs are very specific in terms of the file permissions and ownership. If need be, manually configure permissions for the log file on the client using the following command:

  chmod +r *<URL>/<log_filename>*

Event Aggregation

The Ultra M Manager Node can be configured to aggregate events received from different Ultra M components as identified in Table 27: Component Event Sources, on page 62.

Note This functionality is currently supported only with Ultra M deployments based on OSP 10 and that leverage the Hyper-Converged architecture.

Table 27: Component Event Sources

Solution Component	Event Source Type	Details
UCS server hardware	CIMC	Reports on events collected from UCS C-series hardware via CIMC-based subscription. These events are monitored in real-time.
VIM (Overcloud)	OpenStack service health	Reports on OpenStack service fault events pertaining to: • Failures (stopped, restarted) • High availability • Ceph / storage • Neutron / compute host and network agent • Nova scheduler (VIM instances) By default, these events are collected during a 900 second polling interval as specified within the *ultram_cfg.yaml* file. **Note** In order to ensure optimal performance, it is strongly recommended that you do not change the default polling-interval.
UAS (AutoVNF, UEM, and ESC)	UAS cluster/USP management component events	Reports on UAS service fault events pertaining to: • Service failure (stopped, restarted) • High availability • AutoVNF • UEM • ESC (VNFM) By default, these events are collected during a 900 second polling interval as specified within the *ultram_cfg.yaml* file. **Note** In order to ensure optimal performance, it is strongly recommended that you do not change the default polling-interval.

Events received from the solution components, regardless of the source type, are mapped against the Ultra M SNMP MIB (CISCO-ULTRAM-MIB.my, refer to Ultra M MIB, on page 85). The event data is parsed and categorized against the following conventions:

- **Fault code:** Identifies the area in which the fault occurred for the given component. Refer to the "CFaultCode" convention within the Ultra M MIB for more information.
- **Severity:** The severity level associated with the fault. Refer to the "CFaultSeverity" convention within the Ultra M MIB for more information. Since the Ultra M Manager Node aggregates events from different components within the solution, the severities supported within the Ultra M Manager Node MIB map to those for the specific components. Refer to Ultra M Component Event Severity and Fault Code Mappings, on page 91 for details.
- **Domain:** The component in which the fault occurred (e.g. UCS hardware, VIM, UEM, etc.). Refer to the "CFaultDomain" convention within the Ultra M MIB for more information.

UAS and OpenStack events are monitored at the configured polling interval as described in Table 28: SNMP Fault Entry Table Element Descriptions, on page 65. At the polling interval, the Ultra M Manager Node:

1. Collects data from UAS and OpenStack.
2. Generates/updates .log and .report files and an SNMP-based fault table with this information. It also includes related data about the fault such as the specific source, creation time, and description.
3. Processes any events that occurred:
   a. If an error or fault event is identified, then a .error file is created and an SNMP trap is sent.
   b. If the event received is a clear condition, then an informational SNMP trap is sent to "clear" an active fault.
   c. If no event occurred, then no further action is taken beyond Step 2.

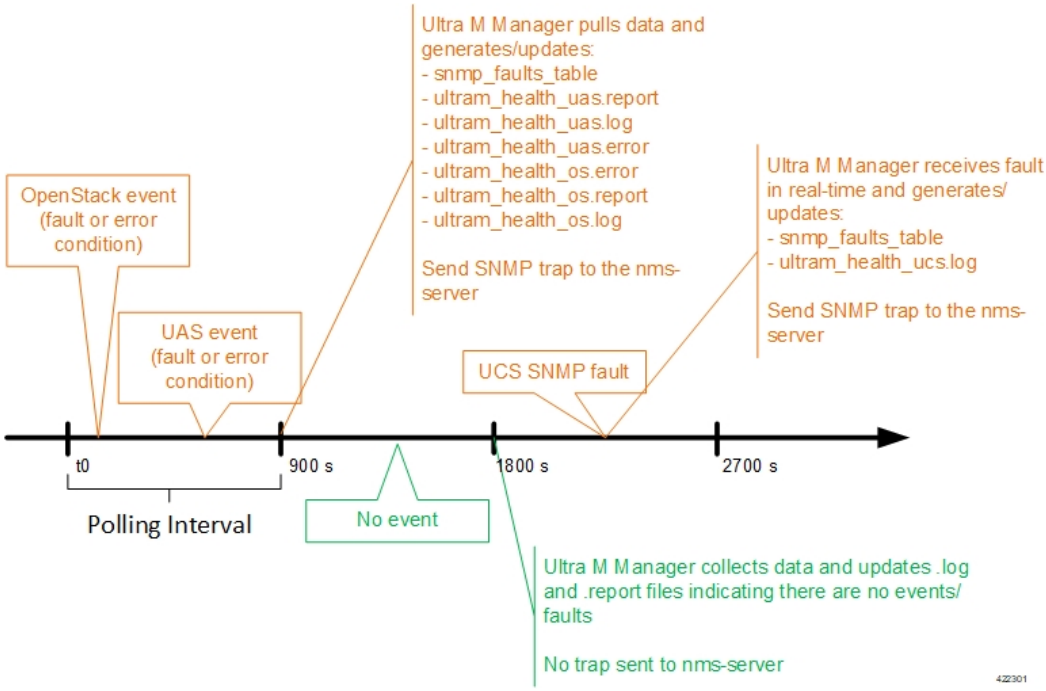
UCS events are monitored and acted upon in real-time. When events occur, the Ultra M Manager generates a .log file and the SNMP fault table.

Active faults are reported "only" once and not on every polling interval. As a result, there is only one trap as long as this fault is active. Once the fault is "cleared", an informational trap is sent.

Note UCS events are considered to be the "same" if a previously received fault has the same distinguished name (DN), severity, and lastTransition time. UCS events are considered as "new" only if any of these elements change.

These processes are illustrated in Figure 13: Ultra M Manager Node Event Aggregation Operation, on page 64. Refer to About Ultra M Manager Log Files, on page 105 for more information.

Figure 13: Ultra M Manager Node Event Aggregation Operation

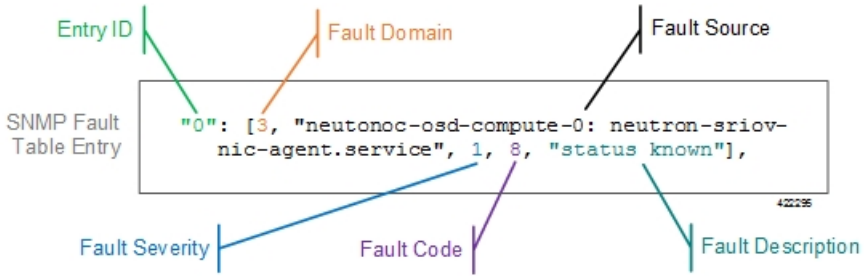


An example of the snmp_faults_table file is shown below and the entry syntax is described in Figure 14: SNMP Fault Table Entry Description, on page 64:

```
"0": [3 "neutonoc-osd-compute-0: neutron-sriov-nic-agent.service" 1 8 "status known"] "1":
 [3 "neutonoc-osd-compute-0: ntpd" 1 8 "Service is not active state: inactive"] "2": [3
"neutonoc-osd-compute-1: neutron-sriov-nic-agent.service" 1 8 "status known"] "3": [3
"neutonoc-osd-compute-1: ntpd" 1 8 "Service is not active state: inactive"] "4": [3
"neutonoc-osd-compute-2: neutron-sriov-nic-agent.service" 1 8 "status known"] "5": [3
"neutonoc-osd-compute-2: ntpd" 1 8 "Service is not active state: inactive"]
```

Refer to About Ultra M Manager Log Files, on page 105 for more information.

Figure 14: SNMP Fault Table Entry Description



Each element in the SNMP Fault Table Entry corresponds to an object defined in the Ultra M SNMP MIB as described in Table 28: SNMP Fault Entry Table Element Descriptions, on page 65. (Refer also to Ultra M MIB, on page 85.)

Table 28: SNMP Fault Entry Table Element Descriptions

SNMP Fault Table Entry Element	MIB Object	Additional Details
Entry ID	cultramFaultIndex	A unique identifier for the entry
Fault Domain	cultramFaultDomain	The component area in which the fault occurred. The following domains are supported in this release: • **hardware(1) :** Harware including UCS servers • **vim(3) :** OpenStack VIM manager • **uas(4) :** Ultra Automation Services Modules
Fault Source	cultramFaultSource	Information identifying the specific component within the Fault Domain that generated the event. The format of the information is different based on the Fault Domain. Refer to Table 29: cultramFaultSource Format Values, on page 67 for details.
Fault Severity	cultramFaultSeverity	The severity associated with the fault as one of the following: • **emergency(1) :** System level FAULT impacting multiple VNFs/Services • **critical(2) :** Critical Fault specific to VNF/Service • **major(3) :** component level failure within VNF/service. • **alert(4) :** warning condition for a service/VNF, may eventually impact service. • **informational(5) :** informational only, does not impact service Refer to Ultra M Component Event Severity and Fault Code Mappings, on page 91 for details on how these severities map to events generated by the various Ultra M components.

SNMP Fault Table Entry Element	MIB Object	Additional Details
Fault Code	cultramFaultCode	A unique ID representing the type of fault as. The following codes are supported: • **other(1) :** Other events • **networkConnectivity(2) :** Network Connectivity Failure Events • **resourceUsage(3) :** Resource Usage Exhausted Event • **resourceThreshold(4) :** Resource Threshold crossing alarms • **hardwareFailure(5) :** Hardware Failure Events • **securityViolation(6) :** Security Alerts • **configuration(7) :** Config Error Events • **serviceFailure(8) :** Process/Service failures Refer to Ultra M Component Event Severity and Fault Code Mappings, on page 91 for details on how these fault codes map to events generated by the various Ultra M components.
Fault Description	cultramFaultDescription	A message containing details about the fault.

Table 29: cultramFaultSource Format Values

FaultDomain	Format Value of cultramFaultSource
Hardware (UCS Servers)	**Node:** *<UCS-SERVER-IP-ADDRESS>*, **affectedDN:** *<FAULT-OBJECT-DISTINGUSIHED-NAME>* Where: *<UCS-SERVER-IP-ADDRESS> :* The management IP address of the UCS server that generated the fault. *<FAULT-OBJECT-DISTINGUSIHED-NAME> :* The distinguished name of the affected UCS object.
UAS	**Node:** *<UAS-MANAGEMENT-IP>* Where: *<UAS-MANAGEMENT-IP> :* The management IP address for the UAS instance.
VIM (OpenStack)	*<OS-HOSTNAME>*: *<SERVICE-NAME>* Where: *<OS-HOSTNAME>* : The OpenStack node hostname that generated the fault. *<SERVICE-NAME>* : Then name of the OpenStack service that generated the fault.

Fault and alarm collection and aggregation functionality within the Hyper-Converged Ultra M solution is configured and enabled through the *ultram_cfg.yaml* file. (An example of this file is located in Example ultram_cfg.yaml File, on page 81.) Parameters in this file dictate feature operation and enable SNMP on the UCS servers and event collection from the other Ultra M solution components.

To enable this functionality on the Ultra M solution:

1. Install the Ultra M Manager bundle RPM using the instructions in Install the Ultra M Manager RPM, on page 68.

Note This step is not needed if the Ultra M Manager bundle was previously installed.

2. Become the root user.

   sudo -i
3. Navigate to /etc.

   cd /etc
4. Edit the *ultram_cfg.yaml* file based on your deployment scenario.

Note The *ultram_cfg.yaml* file pertains to both the syslog proxy and event aggregation functionality. Some parts of this file's configuration overlap and may have been configured in relation to the other function.

5 Navigate to */opt/cisco/usp/ultram-health*.

cd /opt/cisco/usp/ultram-health

6 Start the Ultra M Manager Service, on page 70.

Note Subsequent configuration changes require you restart the health monitor service. Refer to Restarting the Ultra M Manager Service, on page 69 for details.

7 Verify the configuration by checking the *ultram_health.log* file.

cat /var/log/cisco/ultram_health.log

Install the Ultra M Manager RPM

The Ultra M Manager functionality described in this chapter is enabled through software distributed both as part of the USP ISO and as a separate RPM bundle.

Ensure that you have access to either of these RPM bundles prior to proceeding with the instructions below.

To access the Ultra M Manager RPM packaged within the USP ISO, onboard the ISO and navigate to the *ultram_health* directory. Refer to the *USP Deployment Automation Guide* for instructions on onbarding the USP ISO.

1 *Optional*. Remove any previously installed versions of the Ultra M Manager per the instructions in Uninstalling the Ultra M Manager, on page 71.

2 Log on to the Ultra M Manager Node.

3 Become the root user.

sudo -i

4 Copy the "ultram-manager" RPM file to the Ultra M Manager Node.

5 Navigate to the directory in which you copied the file.

6 Install the ultram-manager bundle RPM that was distributed with the ISO.

yum install -y ultram-manager-<*version*>**.x86_64.rpm**
A message similar to the following is displayed upon completion:

```
Installed:
  ultram-health.x86_64 0:5.1.6-2


Complete!
```

7 Verify that log rotation is enabled in support of the syslog proxy functionality by checking the *logrotate* file.

cd /etc/cron.daily
ls -al
Example output:

```
total 28
drwxr-xr-x.   2 root root  4096 Sep 10 18:15 .
drwxr-xr-x. 128 root root 12288 Sep 11 18:12 ..
-rwx------.   1 root root   219 Jan 24  2017 logrotate
-rwxr-xr-x.   1 root root   618 Mar 17  2014 man-db.cron
-rwx------.   1 root root   256 Jun 21 16:57 rhsmd
```

cat /etc/cron.daily/logrotate

Example output:

```
#!/bin/sh

/usr/sbin/logrotate -s /var/lib/logrotate/logrotate.status /etc/logrotate.conf
EXITVALUE=$?
if [ $EXITVALUE != 0 ]; then
    /usr/bin/logger -t logrotate "ALERT exited abnormally with [$EXITVALUE]"
fi
exit 0
```

8 Create and configure the *ultram_health* file.

cd /etc/logrotate.d
vi ultram_health

```
/var/log/cisco/ultram-health/* {
    size 50M
    rotate 30
    missingok
    notifempty
    compress
    }
```

9 Proceed to either Syslog Proxy, on page 58 or Event Aggregation , on page 61 to configure the desired functionality.

Restarting the Ultra M Manager Service

In the event of configuration change or a server reboot, the Ultra M Manager service must be restarted.

To restart the Ultra M Manager service:

1 Check the Ultra M Manager Service Status, on page 69.

2 Stop the Ultra M Manager Service, on page 70.

3 Start the Ultra M Manager Service, on page 70.

4 Check the Ultra M Manager Service Status, on page 69.

Check the Ultra M Manager Service Status

It may be necessary to check the status of the Ultra M Manager service.

Note These instructions assume that you are already logged into the Ultra M Manager Node as the *root* user.

To check the Ultra M Manager status:

1 Check the service status.

service ultram_health.service status
Example Output – Inactive Service:

```
Redirecting to /bin/systemctl status ultram_health.service
 ultram_health.service - Cisco UltraM Health monitoring Service
   Loaded: loaded (/etc/systemd/system/ultram_health.service; enabled; vendor preset:
disabled)
   Active: inactive (dead)
```

Example Output – Active Service:

```
Redirecting to /bin/systemctl status ultram_health.service
 ultram_health.service - Cisco UltraM Health monitoring Service
   Loaded: loaded (/etc/systemd/system/ultram_health.service; enabled; vendor preset:
disabled)
   Active: active (running) since Sun 2017-09-10 22:20:20 EDT; 5s ago
 Main PID: 16982 (start_ultram_he)
   CGroup: /system.slice/ultram_health.service
           ├─16982 /bin/sh /usr/local/sbin/start_ultram_health
           ├─16983 python /opt/cisco/usp/ultram-health/ultram_health.py
/etc/ultram_cfg.yaml
           ├─16991 python /opt/cisco/usp/ultram-health/ultram_health.py
/etc/ultram_cfg.yaml
           └─17052 /usr/bin/python /bin/ironic node-show
19844e8d-2def-4be4-b2cf-937f34ebd117

Sep 10 22:20:20 ospd-tb1.mitg-bxb300.cisco.com systemd[1]: Started Cisco UltraM Health
monitoring Service.
Sep 10 22:20:20 ospd-tb1.mitg-bxb300.cisco.com systemd[1]: Starting Cisco UltraM Health
 monitoring Service...
Sep 10 22:20:20 ospd-tb1.mitg-bxb300.cisco.com start_ultram_health[16982]: 2017-09-10
22:20:20,411 - UCS Health Check started
```

2 Check the status of the mongo process.

ps -ef | grep mongo
Example output:

```
mongodb   3769     1  0 Aug23 ?       00:43:30 /usr/bin/mongod --quiet -f /etc/mongod.conf
 run
```

Stop the Ultra M Manager Service

It may be necessary to stop the Ultra M Manager service under certain circumstances.

Note These instructions assume that you are already logged into the Ultra M Manager Node as the root user.

To stop the Ultra M Manager service, enter the following command from the */opt/cisco/usp/ultram-health* directory:

./service ultram_health.service stop

Start the Ultra M Manager Service

It is necessary to start/restart the Ultra M Manager service in order to execute configuration changes and or after a reboot of the Ultra M Manager Node.

Note These instructions assume that you are already logged into the Ultra M Manager Node as the root user.

To start the Ultra M Manager service, enter the following command from the */opt/cisco/usp/ultram-health* directory:

./service ultram_health.service start

Uninstalling the Ultra M Manager

If you have previously installed the Ultra M Manager, you must uninstall it before installing newer releases.

To uninstall the Ultra M Manager:

1. Log on the Ultra M Manager Node.
2. Become the root user.

   sudo -i
3. Make a backup copy of the existing configuring file (e.g. /etc/ultram_cfg.yaml).
4. Check the installed version.

   yum list installed | grep ultra
   Example output:

```
ultram-manager.x86_64          5.1.3-1             installed
```

5. Uninstall the previous version.

   yum erase ultram-manager
   Example output:

```
Loaded plugins: enabled_repos_upload, package_upload, product-id, search-disabled-repos,
 subscription-manager, versionlock
Resolving Dependencies
--> Running transaction check
---> Package ultram-manager.x86_64 0:5.1.5-1 will be erased
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================================

 Package                    Arch                Version                  Repository
         Size
================================================================================================
Removing:
 ultram-health              x86_64              5.1.5-1                  installed
        148 k

Transaction Summary
================================================================================================
Remove  1 Package

Installed size: 148 k
Is this ok [y/N]:
```

   Enter **y** at the prompt to continue.

   A message similar to the following is displayed upon completion:

```
Removed:
  ultram-health.x86_64 0:5.1.3-1

Complete!
Uploading Enabled Reposistories Report
Loaded plugins: product-id, versionlock
```

6. Proceed to Install the Ultra M Manager RPM, on page 68

Encrypting Passwords in the *ultram_cfg.yaml* File

The ultram_cfg.yaml file requires the specification of passwords for the managed components. These passwords are entered in clear text within the file. To mitigate security risks, the passwords should be encrypted before using the file to deploy Ultra M Manager-based features/functions.

To encrypt the passwords, the Ultra M Manager provides a script called *utils.py* in the */opt/cisco/usp/ultram-manager/* directory. The script can be run against your *ultram_cfg.yaml* file by navigating to that directory and executing the following command as the root user:

utils.py --secure-cfg /etc/ultram_cfg.yaml

Important Data is encrypted using AES via a 256 bit key that is stored in the MongoDB. As such, an OSPD user on OSPD is able to access this key and possibly decrypt the passwords. (This includes the *stack* user as it has sudo access.)

Executing this scripts encrypts the passwords in the configuration file and appends “encrypted: true” to the end of the file (e.g. *ultram_cfg.yamlencrypted: true*) to indicate that the passwords have been encrypted.

Note Do not rename the file once the filename has been changed.

If need be, you can make edits to parameters other than the passwords within the *ultram_cfg.yaml* file after encrypting the passwords.

For new installations, run the script to encrypt the passwords before applying the configuration and starting the Ultra M Manager service as described in Syslog Proxy, on page 58 and Event Aggregation , on page 61.

To encrypt passwords for exsiting installations:

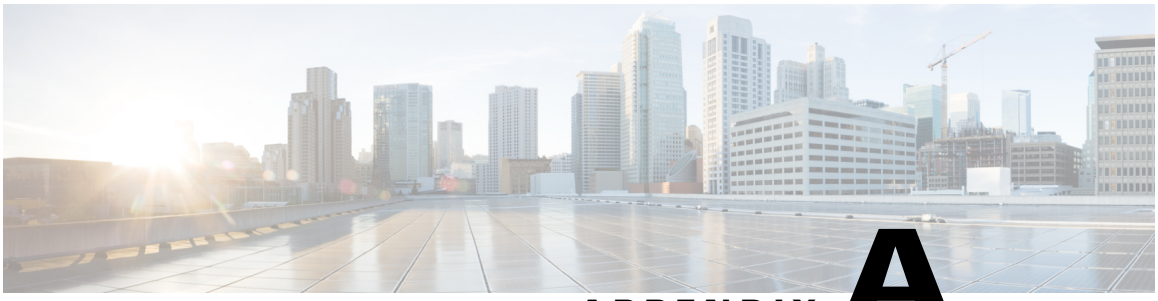
1. Stop the Ultra M Manager Service, on page 70.
2. *Optional.* Installing an updated version of the Ultra M Manager RPM.
   a. Save a copy of your *ultram_cfg.yaml* file to alternate location outside of the Ultra M Manager installation.
   b. Uninstall the Ultra M Manager using the instructions in Uninstalling the Ultra M Manager, on page 71.
   c. Install the new Ultra M Manager version using the instructions in Install the Ultra M Manager RPM, on page 68.
   d. Copy your backed-up *ultram_cfg.yaml* file to the */etc directory*.
3. Navigate to /opt/cisco/usp/ultram-manager/.

   cd /opt/cisco/usp/ultram-manager/
4. Encrypt the clear text passwords in the *ultram_cfg.yaml* file.

   utils.py --secure-cfg /etc/ultram_cfg.yaml

Note Executing this scripts encrypts the passwords in the configuration file and appends “encrypted: true” to the end of the file (e.g. ultram_cfg.yamlencrypted: true).

5 Start the Ultra M Manager Service, on page 70.



APPENDIX A

Network Definitions (Layer 2 and 3)

Table 30: Layer 2 and 3 Network Definition, on page 75 is intended to be used as a template for recording your Ultra M network Layer 2 and Layer 3 deployments.

Some of the Layer 2 and 3 networking parameters identified in Table 30: Layer 2 and 3 Network Definition, on page 75 are configured directly on the UCS hardware via CIMC. Other parameters are configured as part of the VIM Orchestrator or VIM configuration. This configuration is done through various configuration files depending on the parameter:

- undercloud.conf
- network.yaml
- layout.yaml

Table 30: Layer 2 and 3 Network Definition

VLAN ID / Range	Network	Gateway	IP Range Start	IP Range End	Description	Where Configured	Routable?
External-Internet Meant for OSP-D Only							
100	192.168.1.0 /24	192.168.1.1			Internet access required: - 1 IP Address for OSP-D - 1 IP for default gateway	On Ultra M Manger Node hardware	Yes
External – Floating IP Addresses (Virtio)*							

VLAN ID / Range	Network	Gateway	IP Range Start	IP Range End	Description	Where Configured	Routable?
101	192.168.10.0 /24	192.168.10.1			Routable addresses required: - 3 IP addresses for Controllers - 1 VIP for master Controller Node - 4:10 Floating IP Addresses per VNF assigned to management VMs (CF, VNFM, UEM, and UAS software modules) - 1 IP for default gateway	*network.yaml* and/or *layout.yaml***	Yes
Provisioning							
105	**192.0.0.0/ 8**		**192.200.0.100**	**192.200.0.254**	Required to provision all configuration via PXE boot from OSP-D for Ceph, Controller and Compute. Intel-On-Board Port 1 (1G).	*undercloud.conf*	No
IPMI-CIMC							
105	**192.0.0.0/ 8**		**192.100.0.100**	**192.100.0.254**		On UCS servers through CIMC	No
Tenant (Virtio)							

VLAN ID / Range	Network	Gateway	IP Range Start	IP Range End	Description	Where Configured	Routable?
17	11.17.0.0/ 24				All Virtio based tenant networks. (MLOM)	*network. yaml* and/or *layout.yaml***	No
Storage (Virtio)							
18	11.18.0.0/ 24				Required for Controllers, Computes and Ceph for read/write from and to Ceph. (MLOM)	*network. yaml* and/or *layout.yaml***	No
Storage-MGMT (Virtio)							
19	11.19.0.0/ 24				Required for Controllers and Ceph only as Storage Cluster internal network. (MLOM)	*network. yaml* and/or *layout.yaml***	No
Internal-API (Virtio)							
20	11.20.0.0/ 24				Required for Controllers and Computes for openstack manageability. (MLOM)	*network. yaml* and/or *layout.yaml***	No
Mgmt (Virtio)							
21	172.16.181.0/ 24		172.16.181. 100	172.16.181. 254	Tenant based virtio network on openstack.	*network. yaml* and/or *layout.yaml***	No
Other-Virtio							
1001: 1500					Tenant based virtio networks on openstack.	*network. yaml* and/or *layout.yaml***	No

VLAN ID / Range	Network	Gateway	IP Range Start	IP Range End	Description	Where Configured	Routable?
SR-IOV (Phys-PCIe1)							
2101: **2500**					Tenant SRIOV network on openstack. (Intel NIC on PCIe1)	*network.yaml* and/or *layout.yaml***	Yes
SR-IOV (Phys-PCIe4)							
2501: **2900**					Tenant SRIOV network on openstack. (Intel NIC on PCIe4)	*network.yaml* and/or *layout.yaml***	Yes

NOTE: **Bold underlined** text is provided as example configuration information. Your deployment requirements will vary. The IP addresses in **bold** text are the recommended address used for internal routing between VNF components. All other IP addresses and VLAN IDs may be changed/assigned.

* You can ensure that the same floating IP address can assigned to the AutoVNF, CF, UEM, and VNFM after a VM restart by configuring parameters in the AutoDeploy configuration file or the UWS service delivery configuration file. Refer to Table 31: Floating IP address Reuse Parameters, on page 78 for details.

** For Hyper-converged Ultra M models based on OpenStack 10, these parameters must configured in the both the *networks.yaml* and the *layout.yaml* files unless the VIM installation automation feature is used. Refer to the *Ultra Services Platform Deployment Automation Guide* for details.

Caution IP address ranges used for the Tenant (Virtio), Storage (Virtio), and Internal-API (Virtio) in *network.yaml* cannot conflict with the IP addresses specified in *layout.yaml* for the corresponding networks. Address conflicts will prevent the VNF from functioning properly.

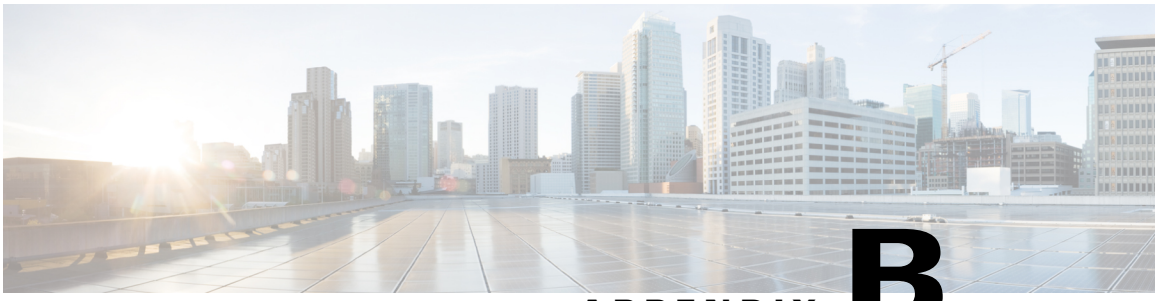
Table 31: Floating IP address Reuse Parameters

Component	Construct	AutoDeploy Configuration File Parameters	UWS Service Deployment Configuration File
AutoVNF	autovnfd	**networks management floating-ip true** **networks management ha-vip**<*vip_address*> **networks management floating-ip-address** <*floating_address*>	<management> <---SNIP---> **<floating-ip>true </floating-ip>** **<ha-vip>** *vip_address***</ha-vip>** **<floating-ip-address>** *floating_address* **</floating-ip-address>** </management>

Component	Construct	AutoDeploy Configuration File Parameters	UWS Service Deployment Configuration File
VNFM	vnfmd	**floating-ip true** **ha-vip** <*vip_address*> **floating-ip-address** <*floating_address*>	<management> <---SNIP---> **<floating-ip>true </floating-ip>** **<ha-vip>** *vip_address***</ha-vip>** **<floating-ip-address>***floating_address* **</floating-ip-address>** </management>
UEM	vnfd	**vnf-em ha-vip** <*vip_address*> **vnf-em floating-ip true** **vnf-em floating-ip-address** <*floating_address*>	<vnf-em> <---SNIP---> **<ha-vip>** *vip_address***</ha-vip>** <---SNIP---> **<floating-ip>true </floating-ip>** **<floating-ip-address>** *floating_address* **</floating-ip-address>** <---SNIP---> </vnf-em>
CF	vnfd	interfaces mgmt <---SNIP---> **enable-ha-vip** <*vip_address*> **floating-ip true** **floating-ip-address** <*floating_address*> <---SNIP--->	<interfaces> <---SNIP---> **<enable-ha-vip>** *vip_address***</enable-ha-vip>** **<floating-ip>true </floating-ip>** **<floating-ip-address>** *floating_address* **</floating-ip-address>** <---SNIP---> </interfaces>

Note This functionality is disabled by default. Set the **floating-ip** and/or **<floating-ip>** parameters to *true* to enable this functionality.

Note Prior to assigning floating and virtual IP addresses, make sure that they are not already allocated through OpenStack. If the addresses are already allocated, then they must be freed up for use or you must assign a new IP address that is available in the VIM.



APPENDIX B

Example ultram_cfg.yaml File

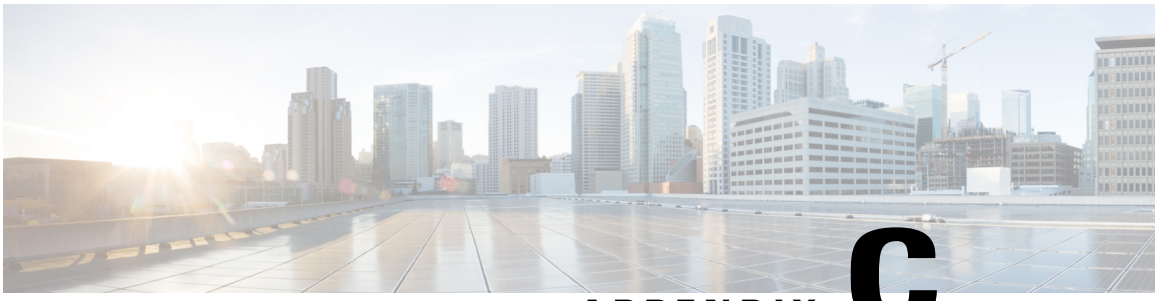
The ultram_cfg.yaml file is used to configure and enable syslog proxy and event aggregation functionality within the Ultra M Manager function. Refer to Event and Syslog Management Within the Ultra M Solution, on page 57 for details.

Caution This is only a sample configuration file provided solely for your reference. You must create and modify your own configuration file according to the specific needs of your deployment.

```
#-------------------------------------------------------------------
# Configuration data for Ultra-M Health Check
#-------------------------------------------------------------------

# Health check polling frequency 15min
polling-interval: 900

# under-cloud info, this is used to authenticate
# OSPD and mostly used to build inventory list (compute, controllers, OSDs)
under-cloud:
  environment:
    OS_AUTH_URL: http://192.200.0.1:5000/v2.0
    OS_USERNAME: admin
    OS_TENANT_NAME: admin
    OS_PASSWORD: *******
  prefix: neutonoc


# over-cloud info, to authenticate OpenStack Keystone endpoint
over-cloud:
  enabled: true
  environment:
    OS_AUTH_URL: http://172.21.201.217:5000/v2.0
    OS_TENANT_NAME: user1
    OS_USERNAME: user1
    OS_PASSWORD: *******
    OS_ENDPOINT_TYPE: publicURL
    OS_IDENTITY_API_VERSION: 2
    OS_REGION_NAME: regionOne

  # SSH Key to be used to login without username/password
  auth-key: /home/stack/.ssh/id_rsa

  # Number of OpenStack controller nodes
  controller_count:  3

  # Number of osd-compute nodes
  osd_compute_count:  3

  # Number of OSD disks per osd-compute node
```

```
  osd_disk_count_per_osd_compute: 4

  # Mark "ceph df" down if raw usage exceeds this setting
  ceph_df_use_threshold: 80.0

  # Max NTP skew limit in miliseconds
  ntp_skew_limit: 100

snmp:
  enabled: true
  identity: 'ULTRAM-SJC-BLDG-4/UTIT-TESTBED/10.23.252.159'
  nms-server:
    172.21.201.53:
      community: public
    10.23.252.159:
      community: ultram
  agent:
    community: public
    snmp-data-file: '/opt/cisco/usp/ultram_health.data/snmp_faults_table'
  log-file: '/var/log/cisco/ultram_snmp.log'

ucs-cluster:
  enabled: true
  user: admin
  password: Cisco123
  data-dir: '/opt/cisco/usp/ultram_health.data/ucs'
  log-file: '/var/log/cisco/ultram_ucs.log'


uas-cluster:
  enabled: false
  log-file: '/var/log/cisco/ultram_uas.log'
  data-dir: '/opt/cisco/usp/ultram_health.data/uas'
  autovnf:
    172.21.201.53:
      autovnf:
        login:
          user: ubuntu
          password: *******
        netconf:
          user: admin
          password: admin
      em:
        login:
          user: ubuntu
          password: *******
        netconf:
          user: admin
          password: *******
      esc:
        login:
          user: admin
          password: *******
    172.21.201.53:
      autovnf:
        login:
          user: ubuntu
          password: *******
        netconf:
          user: admin
          password: admin
      em:
        login:
          user: ubuntu
          password: *******
        netconf:
          user: admin
          password: *******
      esc:
        login:
          user: admin
          password: *******
```

```
#rsyslog configuration, here proxy-rsyslog is IP address of Ultra M Manager Node (NOT
remote rsyslog):
rsyslog:
  level: 4,3,2,1,0
  proxy-rsyslog: 192.200.0.251
```



APPENDIX C

Ultra M MIB

Note Not all aspects of this MIB are supported in this release. Refer to Event and Syslog Management Within the Ultra M Solution, on page 57 for information on the capabilities supported in this release.

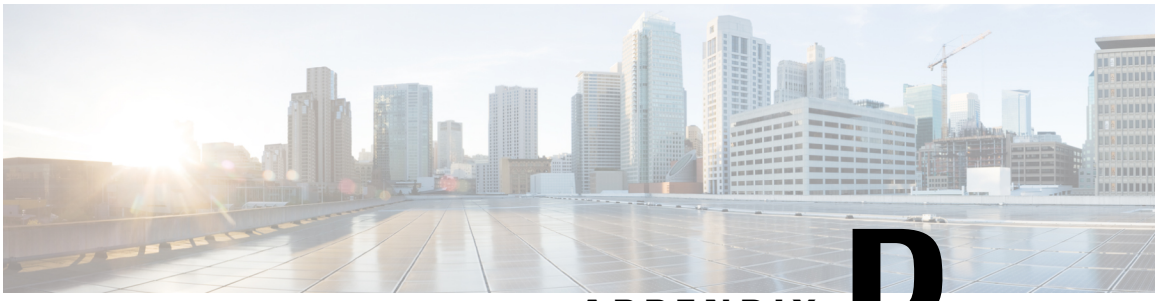
```
-- ************************************************************
-- CISCO-ULTRAM-MIB.my
-- Copyright (c) 2017 by Cisco Systems Inc.
-- All rights reserved.
--
-- ************************************************************
CISCO-ULTRAM-MIB DEFINITIONS ::= BEGIN
IMPORTS
    MODULE-IDENTITY
    OBJECT-TYPE
    NOTIFICATION-TYPE
    Unsigned32
        FROM SNMPv2-SMI
    MODULE-COMPLIANCE
    NOTIFICATION-GROUP
    OBJECT-GROUP
        FROM SNMPv2-CONF
    TEXTUAL-CONVENTION
    DateAndTime
        FROM SNMPv2-TC
    ciscoMgmt
        FROM CISCO-SMI;
ciscoUltramMIB MODULE-IDENTITY
    LAST-UPDATED    "201707060000Z"
    ORGANIZATION    "Cisco Systems Inc."
    CONTACT-INFO
            "Cisco Systems
            Customer Service
            Postal: 170 W Tasman Drive
            San Jose CA  95134
            USA
            Tel: +1 800 553-NETS"
    DESCRIPTION
        "The MIB module to management of Cisco Ultra Services Platform
        (USP) also called Ultra-M Network Function Virtualization (NFV)
        platform. The Ultra-M platform is Cisco validated turnkey
        solution based on ETSI(European Telecommunications Standards
        Institute) NFV architetcure.
        It comprises of following architectural domains:
         1. Management and Orchestration (MANO) these componets
        enables infrastructure virtualization and life cycle management
        of Cisco Ultra Virtual Network Functions (VNFs).
         2. NFV Infrastructure (NFVI) set of physical resources to
        provide NFV infrastructre for example servers switch chassis
```

```
        and so on.
         3. Virtualized Infrastructure Manager (VIM)
         4. One or more Ultra VNFs.
        Ultra-M platform provides a single point of management
        (including SNMP APIs Web Console and CLI/Telnet Console) for
        the resources across these domains within NFV PoD (Point of
        Delivery).
        This is also called Ultra-M manager throughout the context of
        this MIB."
    REVISION        "201707050000Z"
    DESCRIPTION
        "- cultramFaultDomain changed to read-only in compliance.
        - Added a new fault code serviceFailure under
        'CultramFaultCode'.
        - Added a new notification cultramFaultClearNotif.
        - Added new notification group ciscoUltramMIBNotifyGroupExt.
        - Added new compliance group ciscoUltramMIBModuleComplianceRev01
        which deprecates ciscoUltramMIBModuleCompliance."
    REVISION        "201706260000Z"
    DESCRIPTION
        "Latest version of this MIB module."
    ::= { ciscoMgmt 849 }
CFaultCode ::= TEXTUAL-CONVENTION
    STATUS          current
    DESCRIPTION
        "A code identifying a class of fault."
    SYNTAX          INTEGER  {
                        other(1) -- Other events
                        networkConnectivity(2) -- Network Connectivity
                                               -- Failure Events.
                        resourceUsage(3) -- Resource Usage Exhausted
                                         -- Event.
                        resourceThreshold(4) -- Resource Threshold
                                             -- crossing alarms
                        hardwareFailure(5) -- Hardware Failure Events
                        securityViolation(6) -- Security Alerts
                        configuration(7) -- Config Error Events
                        serviceFailure(8) -- Process/Service failures

                    }
CFaultSeverity ::= TEXTUAL-CONVENTION
    STATUS          current
    DESCRIPTION
        "A code used to identify the severity of a fault."
    SYNTAX          INTEGER  {
                        emergency(1) -- System level FAULT impacting
                                     -- multiple VNFs/Services
                        critical(2) -- Critical Fault specific to
                                    -- VNF/Service
                        major(3) -- component level failure within
                                 -- VNF/service.
                        alert(4) -- warning condition for a service/VNF
                                 -- may eventually impact service.
                        informational(5) -- informational only does not
                                         -- impact service
                    }
CFaultDomain ::= TEXTUAL-CONVENTION
    STATUS          current
    DESCRIPTION
        "A code used to categorize Ultra-M fault domain."
    SYNTAX          INTEGER  {
                        hardware(1) -- Harware including Servers L2/L3
                                    -- Elements
                        vimOrchestrator(2) -- VIM under-cloud
                        vim(3) -- VIM manager such as OpenStack
                        uas(4) -- Ultra Automation Services Modules
                        vnfm(5) -- VNF manager
                        vnfEM(6) -- Ultra VNF Element Manager
                        vnf(7) -- Ultra VNF
                    }
-- Textual Conventions definition will be defined before this line
ciscoUltramMIBNotifs  OBJECT IDENTIFIER
    ::= { ciscoUltramMIB 0 }
```

```
ciscoUltramMIBObjects  OBJECT IDENTIFIER
    ::= { ciscoUltramMIB 1 }
ciscoUltramMIBConform  OBJECT IDENTIFIER
    ::= { ciscoUltramMIB 2 }
-- Conformance Information Definition
ciscoUltramMIBCompliances  OBJECT IDENTIFIER
    ::= { ciscoUltramMIBConform 1 }
ciscoUltramMIBGroups  OBJECT IDENTIFIER
    ::= { ciscoUltramMIBConform 2 }
ciscoUltramMIBModuleCompliance MODULE-COMPLIANCE
    STATUS          deprecated
    DESCRIPTION
        "The compliance statement for entities that support
        the Cisco Ultra-M Fault Managed Objects"
    MODULE          -- this module
    MANDATORY-GROUPS {
                        ciscoUltramMIBMainObjectGroup
                        ciscoUltramMIBNotifyGroup
                    }
    ::= { ciscoUltramMIBCompliances 1 }
ciscoUltramMIBModuleComplianceRev01 MODULE-COMPLIANCE
    STATUS          current
    DESCRIPTION
        "The compliance statement for entities that support
        the Cisco Ultra-M Fault Managed Objects."
    MODULE          -- this module
    MANDATORY-GROUPS {
                        ciscoUltramMIBMainObjectGroup
                        ciscoUltramMIBNotifyGroup
                        ciscoUltramMIBNotifyGroupExt
                    }
    OBJECT          cultramFaultDomain
    MIN-ACCESS      read-only
    DESCRIPTION
        "cultramFaultDomain is read-only."
    ::= { ciscoUltramMIBCompliances 2 }
ciscoUltramMIBMainObjectGroup OBJECT-GROUP
    OBJECTS         {
                        cultramNFVIdenity
                        cultramFaultDomain
                        cultramFaultSource
                        cultramFaultCreationTime
                        cultramFaultSeverity
                        cultramFaultCode
                        cultramFaultDescription
                    }
    STATUS          current
    DESCRIPTION
        "A collection of objects providing Ultra-M fault information."
    ::= { ciscoUltramMIBGroups 1 }
ciscoUltramMIBNotifyGroup NOTIFICATION-GROUP
   NOTIFICATIONS    { cultramFaultActiveNotif }
    STATUS          current
    DESCRIPTION
        "The set of Ultra-M notifications defined by this MIB"
    ::= { ciscoUltramMIBGroups 2 }
ciscoUltramMIBNotifyGroupExt NOTIFICATION-GROUP
   NOTIFICATIONS    { cultramFaultClearNotif }
    STATUS          current
    DESCRIPTION
        "The set of Ultra-M notifications defined by this MIB"
    ::= { ciscoUltramMIBGroups 3 }
cultramFaultTable OBJECT-TYPE
    SYNTAX          SEQUENCE OF CUltramFaultEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A table of Ultra-M faults. This table contains active
        faults."
    ::= { ciscoUltramMIBObjects 1 }
cultramFaultEntry OBJECT-TYPE
    SYNTAX          CUltramFaultEntry
    MAX-ACCESS      not-accessible
```

```
    STATUS          current
    DESCRIPTION
        "An entry in the Ultra-M fault table."
    INDEX           { cultramFaultIndex }
    ::= { cultramFaultTable 1 }
CUltramFaultEntry ::= SEQUENCE {
        cultramFaultIndex        Unsigned32
        cultramNFVIdenity        OCTET STRING
        cultramFaultDomain       CFaultDomain
        cultramFaultSource       OCTET STRING
        cultramFaultCreationTime DateAndTime
        cultramFaultSeverity     CFaultSeverity
        cultramFaultCode         CFaultCode
        cultramFaultDescription  OCTET STRING
}
cultramFaultIndex OBJECT-TYPE
    SYNTAX          Unsigned32
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This object uniquely identifies a specific instance of a
        Ultra-M fault.
        For example if two separate computes have a service level
        Failure then each compute will have a fault instance with a
        unique index."
    ::= { cultramFaultEntry 1 }
cultramNFVIdenity OBJECT-TYPE
    SYNTAX          OCTET STRING (SIZE  (1..512))
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "This object uniquely identifies the Ultra-M PoD on which this
        fault is occurring.
        For example this identity can include host-name as well
        management IP where manager node is running
        'Ultra-M-San-Francisco/172.10.185.100'."
    ::= { cultramFaultEntry 2 }
cultramFaultDomain OBJECT-TYPE
    SYNTAX          CFaultDomain
    MAX-ACCESS      read-write
    STATUS          current
    DESCRIPTION
        "A unique Fault Domain that has fault."
    ::= { cultramFaultEntry 3 }
cultramFaultSource OBJECT-TYPE
    SYNTAX          OCTET STRING (SIZE  (1..512))
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "This object uniquely identifies the resource with the fault
        domain where this fault is occurring. For example this can
        include host-name as well management IP of the resource
        'UCS-C240-Server-1/192.100.0.1'."
    ::= { cultramFaultEntry 4 }
cultramFaultCreationTime OBJECT-TYPE
    SYNTAX          DateAndTime
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "The date and time when the fault was occured."
    ::= { cultramFaultEntry 5 }
cultramFaultSeverity OBJECT-TYPE
    SYNTAX          CFaultSeverity
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "A code identifying the perceived severity of the fault."
    ::= { cultramFaultEntry 6 }
cultramFaultCode OBJECT-TYPE
    SYNTAX          CFaultCode
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
```

```
        "A code uniquely identifying the fault class."
    ::= { cultramFaultEntry 7 }
cultramFaultDescription OBJECT-TYPE
    SYNTAX          OCTET STRING (SIZE  (1..2048))
    MAX-ACCESS      read-only
    STATUS          current
    DESCRIPTION
        "A human-readable message providing details about the fault."
    ::= { cultramFaultEntry 8 }
cultramFaultActiveNotif NOTIFICATION-TYPE
    OBJECTS         {
                        cultramNFVIdenity
                        cultramFaultDomain
                        cultramFaultSource
                        cultramFaultCreationTime
                        cultramFaultSeverity
                        cultramFaultCode
                        cultramFaultDescription
                    }
    STATUS          current
    DESCRIPTION
        "This notification is generated by a Ultra-M manager whenever a
        fault is active."
   ::= { ciscoUltramMIBNotifs 1 }
cultramFaultClearNotif NOTIFICATION-TYPE
    OBJECTS         {
                        cultramNFVIdenity
                        cultramFaultDomain
                        cultramFaultSource
                        cultramFaultCreationTime
                        cultramFaultSeverity
                        cultramFaultCode
                        cultramFaultDescription
                    }
    STATUS          current
    DESCRIPTION
        "This notification is generated by a Ultra-M manager whenever a
        fault is cleared."
   ::= { ciscoUltramMIBNotifs 2 }
END
```



APPENDIX D

Ultra M Component Event Severity and Fault Code Mappings

Events are assigned to one of the following severities (refer to CFaultSeverity in Ultra M MIB, on page 85):

- emergency(1), -- System level FAULT impacting multiple VNFs/Services
- critical(2), -- Critical Fault specific to VNF/Service
- major(3), -- component level failure within VNF/service.
- alert(4), -- warning condition for a service/VNF, may eventually impact service.
- informational(5) -- informational only, does not impact service

Events are also mapped to one of the following fault codes (refer to cFaultCode in the Ultra M MIB):

- other(1), -- Other events
- networkConnectivity(2), -- Network Connectivity -- Failure Events.
- resourceUsage(3), -- Resource Usage Exhausted -- Event.
- resourceThreshold(4), -- Resource Threshold -- crossing alarms
- hardwareFailure(5), -- Hardware Failure Events
- securityViolation(6), -- Security Alerts
- configuration(7), -- Config Error Events serviceFailure(8) -- Process/Service failures

The Ultra M Manager Node serves as an aggregator for events received from the different Ultra M components. These severities and fault codes are mapped to those defined for the specific components. The information in this section provides severity mapping information for the following:

- OpenStack Events, page 92
- UCS Server Events, page 96
- UAS Events, page 97

OpenStack Events

Component: Ceph

Table 32: Component: Ceph

Failure Type	Ultra M Severity	Fault Code
CEPH Status is not healthy	Emergency	serviceFailure
One or more CEPH monitors are down	Emergency	serviceFailure
Disk usage exceeds threshold	Critical	resourceThreshold
One or more OSD nodes are down	Critical	serviceFailure
One or more OSD disks are failed	Critical	resourceThreshold
One of the CEPH monitor is not healthy.	Major	serviceFailure
One or more CEPH monitor restarted.	Major	serviceFailure
OSD disk weights not even across the board.		resourceThreshold

Component: Cinder

Table 33: Component: Cinder

Failure Type	Ultra M Severity	Fault Code
Cinder Service is down	Emergency	serviceFailure

Component: Neutron

Table 34: Component: Neutron

Failure Type	Ultra M Severity	Fault Code
One of Neutron Agent Down	Critical	serviceFailure

Component: Nova

Table 35: Component: Nova

Failure Type	Ultra M Severity	Fault Code
Compute service down	Critical	serviceFailure

Component: NTP

Table 36: Component: NTP

Failure Type	Ultra M Severity	Fault Code
NTP skew limit exceeds configured threshold.	Critical	serviceFailure

Component: PCS

Table 37: Component: PCS

Failure Type	Ultra M Severity	Fault Code
One or more controller nodes are down	Critical	serviceFailure
Ha-proxy is down on one of the node	Major	serviceFailure
Galera service is down on one of the node.	Critical	serviceFailure

Failure Type	Ultra M Severity	Fault Code
Rabbitmq is down.	Critical	serviceFailure
Radis Master is down.	Emergency	serviceFailure
One or more Radis Slaves are down.	Critical	serviceFailure
corosync/pacemaker/pcsd - not all daemons active	Critical	serviceFailure
Cluster status changed.	Major	serviceFailure
Current DC not found.	Emergency	serviceFailure
Not all PCDs are online.	Critical	serviceFailure

Component: Rabbitmqctl

Table 38: Component: Rabbitmqctl

Failure Type	Ultra M Severity	Fault Code
Cluster Status is not healthy	Emergency	serviceFailure

Component: Services

Table 39: Component: Services

Failure Type	Ultra M Severity	Fault Code
Service is disabled.	Critical	serviceFailure
Service is down.	Emergency	serviceFailure
Service Restarted.	Major	serviceFailure

The following OpenStack services are monitored:

- Controller Nodes:
  - httpd.service
  - memcached

- mongod.service
- neutron-dhcp-agent.service
- neutron-l3-agent.service
- neutron-metadata-agent.service
- neutron-openvswitch-agent.service
- neutron-server.service
- ntpd.service
- openstack-aodh-evaluator.service
- openstack-aodh-listener.service
- openstack-aodh-notifier.service
- openstack-ceilometer-central.service
- openstack-ceilometer-collector.service
- openstack-ceilometer-notification.service
- openstack-cinder-api.service
- openstack-cinder-scheduler.service
- openstack-glance-api.service
- openstack-glance-registry.service
- openstack-gnocchi-metricd.service
- openstack-gnocchi-statsd.service
- openstack-heat-api-cfn.service
- openstack-heat-api-cloudwatch.service
- openstack-heat-api.service
- openstack-heat-engine.service
- openstack-nova-api.service
- openstack-nova-conductor.service
- openstack-nova-consoleauth.service
- openstack-nova-novncproxy.service
- openstack-nova-scheduler.service
- openstack-swift-account-auditor.service
- openstack-swift-account-reaper.service
- openstack-swift-account-replicator.service
- openstack-swift-account.service
- openstack-swift-container-auditor.service

- openstack-swift-container-replicator.service
- openstack-swift-container-updater.service
- openstack-swift-container.service
- openstack-swift-object-auditor.service
- openstack-swift-object-replicator.service
- openstack-swift-object-updater.service
- openstack-swift-object.service
- openstack-swift-proxy.service

- Compute Nodes:
  - ceph-mon.target
  - ceph-radosgw.target
  - ceph.target
  - libvirtd.service
  - neutron-sriov-nic-agent.service
  - neutron-openvswitch-agent.service
  - ntpd.service
  - openstack-nova-compute.service
  - openvswitch.service

- OSD Compute Nodes:
  - ceph-mon.target
  - ceph-radosgw.target
  - ceph.target
  - libvirtd.service
  - neutron-sriov-nic-agent.service
  - neutron-openvswitch-agent.service
  - ntpd.service
  - openstack-nova-compute.service
  - openvswitch.service

UCS Server Events

UCS Server events are described here:https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/ts/faults/reference/ErrMess/FaultsIntroduction.html

The following table maps the UCS severities to those within the Ultra M MIB.

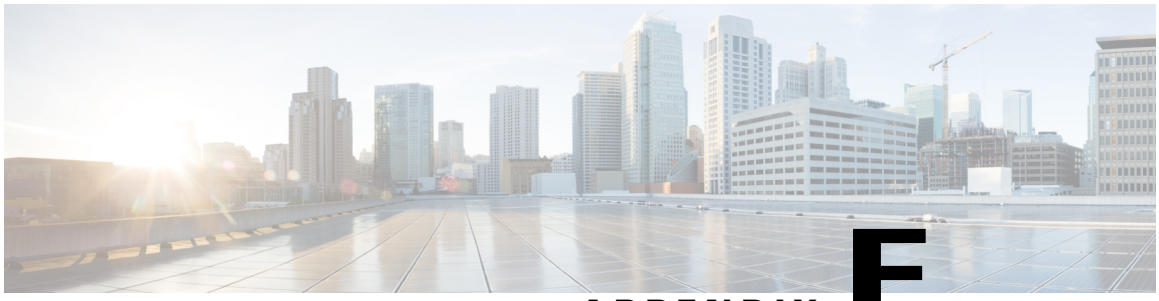
Table 40: UCS Server Severities

UCS Server Severity	Ultra M Severity	Fault Code
Critical	Critical	hardwareFailure
Info	Informational	hardwareFailure
Major	Major	hardwareFailure
Warning	Alert	hardwareFailure
Alert	Alert	hardwareFailure
Cleared	Informational	Not applicable

UAS Events

Table 41: UAS Events

Failure Type	Ultra M Severity	Fault Code
UAS Service Failure	Critical	serviceFailure*
UAS Service Recovered	Informational	serviceFailure*
* *serviceFailure* is used except where the Ultra M Health Monitor is unable to connect to any of the modules. In this case, the fault code is set to *networkConnectivity*.		



APPENDIX E

Ultra M Troubleshooting

Ultra M Component Reference Documentation

The following sections provide links to troubleshooting information for the various components that comprise the Ultra M solution.

UCS C-Series Server

- Obtaining Showtech Support to TAC
- Display of system Event log events
- Display of CIMC Log
- Run Debug Firmware Utility
- Run Diagnostics CLI
- Common Troubleshooting Scenarios
- Troubleshooting Disk and Raid issues
- DIMM Memory Issues
- Troubleshooting Server and Memory Issues
- Troubleshooting Communication Issues

Nexus 9000 Series Switch

- Troubleshooting Installations, Upgrades, and Reboots

- Troubleshooting Licensing Issues
- Troubleshooting Ports
- Troubleshooting vPCs
- Troubleshooting VLANs
- Troubleshooting STP
- Troubleshooting Routing
- Troubleshooting Memory
- Troubleshooting Packet Flow Issues
- Troubleshooting PowerOn Auto Provisioning
- Troubleshooting the Python API
- Troubleshooting NX-API
- Troubleshooting Service Failures
- Before Contacting Technical Support
- Troubleshooting Tools and Methodology

Catalyst 2960 Switch

- Diagnosing Problems
- Switch POST Results
- Switch LEDs
- Switch Connections
- Bad or Damaged Cable
- Ethernet and Fiber-Optic Cables
- Link Status
- 10/100/1000 Port Connections
- 10/100/1000 PoE+ Port Connections
- SFP and SFP+ Module
- Interface Settings
- Ping End Device
- Spanning Tree Loops
- Switch Performance
- Speed, Duplex, and Autonegotiation
- Autonegotiation and Network Interface Cards
- Cabling Distance

- Clearing the Switch IP Address and Configuration
- Finding the Serial Number
- Replacing a Failed Stack Member

Red Hat

- Troubleshooting Director issue
- Backup and Restore Director Undercloud

OpenStack

- Red Hat Openstack Troubleshooting commands and sceanrios

UAS

Refer to the *USP Deployment Automation Guide*.

UGP

Refer to the *Ultra Gateway Platform System Administration Guide*.

Collecting Support Information

From UCS:

- Collect support information:

  chassis show tech support
  show tech support `(if applicable)`

- Check which UCS MIBS are being polled (if applicable). Refer to https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/sw/mib/c-series/b_UCS_Standalone_C-Series_MIBRef/b_UCS_Standalone_C-Series_MIBRef_chapter_0100.html

From Host/Server/Compute/Controler/Linux:

- Identify if Passthrought/SR-IOV is enabled.
- Run sosreport:

Note This functionality is enabled by default on Red Hat, but not on Ubuntu. It is recommended that you enable *sysstat* and *sosreport* on Ubuntu (run **apt-get install sysstat** and **apt-get install sosreport**). It is also recommended that you install sysstat on Red Hat (run **yum install sysstat**).

- Get and run the **os_ssd_pac** script from Cisco:
  - Compute (all):

    ./os_ssd_pac.sh -a
    ./os_ssd_pac.sh -k -s

    Note For initial collection, it is always recommended to include the **-s** option (sosreport). Run **./os_ssd_pac.sh -h** for more information.

  - Controller (all):

    ./os_ssd_pac.sh -f
    ./os_ssd_pac.sh -c -s

    Note For initial collection it is always recommended to include the -s option (sosreport). Run **./os_ssd_pac.sh -h** for more information.

- For monitoring purposes, from *crontab* use option: **-m** (for example run every 5 or 10 minutes)

From Switches

From all switches connected to the Host/Servers. (This also includes other switches which have same vlans terminated on the Host/Servers.)

show tech-support
syslogs
snmp traps

Note It is recommended that mac-move notifications are enabled on all switches in network by running mac address-table notification mac-move.

From ESC (Active and Standby)

Note It is recommended that you take a backup of the software and data before performing any of the following operations. Backups can be taken by executing opt/cisco/esc/esc-scripts/esc_dbtool.py backup. (Refer to https://www.cisco.com/c/en/us/td/docs/net_mgmt/elastic_services_controller/2-3/user/guide/Cisco-Elastic-Services-Controller-User-Guide-2-3/Cisco-Elastic-Services-Controller-User-Guide-2-2_chapter_010010.html#id_18936 for more information.)

/opt/cisco/esc/esc-scripts/health.sh
/usr/bin/collect_esc_log.sh
./os_ssd_pac -a

From UAS

- Monitor ConfD:

  confd -status
  confd --debug-dump /tmp/confd_debug-dump
  confd --printlog /tmp/confd_debug-dump

  Note Once the file **/tmp/confd_debug-dump**> is collected, it can be removed (**rm /tmp/confd_debug-dump**).

- Monitor UAS Components:

  source /opt/cisco/usp/uas/confd-6.1/confdrc
  confd_cli -u admin -C
  show uas
  show uas ha-vip
  show uas state
  show confd-state
  show running-config
  show transactions date-and-time
  show logs | display xml
  show errors displaylevel 64
  show notification stream uas_notify last 1000
  show autovnf-oper:vnfm
  show autovnf-oper:vnf-em
  show autovnf-oper:vdu-catalog
  show autovnf-oper:transactions
  show autovnf-oper:network-catalog
  show autovnf-oper:errors
  show usp
  show confd-state internal callpoints
  show confd-state webui listen
  show netconf-state

- Monitor Zookeeper:

  /opt/cisco/usp/packages/zookeeper/current/bin/zkCli.sh ls /config/control-function
  /opt/cisco/usp/packages/zookeeper/current/bin/zkCli.sh ls /config/element-manager
  /opt/cisco/usp/packages/zookeeper/current/bin/zkCli.sh ls /config/session-function
  /opt/cisco/usp/packages/zookeeper/current/bin/zkCli.sh ls /
  /opt/cisco/usp/packages/zookeeper/current/bin/zkCli.sh ls /stat
  /opt/cisco/usp/packages/zookeeper/current/bin/zkCli.sh ls /log

- Collect Zookeeper data:

  cd /tmp
  tar zcfv zookeeper_data.tgz /var/lib/zookeeper/data/version-2/
  ls -las /tmp/zookeeper_data.tgz

- Get support details

  ./os_ssd_pac -a

From UEM (Active and Standby)

- Collect logs

  /opt/cisco/em-scripts/collect-em-logs.sh

- Monitor NCS:

  ncs -status
  ncs --debug-dump /tmp/ncs_debug-dump
  ncs --printlog /tmp/ncs_debug-dump

Note Once the file **/tmp/ncs_debug-dump** is collected, it can be removed (**rm /tmp/ncs_debug-dump**).

- Collect support details:

  ./os_ssd_pac -a

From UGP (Through StarOS)

- Collect the multiple outputs of the **show support details**.

Note It is recommended to collect at least two samples, 60 minutes apart if possible.

- Collect raw bulkstats before and after events.
- Collect syslogs and snmp traps before and after events.

- Collect PCAP or sniffer traces of all relevant interfaces if possible.

Note Familiarize yourself with how running SPAN/RSPAN on Nexus and Catalyst switches. This is important for resolving Passthrough/SR-IOV issues.

- Collect console outputs from all nodes.
- Export CDRs and EDRs.
- Collect the outputs of **monitor subscriber next-call** or **monitor protocol** depending on the activity
- Refer to https://supportforums.cisco.com/sites/default/files/cisco_asr5000_asr5500_troubleshooting_guide.pdf for more information.

About Ultra M Manager Log Files

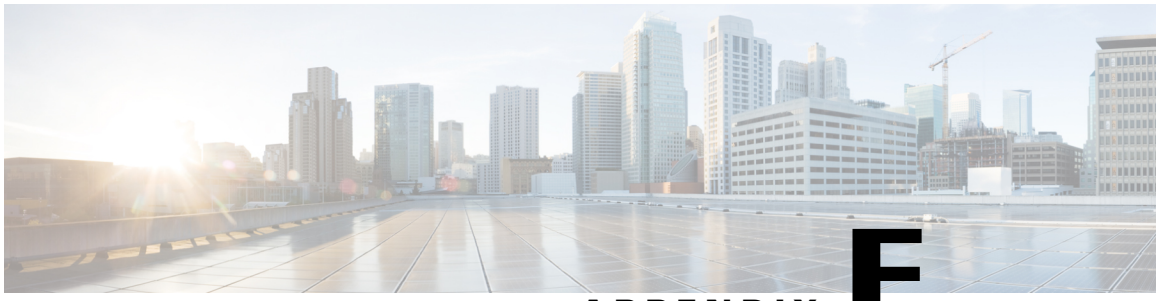
All Ultra M Manager log files are created under "/var/log/cisco/ultram-health".

cd /var/log/cisco/ultram-health
ls -alrt
Example output:

```
total 116
drwxr-xr-x. 3 root root  4096 Sep 10 17:41 ..
-rw-r--r--. 1 root root     0 Sep 12 15:15 ultram_health_snmp.log
-rw-r--r--. 1 root root   448 Sep 12 15:16 ultram_health_uas.report
-rw-r--r--. 1 root root   188 Sep 12 15:16 ultram_health_uas.error
-rw-r--r--. 1 root root   580 Sep 12 15:16 ultram_health_uas.log
-rw-r--r--. 1 root root 24093 Sep 12 15:16 ultram_health_ucs.log
-rw-r--r--. 1 root root  8302 Sep 12 15:16 ultram_health_os.error
drwxr-xr-x. 2 root root  4096 Sep 12 15:16 .
-rw-r--r--. 1 root root 51077 Sep 12 15:16 ultram_health_os.report
-rw-r--r--. 1 root root  6677 Sep 12 15:16 ultram_health_os.log
```

NOTES:

- The files are named according to the following conventions:
  - ultram_health_os: Contain information related to OpenStack
  - ultram_health_ucs: Contain information related to UCS
  - ultram_health_uas: Contain information related to UAS
- Files with the "*.log" extension contain debug/error outputs from different components. These files get added to over time and contain useful data for debugging in case of issues.
- Files with the ".report" extension contain the current report. These files get created on every tun.
- Files with the ".error" extension contain actual data received from the nodes as part of health monitoring. These are the events that causes the Ultra M health monitor to send traps out. These files are updated every time a component generates an event.



APPENDIX F

Using the UCS Utilities Within the Ultra M Manager

This appendix describes the UCS facilities within the Ultra M Manager.

Overview

Cisco UCS server BIOS, MLOM, and CIMC software updates may be made available from time to time.

Utilities have been added to the Ultra M Manager software to simplify the process of upgrading the UCS server software (firmware) within the Ultra M solution.

These utilities are available through a script called *ultram_ucs_utils.py* located in the */opt/cisco/usp/ultram-health* directory. Refer to ultram_ucs_utils.py Help, on page 127 for more information on this script.

NOTES:

- This functionality is currently supported only with Ultra M deployments based on OSP 10 and that leverage the Hyper-Converged architecture.

- You should only upgrade your UCS server software to versions that have been validated for use within the Ultra M solution.
- All UCS servers within the Ultra M solution stack should be upgraded to the same firmware versions.
- Though it is highly recommended that all server upgrades be performed during a single maintenance window, it is possible to perform the upgrade across multiple maintenance windows based on Node type (e.g. Compute, OSD Compute, and Controller).

There are two upgrade scenarios:

- **Upgrading servers in an existing deployment.** In the scenario, the servers are already in use hosting the Ultra M solution stack. This upgrade procedure is designed to maintain the integrity of the stack.
  - Compute Nodes are upgraded in parallel.
  - OSD Compute Nodes are upgraded sequentially.
  - Controller Nodes are upgraded sequentially.
- **Upgrading bare metal servers.** In this scenario, the bare metal servers have not yet been deployed within the Ultra M solution stack. This upgrade procedure leverages the parallel upgrade capability within Ultra M Manager UCS utilities to upgrade the servers in parallel.

To use UItra M Manager UCS utilities to upgrade software for UCS servers in an existing deployment:

1. Perform Pre-Upgrade Preparation.
2. Shutdown the ESC VMs, on page 112.
3. Upgrade the Compute Node Server Software.
4. Upgrade the OSD Compute Node Server Software, on page 114.
5. Restart the UAS and ESC (VNFM) VMs, on page 117.
6. Upgrade the Controller Node Server Software, on page 117.
7. Upgrade Firmware on the OSP-D Server/Ultra M Manager Node, on page 122.

To use UItra M Manager UCS utilities to upgrade software for bare metal UCS servers:

1. Perform Pre-Upgrade Preparation.
2. Upgrade Firmware on UCS Bare Metal, on page 120.
3. Upgrade Firmware on the OSP-D Server/Ultra M Manager Node, on page 122.

Perform Pre-Upgrade Preparation

Prior to performing the actual UCS server software upgrade, you must perform the steps in this section to prepare your environment for the upgrade.

NOTES:

- These instructions assume that all hardware is fully installed, cabled, and operational.
- These instructions assume that the VIM Orchestrator and VIM have been successfully deployed.

- UCS server software is distributed separately from the USP software ISO.

To prepare your environment prior to upgrading the UCS server software:

1. Log on to the Ultra M Manager Node.
2. Create a directory called */var/www/html/firmwares* to contain the upgrade files.

   mkdir -p /var/www/html/firmwares
3. Download the UCS software ISO to the directory you just created.

   UCS software is available for download from https://software.cisco.com/download/type.html?mdfid=286281356&flowid=71443
4. Extract the *bios.cap* file.

   mkdir /tmp/UCSISO

   sudo mount -t iso9660 -o loop ucs-c240m4-huu-<*version*>**.iso UCSISO/**

   ```
   mount: /dev/loop2 is write-protected, mounting read-only
   ```

   cd UCSISO/

   ls

   ```
   EFI                    GETFW            isolinux  Release-Notes-DN2.txt  squashfs_img.md5
   tools.squashfs.enc
   firmware.squashfs.enc  huu-release.xml  LiveOS    squashfs_img.enc.md5   TOC_DELNORTE2.xml
     VIC_FIRMWARE
   ```

   cd GETFW/

   ls

   ```
   getfw  readme.txt
   ```

   mkdir -p /tmp/HUU
   sudo ./getfw -s /tmp/ucs-c240m4-huu-<*version*>**.iso -d /tmp/HUU**

   ```
   Nothing was selected hence getting only CIMC and BIOS
   FW/s available at '/tmp/HUU/ucs-c240m4-huu-<version>'
   ```

   cd /tmp/HUU/ucs-c240m4-huu-<*version*>**/bios/**

   ls

   ```
   bios.cap
   ```
5. Copy the *bios.cap* and *huu.iso* to the */var/www/html/firmwares/* directory.

   sudo cp bios.cap /var/www/html/firmwares/

   ls -lrt /var/www/html/firmwares/

   ```
   total 692228
   -rw-r--r--.  1 root root 692060160 Sep 28 22:43 ucs-c240m4-huu-<version>.iso
   -rwxr-xr-x.  1 root root  16779416 Sep 28 23:55 bios.cap
   ```
6. *Optional.* If it is not already installed, install the Ultra M Manager using the information and instructions in Install the Ultra M Manager RPM, on page 68.
7. Navigate to the */opt/cisco/usp/ultram-manager* directory.

   cd /opt/cisco/usp/ultram-manager

   Once this step is completed, if you are upgrading UCS servers in an existing Ultra M solution stack, proceed to 8, on page 110. If you are upgrading bare metal UCS servers, proceed to 9, on page 110.

8 *Optional.* If you are upgrading software for UCS servers in an existing Ultra M solution stack, then create UCS server node list configuration files for each node type as shown in the following table.

Configuration File Name	File Contents
compute.cfg	A list of the CIMC IP addresses for all of the Compute Nodes.
osd_compute_0.cfg	The CIMC IP address of the primary OSD Compute Node (osd-compute-0).
osd_compute_1.cfg	The CIMC IP address of the second OSD Compute Node (osd-compute-1).
osd_compute_2.cfg	The CIMC IP address of the third OSD Compute Node (osd-compute-2).
controller_0.cfg	The CIMC IP address of the primary Controller Node (controller-0).
controller_1.cfg	The CIMC IP address of the second Controller Node (controller-1).
controller_2.cfg	The CIMC IP address of the third Controller Node (controller-2).

Note Each address must be preceded by a dash and a space ("-"). The following is an example of the required format:

```
- 192.100.0.9
- 192.100.0.10
- 192.100.0.11
- 192.100.0.12
```

Separate configuration files are required for each OSD Compute and Controller Node in order to maintain the integrity of the Ultra M solution stack throughout the upgrade process.

9 *Optional.* If you are upgrading software on bare metal UCS servers prior to deploying them as part of the Ultra M solution stack, then create a configuration file called *hosts.cfg* containing a list of the CIMC IP addresses for all of the servers to be used within the Ultra M solution stack except the OSP-D server/Ultra M Manager Node.

Note Each address must be preceded by a dash and a space (-). The following is an example of the required format:

```
- 192.100.0.9
- 192.100.0.10
- 192.100.0.11
- 192.100.0.12
```

10 Create a configuration file called *ospd.cfg* containing the CIMC IP address of the OSP-D Server/Ultra M Manager Node.

Note The address must be preceded by a dash and a space ("-"). The following is an example of the required format:

```
- 192.300.0.9
```

11 Validate your configuration files by performing a sample test of the script to pull existing firmware versions from all Controller, OSD Compute, and Compute Nodes in your Ultra M solution deployment.

./ultram_ucs_utils.py --cfg "*<config_file_name>*" **--login** *<cimc_username> <cimc_user_password>* **--status 'firmwares'**
The following is an example output for a *hosts.cfg* file with a single Compute Node (192.100.0.7):

```
2017-10-01 10:36:28,189 - Successfully logged out from the server: 192.100.0.7
2017-10-01 10:36:28,190 -
--------------------------------------------------------------------------------------
Server IP      | Component                                          | Version
--------------------------------------------------------------------------------------
192.100.0.7    | bios/fw-boot-loader                              | C240M4.3.0.3c.0.0831170228

               | mgmt/fw-boot-loader                                | 3.0(3e).36
               | mgmt/fw-system                                     | 3.0(3e)
               | adaptor-MLOM/mgmt/fw-boot-loader                   | 4.1(2d)
               | adaptor-MLOM/mgmt/fw-system                        | 4.1(3a)
               | board/storage-SAS-SLOT-HBA/fw-boot-loader          |
6.30.03.0_4.17.08.00_0xC6130202
               | board/storage-SAS-SLOT-HBA/fw-system               | 4.620.00-7259
               | sas-expander-1/mgmt/fw-system                      | 65104100
               | Intel(R) I350 1 Gbps Network Controller            | 0x80000E75-1.810.8
               | Intel X520-DA2 10 Gbps 2 port NIC                  | 0x800008A4-1.810.8
               | Intel X520-DA2 10 Gbps 2 port NIC                  | 0x800008A4-1.810.8
               | UCS VIC 1227 10Gbps 2 port CNA SFP+                | 4.1(3a)
               | Cisco 12G SAS Modular Raid Controller              | 24.12.1-0203
--------------------------------------------------------------------------------------
```

If you receive errors when executing the script, ensure that the CIMC username and password are correct. Additionally, verify that all of the IP addresses have been entered properly in the configuration files.

Note It is highly recommended that you save the data reported in the output for later reference and validation after performing the upgrades.

12 Take backups of the various configuration files, logs, and other relevant information using the information and instructions in the *Backing Up Deployment Information* appendix in the *Ultra Services Platform Deployment Automation Guide*.

13 Continue the upgrade process based on your deployment status.

- Proceed to Shutdown the ESC VMs, on page 112 if you are upgrading software for servers that were previously deployed as part of the Ultra M solution stack.
- Proceed to Upgrade Firmware on UCS Bare Metal, on page 120 if you are upgrading software for servers that have not yet been deployed as part of the Ultra M solution stack.

Shutdown the ESC VMs

The Cisco Elastic Services Controller (ESC) serves as the VNFM in Ultra M solution deployments. ESC is deployed on a redundant pair of VMs. These VMs must be shut down prior to performing software upgrades on the UCS servers in the solution deployment.

To shut down the ESC VMs:

1. Login to OSP-D and make sure to "su - stack" and "source stackrc".
2. Run Nova list to get the UUIDs of the ESC VMs.

   nova list --fields name,host,status | grep <*vnf_deployment_name*>
   Example output:

```
<--- SNIP --->
| b470cfeb-20c6-4168-99f2-1592502c2057 | vnf1-ESC-ESC-
0                                                   | tb5-ultram-osd-compute-2.localdomain |
 ACTIVE |
| 157d7bfb-1152-4138-b85f-79afa96ad97d | vnf1-ESC-ESC-
1                                                   | tb5-ultram-osd-compute-1.localdomain |
 ACTIVE |
<--- SNIP --->
```

3. Stop the standby ESC VM.

   nova stop <*standby_vm_uuid*>
4. Stop the active ESC VM.

   nova stop <*active_vm_uuid*>
5. Verify that the VMs have been shutoff.

   nova list --fields name,host,status | grep <*vnf_deployment_name*>
   Look for the entries pertaining to the ESC UUIDs.

   Example output:

```
<--- SNIP --->
| b470cfeb-20c6-4168-99f2-1592502c2057 | vnf1-ESC-ESC-
0                                                   | tb5-ultram-osd-compute-2.localdomain |
 SHUTOFF |
| 157d7bfb-1152-4138-b85f-79afa96ad97d | vnf1-ESC-ESC-
1                                                   | tb5-ultram-osd-compute-1.localdomain |
 SHUTOFF |
<--- SNIP --->
```

6. Proceed to Upgrade the Compute Node Server Software, on page 112.

Upgrade the Compute Node Server Software

NOTES:

- Ensure that the ESC VMs have been shutdown according to the procedure in Shutdown the ESC VMs, on page 112.
- This procedure assumes that you are already logged in to the Ultra M Manager Node.
- This procedure requires the *compute.cfg* file created as part of the procedure detailed in Perform Pre-Upgrade Preparation, on page 108.

- It is highly recommended that all Compute Nodes be upgraded using this process during a single maintenance window.

To upgrade the UCS server software on the Compute Nodes:

1. Upgrade the BIOS on the UCS server-based Compute Nodes.

   ./ultram_ucs_utils.py --cfg "compute.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade bios --server** <*ospd_server_cimc_ip_address*> **--timeout 30 --file /firmwares/bios.cap**
   Example output:

```
2017-09-29 09:15:48,753 - Updating BIOS firmware on all the servers
2017-09-29 09:15:48,753 - Logging on UCS Server: 192.100.0.7
2017-09-29 09:15:48,758 - No session found, creating one on server: 192.100.0.7
2017-09-29 09:15:50,194 - Login successful to server: 192.100.0.7
2017-09-29 09:16:13,269 - 192.100.0.7 => updating | Image Download (5 %), OK
2017-09-29 09:17:26,669 - 192.100.0.7 => updating | Write Host Flash (75 %), OK
2017-09-29 09:18:34,524 - 192.100.0.7 => updating | Write Host Flash (75 %), OK
2017-09-29 09:19:40,892 - 192.100.0.7 => Activating BIOS
2017-09-29 09:19:55,011 -
--------------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------------
192.100.0.7     | SUCCESS | NA                  | Status: success, Progress: Done, OK
```

Note The Compute Nodes are automatically powered down after this process leaving only the CIMC interface available.

2. Upgrade the UCS server using the Host Upgrade Utility (HUU).

   ./ultram_ucs_utils.py --cfg "compute.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade huu --server** <*ospd_server_cimc_ip_address*> **--file /firmwares/**<*ucs_huu_iso_filename*>
   If the HUU script times out before completing the upgrade, the process might still be running on the remote hosts. You can periodically check the upgrade process by entering:

   ./ultram_ucs_utils.py --cfg "compute.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status huu-upgrade**
   Example output:

```
--------------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------------
192.100.0.7    | SUCCESS | 2017-10-20 07:10:11 | Update Complete  CIMC Completed, SasExpDN
 Completed, I350 Completed, X520 Completed, X520 Completed, 3108AB-8i Completed, UCS VIC
 1227 Completed, BIOS Completed,
--------------------------------------------------------------------------
```

3. Verify that the BIOS firmware and HUU upgrade was successful by checking the post-upgrade versions.

   ./ultram_ucs_utils.py --cfg "compute.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status firmwares**

4. Set the package-c-state-limit CIMC setting.

   ./ultram_ucs_utils.py --mgmt set-bios --bios-param biosVfPackageCStateLimit --bios-values vpPackageC-StateLimit=C0/C1 --cfg compute.cfg --login<*cimc_username*> <*cimc_user_password*>

5. Verify that the package-c-state-limit CIMC setting has been made.

   ./ultram_ucs_utils.py --status bios-settings --cfg compute.cfg --login <*cimc_username*> <*cimc_user_password*>
   Look for **PackageCStateLimit** to be set to *C0/C1*.

6. Modify the Grub configuration on each Compute Node.

a. Log into your first compute (compute-0) and update the grub setting with "processor.max_cstate=0 intel_idle.max_cstate=0".

sudo grubby --info=/boot/vmlinuz-`uname -r`
sudo grubby --update-kernel=/boot/vmlinuz-`uname -r` --args="processor.max_cstate=0 intel_idle.max_cstate=0"

b. Verify that the update was successful.

sudo grubby --info=/boot/vmlinuz-`uname -r`
Look for the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments in the output.

c. Reboot the Compute Nodes.

sudo reboot

d. Repeat steps 6.a, on page 114 through 6.c, on page 114 for all other Compute Nodes.

7. Recheck all CIMC and kernel settings.

a. Log in to the Ultra M Manager Node.

b. Verify CIMC settings

./ultram_ucs_utils.py --status bios-settings --cfg compute.cfg --login *<cimc_username> <cimc_user_password>*

c. Verify the processor c-state.

for ip in `nova list | grep -i compute | awk '{print $12}' | sed 's/ctlplane=//g'`; do ssh heat-admin@$ip 'sudo cat /sys/module/intel_idle/parameters/max_cstate'; done
for ip in `nova list | grep -i compute | awk '{print $12}' | sed 's/ctlplane=//g'`; do ssh heat-admin@$ip 'sudo cpupower idle-info'; done

8. Proceed to Upgrade the OSD Compute Node Server Software.

Note Other Node types can be upgraded at a later time. If you'll be upgrading them during a later maintenance window, proceed to Restart the UAS and ESC (VNFM) VMs, on page 117.

Upgrade the OSD Compute Node Server Software

NOTES:

- This procedure requires the *osd_compute_0.cfg*, *osd_compute_1.cfg*, and *osd_compute_2.cfg* files created as part of the procedure detailed in Perform Pre-Upgrade Preparation, on page 108.
- It is highly recommended that all OSD Compute Nodes be upgraded using this process during a single maintenance window.

To upgrade the UCS server software on the OSD Compute Nodes:

1. Move the Ceph storage to maintenance mode.

a. Log on to the lead Controller Node (controller-0).

b Move the Ceph storage to maintenance mode.

sudo ceph status
sudo ceph osd set noout
sudo ceph osd set norebalance
sudo ceph status

2 *Optional.* If they've not already been shut down, shut down both ESC VMs using the instructions in Shutdown the ESC VMs, on page 112.

3 Log on to the Ultra M Manager Node.

4 Upgrade the BIOS on the initial UCS server-based OSD Compute Node (osd-compute-1).

./ultram_ucs_utils.py --cfg "osd_compute_0.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade bios --server** <*ospd_server_cimc_ip_address*> **--timeout 30 --file /firmwares/bios.cap**
Example output:

```
2017-09-29 09:15:48,753 - Updating BIOS firmware on all the servers
2017-09-29 09:15:48,753 - Logging on UCS Server: 192.100.0.17
2017-09-29 09:15:48,758 - No session found, creating one on server: 192.100.0.17
2017-09-29 09:15:50,194 - Login successful to server: 192.100.0.17
2017-09-29 09:16:13,269 - 192.100.0.17 => updating | Image Download (5 %), OK
2017-09-29 09:17:26,669 - 192.100.0.17 => updating | Write Host Flash (75 %), OK
2017-09-29 09:18:34,524 - 192.100.0.17 => updating | Write Host Flash (75 %), OK
2017-09-29 09:19:40,892 - 192.100.0.17 => Activating BIOS
2017-09-29 09:19:55,011 -
--------------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------------
192.100.0.17     | SUCCESS | NA                  | Status: success, Progress: Done, OK
```

Note The Compute Nodes are automatically powered down after this process leaving only the CIMC interface available.

5 Upgrade the UCS server using the Host Upgrade Utility (HUU).

./ultram_ucs_utils.py --cfg "osd_compute.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade huu --server** <*ospd_server_cimc_ip_address*> **--file /firmwares/**<*ucs_huu_iso_filename*>
If the HUU script times out before completing the upgrade, the process might still be running on the remote hosts. You can periodically check the upgrade process by entering:

./ultram_ucs_utils.py --cfg "osd_compute.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status huu-upgrade**
Example output:

```
--------------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------------
192.100.0.17    | SUCCESS | 2017-10-20 07:10:11 | Update Complete  CIMC Completed, SasExpDN
 Completed, I350 Completed, X520 Completed, X520 Completed, 3108AB-8i Completed, UCS VIC
 1227 Completed, BIOS Completed,
--------------------------------------------------------------------------
```

6 Verify that the BIOS firmware and HUU upgrade was successful by checking the post-upgrade versions.

./ultram_ucs_utils.py --cfg "osd_compute_0.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status firmwares**

7 Set the package-c-state-limit CIMC setting.

./ultram_ucs_utils.py --mgmt set-bios --bios-param biosVfPackageCStateLimit --bios-values vpPackageC-StateLimit=C0/C1 --cfg osd_compute_0.cfg --login <*cimc_username*> <*cimc_user_password*>

8 Verify that the package-c-state-limit CIMC setting has been made.

./ultram_ucs_utils.py --status bios-settings --cfg osd_compute_0.cfg --login <*cimc_username*> <*cimc_user_password*>
Look for **PackageCStateLimit** to be set to *C0/C1*.

9 Modify the Grub configuration on the primary OSD Compute Node.

a Log on to the OSD Compute (osd-compute-0) and update the grub setting with "processor.max_cstate=0 intel_idle.max_cstate=0".

sudo grubby --info=/boot/vmlinuz-`uname -r`
sudo grubby --update-kernel=/boot/vmlinuz-`uname -r` --args="processor.max_cstate=0 intel_idle.max_cstate=0"

b Verify that the update was successful.

sudo grubby --info=/boot/vmlinuz-`uname -r`
Look for the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments in the output.

c Reboot the OSD Compute Nodes.

sudo reboot

10 Recheck all CIMC and kernel settings.

a Verify the processor c-state.

cat /sys/module/intel_idle/parameters/max_cstate
cpupower idle-info

b Login to Ultra M Manager Node.

c Verify CIMC settings.

./ultram_ucs_utils.py --status bios-settings --cfg osd_compute_0.cfg --login <*cimc_username*> <*cimc_user_password*>

11 Repeat steps 4, on page 115 through 10, on page 116 on the second OSD Compute Node (osd-compute-1).

Note Be sure to use the *osd_compute_1.cfg* file where needed.

12 Repeat steps 4, on page 115 through 10, on page 116 on the third OSD Compute Node (osd-compute-2).

Note Be sure to use the *osd_compute_2.cfg* file where needed.

13 Check the ironic node-list and restore any hosts that went into maintenance mode true state.

a Login to OSP-D and make sure to "su - stack" and "source stackrc".

b Perform the check and any required restorations.

ironic node-list
ironic node-set-maintenance $NODE_<*node_uuid*> **off**

14 Move the Ceph storage out of maintenance mode.

a Log on to the lead Controller Node (controller-0).

b Move the Ceph storage to maintenance mode.

sudo ceph status
sudo ceph osd unset noout
sudo ceph osd unset norebalance
sudo ceph status
sudo pcs status

15 Proceed to Restart the UAS and ESC (VNFM) VMs, on page 117.

Restart the UAS and ESC (VNFM) VMs

Upon performing the UCS server software upgrades, VMs that were previously shutdown must be restarted.

To restart the VMs:

1 Login to OSP-D and make sure to "su - stack" and "source stackrc".

2 Run Nova list to get the UUIDs of the ESC VMs.

3 Start the AutoIT-VNF VM.

nova start <*autoit_vm_uuid*>

4 Start the AutoDeploy VM.

nova start <*autodeploy_vm_uuid*>

5 Start the standby ESC VM.

nova start <*standby_vm_uuid*>

6 Start the active ESC VM.

nova start <*active_vm_uuid*>

7 Verify that the VMs have been restarted and are ACTIVE.

nova list --fields name,host,status | grep <*vnf_deployment_name*>
Once ESC is up and running, it triggers the recovery of rest of the VMs (AutoVNF, UEMs, CFs and SFs).

8 Login to each of the VMs and verify that they are operational.

Upgrade the Controller Node Server Software

NOTES:

- This procedure requires the *controller_0.cfg*, *controller_1.cfg*, and *controller_2.cfg* files created as part of the procedure detailed in Perform Pre-Upgrade Preparation, on page 108.
- It is highly recommended that all Controller Nodes be upgraded using this process during a single maintenance window.

To upgrade the UCS server software on the Controller Nodes:

1 Check the Controller Node status and move the Pacemaker Cluster Stack (PCS) to maintenance mode.

a Login to the primary Controller Node (controller-0) from the OSP-D Server.

b Check the state of the Controller Node Pacemaker Cluster Stack (PCS).

sudo pcs status

Note Resolve any issues prior to proceeding to the next step.

c Place the PCS cluster on the Controller Node into standby mode.

sudo pcs cluster standby <*controller_name*>

d Recheck the Controller Node status again and make sure that the Controller Node is in standby mode for the PCS cluster.

sudo pcs status

2 Log on to the Ultra M Manager Node.

3 Upgrade the BIOS on the primary UCS server-based Controller Node (controller-0).

./ultram_ucs_utils.py --cfg "controller_0.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade bios --server** <*ospd_server_cimc_ip_address*> **--timeout 30 --file /firmwares/bios.cap**
Example output:

```
2017-09-29 09:15:48,753 - Updating BIOS firmware on all the servers
2017-09-29 09:15:48,753 - Logging on UCS Server: 192.100.2.7
2017-09-29 09:15:48,758 - No session found, creating one on server: 192.100.2.7
2017-09-29 09:15:50,194 - Login successful to server: 192.100.2.7
2017-09-29 09:16:13,269 - 192.100.2.7 => updating | Image Download (5 %), OK
2017-09-29 09:17:26,669 - 192.100.2.7 => updating | Write Host Flash (75 %), OK
2017-09-29 09:18:34,524 - 192.100.2.7 => updating | Write Host Flash (75 %), OK
2017-09-29 09:19:40,892 - 192.100.2.7 => Activating BIOS
2017-09-29 09:19:55,011 -
--------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------
192.100.2.7     | SUCCESS | NA                  | Status: success, Progress: Done, OK
```

Note The Compute Nodes are automatically powered down after this process leaving only the CIMC interface available.

4 Upgrade the UCS server using the Host Upgrade Utility (HUU).

./ultram_ucs_utils.py --cfg "controller_0.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade huu --server** <*ospd_server_cimc_ip_address*> **--file /firmwares/**<*ucs_huu_iso_filename*>
If the HUU script times out before completing the upgrade, the process might still be running on the remote hosts. You can periodically check the upgrade process by entering:

./ultram_ucs_utils.py --cfg "controller_0.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status huu-upgrade**
Example output:

```
--------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------
192.100.2.7    | SUCCESS | 2017-10-20 07:10:11 | Update Complete  CIMC Completed, SasExpDN
 Completed, I350 Completed, X520 Completed, X520 Completed, 3108AB-8i Completed, UCS VIC
 1227 Completed, BIOS Completed,
--------------------------------------------------------------------
```

5 Verify that the BIOS firmware and HUU upgrade was successful by checking the post-upgrade versions.

./ultram_ucs_utils.py --cfg "controller_0.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status firmwares**

6 Set the package-c-state-limit CIMC setting.

./ultram_ucs_utils.py --mgmt set-bios --bios-param biosVfPackageCStateLimit --bios-values vpPackageC-StateLimit=C0/C1 --cfg controller_0.cfg --login <*cimc_username*> <*cimc_user_password*>

7 Verify that the package-c-state-limit CIMC setting has been made.

./ultram_ucs_utils.py --status bios-settings --cfg controller_0.cfg --login <*cimc_username*> <*cimc_user_password*>
Look for **PackageCStateLimit** to be set to *C0/C1*.

8 Modify the Grub configuration on the primary OSD Compute Node.

a Log on to the OSD Compute (osd-compute-0) and update the grub setting with "processor.max_cstate=0 intel_idle.max_cstate=0".

sudo grubby --info=/boot/vmlinuz-`uname -r`
sudo grubby --update-kernel=/boot/vmlinuz-`uname -r` --args="processor.max_cstate=0 intel_idle.max_cstate=0"

b Verify that the update was successful.

sudo grubby --info=/boot/vmlinuz-`uname -r`
Look for the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments in the output.

c Reboot the OSD Compute Nodes.

sudo reboot

9 Recheck all CIMC and kernel settings.

a Verify the processor c-state.

cat /sys/module/intel_idle/parameters/max_cstate
cpupower idle-info

b Login to Ultra M Manager Node.

c Verify CIMC settings.

./ultram_ucs_utils.py --status bios-settings --cfg controller_0.cfg --login <*cimc_username*> <*cimc_user_password*>

10 Check the ironic node-list and restore the Controller Node if it went into maintenance mode true state.

a Login to OSP-D and make sure to "su - stack" and "source stackrc".

b Perform the check and any required restorations.

ironic node-list
ironic node-set-maintenance $NODE_<*node_uuid*> **off**

11 Take the Controller Node out of the PCS standby state.

sudo pcs cluster unstandby <*controller-0-id*>

12 Wait 5 to 10 minutes and check the state of the PCS cluster to verify that the Controller Node is ONLINE and all services are in good state.

sudo pcs status

13 Repeat steps 3, on page 118 through 11, on page 119 on the second Controller Node (controller-1).

Note Be sure to use the *controller_1.cfg* file where needed.

14 Repeat steps 3, on page 118 through 11, on page 119 on the third Controller Node (controller-2).

Note Be sure to use the *controller_2.cfg* file where needed.

15 Proceed to Upgrade Firmware on the OSP-D Server/Ultra M Manager Node, on page 122.

Upgrade Firmware on UCS Bare Metal

NOTES:

- This procedure assumes that the UCS servers receiving the software (firmware) upgrade have not previously been deployed as part of an Ultra M solution stack.
- The instructions in this section pertain to all servers to be used as part of an Ultra M solution stack except the OSP-D Server/Ultra M Manager Node.
- This procedure requires the *hosts.cfg* file created as part of the procedure detailed in Perform Pre-Upgrade Preparation, on page 108.

To upgrade the software on the UCS servers:

1 Log on to the Ultra M Manager Node.

2 Upgrade the BIOS on the UCS servers.

./ultram_ucs_utils.py --cfg "hosts.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade bios --server** <*ospd_server_cimc_ip_address*> **--timeout 30 --file /firmwares/bios.cap**
Example output:

```
2017-09-29 09:15:48,753 - Updating BIOS firmware on all the servers
2017-09-29 09:15:48,753 - Logging on UCS Server: 192.100.0.7
2017-09-29 09:15:48,758 - No session found, creating one on server: 192.100.0.7
2017-09-29 09:15:50,194 - Login successful to server: 192.100.0.7
2017-09-29 09:16:13,269 - 192.100.0.7 => updating | Image Download (5 %), OK
2017-09-29 09:17:26,669 - 192.100.0.7 => updating | Write Host Flash (75 %), OK
2017-09-29 09:18:34,524 - 192.100.0.7 => updating | Write Host Flash (75 %), OK
2017-09-29 09:19:40,892 - 192.100.0.7 => Activating BIOS
2017-09-29 09:19:55,011 -
--------------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------------
192.100.0.7     | SUCCESS | NA                  | Status: success, Progress: Done, OK
```

Note The Compute Nodes are automatically powered down after this process leaving only the CIMC interface available.

3 Upgrade the UCS server using the Host Upgrade Utility (HUU).

./ultram_ucs_utils.py --cfg "hosts.cfg" --login <*cimc_username*> <*cimc_user_password*> **--upgrade huu --server** <*ospd_server_cimc_ip_address*> **--file /firmwares/**<*ucs_huu_iso_filename*>
If the HUU script times out before completing the upgrade, the process might still be running on the remote hosts. You can periodically check the upgrade process by entering:

./ultram_ucs_utils.py --cfg "hosts.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status huu-upgrade**

Example output:

```
--------------------------------------------------------------------
Server IP       | Overall | Updated-on          | Status
--------------------------------------------------------------------
192.100.0.7    | SUCCESS | 2017-10-20 07:10:11 | Update Complete  CIMC Completed, SasExpDN
 Completed, I350 Completed, X520 Completed, X520 Completed, 3108AB-8i Completed, UCS VIC
 1227 Completed, BIOS Completed,
--------------------------------------------------------------------
```

4 Verify that the BIOS firmware and HUU upgrade was successful by checking the post-upgrade versions.

./ultram_ucs_utils.py --cfg "hosts.cfg" --login <*cimc_username*> <*cimc_user_password*> **--status firmwares**

5 Set the package-c-state-limit CIMC setting.

./ultram_ucs_utils.py --mgmt set-bios --bios-param biosVfPackageCStateLimit --bios-values vpPackageC-StateLimit=C0/C1 --cfg hosts.cfg --login <*cimc_username*> <*cimc_user_password*>

6 Verify that the package-c-state-limit CIMC setting has been made.

./ultram_ucs_utils.py --status bios-settings --cfg hosts.cfg --login <*cimc_username*> <*cimc_user_password*>
Look for **PackageCStateLimit** to be set to *C0/C1*.

7 Recheck all CIMC and BIOS settings.

a Log in to the Ultra M Manager Node.

b Verify CIMC settings.

./ultram_ucs_utils.py --status bios-settings --cfg hosts.cfg --login <*cimc_username*> <*cimc_user_password*>

8 Modify the "ComputeKernelArgs" statement in the *network.yaml* with the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments.

vi network.yaml

```
<---SNIP--->
ComputeKernelArgs: "intel_iommu=on default_hugepagesz=1GB hugepagesz=1G hugepages=12
processor.max_cstate=0 intel_idle.max_cstate=0"
```

9 Modify the Grub configuration on all Controller Nodes after the VIM (Overcloud) has been deployed.

a Log into your first Controller Node (controller-0).

ssh heat-admin@<*controller_address*>

b Check the grubby settings.

sudo grubby --info=/boot/vmlinuz-`uname -r`
Example output:

```
index=0
kernel=/boot/vmlinuz-3.10.0-514.21.1.el7.x86_64
args="ro console=tty0 console=ttyS0,115200n8 crashkernel=auto rhgb quiet "
root=UUID=fa9e939e-9e3c-4f1c-a07c-3f506756ad7b
initrd=/boot/initramfs-3.10.0-514.21.1.el7.x86_64.img
title=Red Hat Enterprise Linux Server (3.10.0-514.21.1.el7.x86_64) 7.3 (Maipo)
```

c Update the grub setting with the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments.

sudo grubby --update-kernel=/boot/vmlinuz-`uname -r` --args="processor.max_cstate=0 intel_idle.max_cstate=0"

d Verify that the update was successful.

sudo grubby --info=/boot/vmlinuz-`uname -r`
Look for the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments in the output.

Example output:

```
index=0
kernel=/boot/vmlinuz-3.10.0-514.21.1.el7.x86_64
args="ro console=tty0 console=ttyS0,115200n8 crashkernel=auto rhgb quiet
processor.max_cstate=0 intel_idle.max_cstate=0"
root=UUID=fa9e939e-9e3c-4f1c-a07c-3f506756ad7b
initrd=/boot/initramfs-3.10.0-514.21.1.el7.x86_64.img
title=Red Hat Enterprise Linux Server (3.10.0-514.21.1.el7.x86_64) 7.3 (Maipo)
```

e Reboot the Controller Node.

sudo reboot

Important Do not proceed with the next step until the Controller Node is up and rejoins the cluster.

f Repeat steps 9.a, on page 121 through 9.e, on page 122 for all other Controller Nodes.

10 Proceed to Upgrade Firmware on the OSP-D Server/Ultra M Manager Node, on page 122.

Upgrade Firmware on the OSP-D Server/Ultra M Manager Node

1 Open your web browser.

2 Enter the CIMC address of the OSP-D Server/Ultra M Manager Node in the URL field.

3 Login to the CIMC using the configured user credentials.

4 Click **Launch KVM Console**.

5 Click **Virtual Media**.

6 Click **Add Image** and select the HUU ISO file pertaining to the version you wish to upgrade to.

7 Select the ISO that you have added in the **Mapped** column of the **Client View**. Wait for the selected ISO to appear as a mapped device.

8 Boot the server and press F6 when prompted to open the **Boot Menu**.

9 Select the desired ISO.

10 Select **Cisco vKVM-Mapped vDVD1.22**, and press **Enter**. The server boots from the selected device.

11 Follow the onscreen instructions to update the desired software and reboot the server. Proceed to the next step once the server has rebooted.

12 Log on to the Ultra M Manager Node.

13 Set the package-c-state-limit CIMC setting.

./ultram_ucs_utils.py --mgmt set-bios --bios-param biosVfPackageCStateLimit --bios-values vpPackageC-StateLimit=C0/C1 --cfg ospd.cfg --login *<cimc_username> <cimc_user_password>*

14 Verify that the package-c-state-limit CIMC setting has been made.

./ultram_ucs_utils.py --status bios-settings --cfg controller.cfg --login *<cimc_username> <cimc_user_password>*
Look for **PackageCStateLimit** to be set to C0/C1.

15 Update the grub setting with "processor.max_cstate=0 intel_idle.max_cstate=0".

sudo grubby --info=/boot/vmlinuz-`uname -r`
sudo grubby --update-kernel=/boot/vmlinuz-`uname -r` --args="processor.max_cstate=0 intel_idle.max_cstate=0"

16 Verify that the update was successful.

sudo grubby --info=/boot/vmlinuz-`uname -r`
Look for the "processor.max_cstate=0 intel_idle.max_cstate=0" arguments in the output.

17 Reboot the server.

sudo reboot

18 Recheck all CIMC and kernel settings upon reboot.

a Verify CIMC settings

./ultram_ucs_utils.py --status bios-settings --cfg ospd.cfg --login <*cimc_username*> <*cimc_user_password*>

b Verify the processor c-state.

cat /sys/module/intel_idle/parameters/max_cstate
cpupower idle-info

Controlling UCS BIOS Parameters Using *ultram_ucs_utils.py* Script

The ultram_ucs_utils.py script can be used to modify and verify parameters within the UCS server BIOS. This script is in the */opt/cisco/usp/ultram-manager* directory.

Important Refer to the UCS server documentation BIOS documentation for information on parameters and their respective values.

To configure UCS server BIOS parameters:

1 Log on to the Ultra M Manager Node.

2 Modify the desired BIOS parameters.

./ultram_ucs_utils.py --cfg "*config_file_name*" **--login** *cimc_username cimc_user_password* **--mgmt 'set-bios' –-bios-param** *bios_paramname* **–-bios-values** *bios_value1 bios_value2*
Example:

```
./ultram_ucs_utils.py --cfg cmp_17 --login admin abcabc --mgmt 'set-bios --bios-param
biosVfUSBPortsConfig --bios-values vpAllUsbDevices=Disabled vpUsbPortRear=Disabled
```

Example output:

```
2017-10-06 19:48:39,241 - Set BIOS Parameters
2017-10-06 19:48:39,241 - Logging on UCS Server: 192.100.0.25
2017-10-06 19:48:39,243 - No session found, creating one on server: 192.100.0.25
2017-10-06 19:48:40,711 - Login successful to server: 192.100.0.25
2017-10-06 19:48:52,709 - Logging out from the server: 192.100.0.25
2017-10-06 19:48:53,893 - Successfully logged out from the server: 192.100.0.25
```

3 Verify that your settings have been incorporated.

./ultram_ucs_utils.py --cfg "*config_file_name*" **--login** *cimc_username cimc_user_password* **-- status bios-settings**

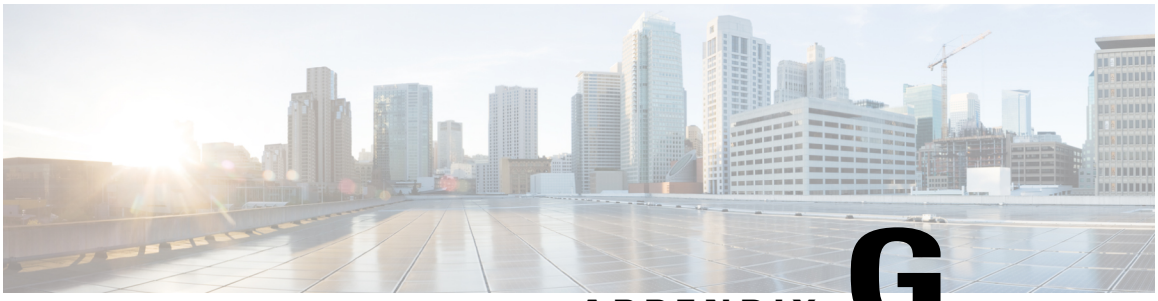
Example output:

./ultram_ucs_utils.py --cfg cmp_17 --login admin abcabc --status bios-settings

```
2017-10-06 19:49:12,366 - Getting status information from all the servers
2017-10-06 19:49:12,366 - Logging on UCS Server: 192.100.0.25
2017-10-06 19:49:12,370 - No session found, creating one on server: 192.100.0.25
2017-10-06 19:49:13,752 - Login successful to server: 192.100.0.25
2017-10-06 19:49:19,739 - Logging out from the server: 192.100.0.25
2017-10-06 19:49:20,922 - Successfully logged out from the server: 192.100.0.25
2017-10-06 19:49:20,922 -
--------------------------------------------------------------------------
Server IP      | BIOS Settings
--------------------------------------------------------------------------
192.100.0.25   | biosVfHWPMEnable
               |  vpHWPMEnable: Disabled
               | biosVfLegacyUSBSupport
               |  vpLegacyUSBSupport: enabled
               | biosVfPciRomClp
               |  vpPciRomClp: Disabled
               | biosVfSelectMemoryRASConfiguration
               |  vpSelectMemoryRASConfiguration: maximum-performance
               | biosVfExtendedAPIC
               |  vpExtendedAPIC: XAPIC
               | biosVfOSBootWatchdogTimerPolicy
               |  vpOSBootWatchdogTimerPolicy: power-off
               | biosVfCoreMultiProcessing
               |  vpCoreMultiProcessing: all
               | biosVfQPIConfig
               |  vpQPILinkFrequency: auto
               | biosVfOutOfBandMgmtPort
               |  vpOutOfBandMgmtPort: Disabled
               | biosVfVgaPriority
               |  vpVgaPriority: Onboard
               | biosVfMemoryMappedIOAbove4GB
               |  vpMemoryMappedIOAbove4GB: enabled
               | biosVfEnhancedIntelSpeedStepTech
               |  vpEnhancedIntelSpeedStepTech: enabled
               | biosVfCmciEnable
               |  vpCmciEnable: Enabled
               | biosVfAutonumousCstateEnable
               |  vpAutonumousCstateEnable: Disabled
               | biosVfOSBootWatchdogTimer
               |  vpOSBootWatchdogTimer: disabled
               | biosVfAdjacentCacheLinePrefetch
               |  vpAdjacentCacheLinePrefetch: enabled
               | biosVfPCISlotOptionROMEnable
               |  vpSlot1State: Disabled
               |  vpSlot2State: Disabled
               |  vpSlot3State: Disabled
               |  vpSlot4State: Disabled
               |  vpSlot5State: Disabled
               |  vpSlot6State: Disabled
               |  vpSlotMLOMState: Enabled
               |  vpSlotHBAState: Enabled
               |  vpSlotHBALinkSpeed: GEN3
               |  vpSlotN1State: Disabled
               |  vpSlotN2State: Disabled
               |  vpSlotFLOMLinkSpeed: GEN3
               |  vpSlotRiser1Slot1LinkSpeed: GEN3
               |  vpSlotRiser1Slot2LinkSpeed: GEN3
               |  vpSlotRiser1Slot3LinkSpeed: GEN3
               |  vpSlotSSDSlot1LinkSpeed: GEN3
               |  vpSlotSSDSlot2LinkSpeed: GEN3
               |  vpSlotRiser2Slot4LinkSpeed: GEN3
               |  vpSlotRiser2Slot5LinkSpeed: GEN3
               |  vpSlotRiser2Slot6LinkSpeed: GEN3
               | biosVfProcessorC3Report
               |  vpProcessorC3Report: disabled
               | biosVfPCIeSSDHotPlugSupport
               |  vpPCIeSSDHotPlugSupport: Disabled
               | biosVfExecuteDisableBit
               |  vpExecuteDisableBit: enabled
               | biosVfCPUEnergyPerformance
```

```
|  vpCPUEnergyPerformance: balanced-performance
| biosVfAltitude
|  vpAltitude: 300-m
| biosVfSrIov
|  vpSrIov: enabled
| biosVfIntelVTForDirectedIO
|  vpIntelVTDATSSupport: enabled
|  vpIntelVTDCoherencySupport: disabled
|  vpIntelVTDInterruptRemapping: enabled
|  vpIntelVTDPassThroughDMASupport: disabled
|  vpIntelVTForDirectedIO: enabled
| biosVfCPUPerformance
|  vpCPUPerformance: enterprise
| biosVfPchUsb30Mode
|  vpPchUsb30Mode: Disabled
| biosVfTPMSupport
|  vpTPMSupport: enabled
| biosVfIntelHyperThreadingTech
|  vpIntelHyperThreadingTech: disabled
| biosVfIntelTurboBoostTech
|  vpIntelTurboBoostTech: enabled
| biosVfUSBEmulation
|  vpUSBEmul6064: enabled
| biosVfMemoryInterleave
|  vpChannelInterLeave: auto
|  vpRankInterLeave: auto
| biosVfConsoleRedirection
|  vpBaudRate: 115200
|  vpConsoleRedirection: disabled
|  vpFlowControl: none
|  vpTerminalType: vt100
|  vpPuttyKeyPad: ESCN
|  vpRedirectionAfterPOST: Always Enable
| biosVfQpiSnoopMode
|  vpQpiSnoopMode: auto
| biosVfPStateCoordType
|  vpPStateCoordType: HW ALL
| biosVfProcessorC6Report
|  vpProcessorC6Report: enabled
| biosVfPCIOptionROMs
|  vpPCIOptionROMs: Enabled
| biosVfDCUPrefetch
|  vpStreamerPrefetch: enabled
|  vpIPPrefetch: enabled
| biosVfFRB2Enable
|  vpFRB2Enable: enabled
| biosVfLOMPortOptionROM
|  vpLOMPortsAllState: Enabled
|  vpLOMPort0State: Enabled
|  vpLOMPort1State: Enabled
| biosVfPatrolScrub
|  vpPatrolScrub: enabled
| biosVfNUMAOptimized
|  vpNUMAOptimized: enabled
| biosVfCPUPowerManagement
|  vpCPUPowerManagement: performance
| biosVfDemandScrub
|  vpDemandScrub: enabled
| biosVfDirectCacheAccess
|  vpDirectCacheAccess: auto
| biosVfPackageCStateLimit
|  vpPackageCStateLimit: C6 Retention
| biosVfProcessorC1E
|  vpProcessorC1E: enabled
| biosVfUSBPortsConfig
|  vpAllUsbDevices: disabled
|  vpUsbPortRear: disabled
|  vpUsbPortFront: enabled
|  vpUsbPortInternal: enabled
|  vpUsbPortKVM: enabled
|  vpUsbPortVMedia: enabled
| biosVfSataModeSelect
|  vpSataModeSelect: AHCI
```

```
                    | biosVfOSBootWatchdogTimerTimeout
                    |  vpOSBootWatchdogTimerTimeout: 10-minutes
                    | biosVfWorkLoadConfig
                    |  vpWorkLoadConfig: Balanced
                    | biosVfCDNEnable
                    |  vpCDNEnable: Disabled
                    | biosVfIntelVirtualizationTechnology
                    |  vpIntelVirtualizationTechnology: enabled
                    | biosVfHardwarePrefetch
                    |  vpHardwarePrefetch: enabled
                    | biosVfPwrPerfTuning
                    |  vpPwrPerfTuning: os
--------------------------------------------------------------------------
```



APPENDIX G

ultram_ucs_utils.py Help

Enter the following command to display help for the UCS utilities available through the Ultra M Manager:

./ultram_ucs_utils.py h

```
usage: ultram_ucs_utils.py [-h] --cfg CFG --login UC_LOGIN UC_LOGIN
                           (--upgrade  | --mgmt  | --status  | --undercloud UC_RC)
                           [--mode] [--serial-delay SERIAL_DELAY]
                           [--server SERVER] [--file FILE]
                           [--protocol {http,https,tftp,sftp,ftp,scp}]
                           [--access ACCESS ACCESS] [--secure-boot]
                           [--update-type {immediate,delayed}] [--reboot]
                           [--timeout TIMEOUT] [--verify] [--stop-on-error]
                           [--bios-param BIOS_PARAM]
                           [--bios-values BIOS_VALUES [BIOS_VALUES ...]]

optional arguments:
  -h, --help            show this help message and exit
  --cfg CFG             Configuration file to read servers
  --login UC_LOGIN UC_LOGIN
                        Common Login UserName / Password to authenticate UCS servers
  --upgrade             Firmware upgrade, choose one from:
                          'bios': Upgrade BIOS firmware version
                          'cimc': Upgrade CIMC firmware version
                          'huu' : Upgrade All Firmwares via HUU based on ISO
  --mgmt                Server Management Tasks, choose one from:
                          'power-up'      :  Power on the server immediately
                          'power-down'    :  Power down the server (non-graceful)
                          'soft-shut-down':  Shutdown the server gracefully
                          'power-cycle'   :  Power Cycle the server immediately
                          'hard-reset'    :  Hard Reset the server
                          'cimc-reset'    :  Reboot CIMC
                          'cmos-reset'    :  Reset CMOS
                          'set-bios'      :  Set BIOS Parameter
  --status              Firmware Update Status:
                          'bios-upgrade'  :  Last BIOS upgrade status
                          'cimc-upgrade'  :  Last CIMC upgrade status
                          'huu-upgrade'   :  Last ISO upgrade via Host Upgrade Utilties
                         'firmwares'     :  List Current set of running firmware versions

                          'server'        :  List Server status
                          'bios-settings' :  List BIOS Settings
  --undercloud UC_RC    Get the list of servers from undercloud
  --mode                Execute action in serial/parallel
  --serial-delay SERIAL_DELAY
                        Delay (seconds) in executing firmware upgrades on node in case of
 serial mode

Firmware Upgrade Options::
  --server SERVER       Server IP hosting the file via selected protocol
  --file FILE           Firmware file path for UCS server to access from file server
  --protocol {http,https,tftp,sftp,ftp,scp}
```

```
                        Protocol to get the firmware file on UCS server
  --access ACCESS ACCESS
                        UserName / Password to access the file from remote server using
https,sftp,ftp,scp
  --secure-boot         Use CIMC Secure-Boot.
  --update-type {immediate,delayed}
                        Update type whether to send delayed update to server or immediate

  --reboot              Reboot CIMC before performing update
  --timeout TIMEOUT     Update timeout in mins should be more than 30 min and less than
200 min
  --verify              Use this option to verify update after reboot
  --stop-on-error       Stop the firmware update once an error is encountered

BIOS Parameters configuratioon:
  --bios-param BIOS_PARAM
                        BIOS Paramater Name to be set
  --bios-values BIOS_VALUES [BIOS_VALUES ...]
                       BIOS Paramater values in terms of key=value pair separated by space
```