



CHAPTER 3

ASR Router and Nexus Switch Configuration

This section provides a configuration guide for the Cisco ASR 9001 Router and Cisco Nexus 9396PX Switch relative to the VMS Pod. It includes configuration snippets for access, management, and interface configuration designed to provide the minimum necessary configuration to bring up the VMS Top of Rack Router and Switch.

This section is not designed as a comprehensive best-practice configuration guide.

Logical Network Topology

This section provides a high-level overview of the physical and logical network design, inclusive of the VLAN topology connecting the UCS, Switch, and Router. This understanding is important for use in configuring the Top of Rack Cisco ASR 9001 Router and Cisco Nexus 9300 Series Switch in support of the VMS Pod.

[Figure 3-1](#) shows the high-level network overview of the VMS Pod. All UCS connect to the Nexus 9300 Series Switch while the ISR CPE's connect to the VMS via an external network, whether locally connected via a switch, or across the Internet. A DHCP Server may be required to provide an IP Address to the ISR CPE's.

As can be seen in [Table 3-1](#) and [Figure 3-2](#), the various networks used by VMS are grouped into Management and External (public) networks. The networks identified have specific purposes. For obvious security reasons, the Management networks should be kept separated from the External networks. While there are numerous methods to accomplish secure separation between Management and External networks, for purposes of simplicity this VMS Pod Guide has designated the Cisco Nexus 9300 Series Switch responsible for all Layer 2 forwarding while the Cisco ASR 9001 Router is responsible for all Layer 3 forwarding and routing. Therefore the Management networks will be kept separate from the External networks by using two VRF instances on the Top of Rack ASR 9001 Router as shown in [Figure 3-3](#).

The information in [Table 3-1](#) will be used during the configuration of the Top of Rack ASR 9001 Router and Nexus 9300 Series Switch and will be requested during the OpenStack, Cloud Foundry and VMS installation procedures. As such, it is recommended that the network administrator create a reference matrix similar to [Table 3-1](#) with the VLAN IDs, subnets, and VRF names to be used. While all information in the Table may be changed as desired by the network administrator it is highly recommended that the VLAN Names (currently named to easily associate their purpose in configuration and troubleshooting) and Subnet Masks (as presently sized) should not be changed.

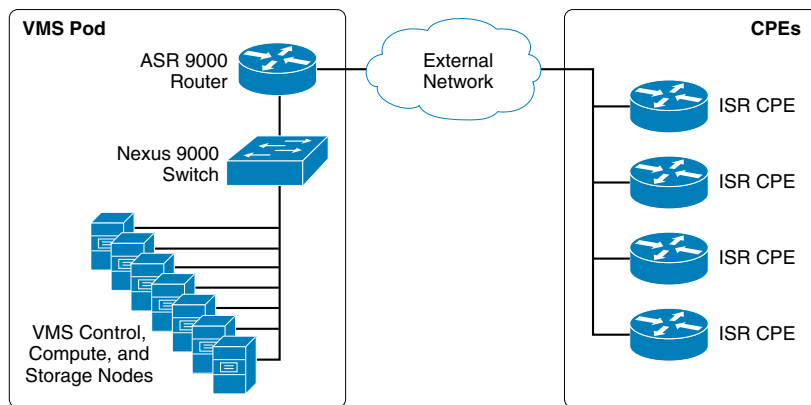


Note

The external facing subnets (orch-internet, vnf-outside, and vnf-internet) should be assigned from public IP address space if testing Portal reachability or CPE connectivity from the Internet.

Table 3-1 VLANs, Subnets, and VRFs

VLAN Group 1: VMS External Facing Networks					
Network	VLAN Name	VLAN ID Example	IP Subnet / Mask Example	VRF Name Example	Referenced by Installers
Internet Orchestration	orch-internet	101	11.17.1.0 /24	external	Yes
VNF WAN	vnf-outside	102	11.17.16.0 /20	external	Yes
VNF Internet	vnf-internet	103	11.17.32.0 /20	external	Yes
Public	public	150	11.17.0.0 /30	external	No
VLAN Group 2: VMS Management Networks					
Network	VLAN Name	VLAN ID Example	IP Subnet / Mask Example	VRF Name Example	Referenced by Installers
Cisco UCS CIMC Mgmt	cimc-mgmt	200	10.10.1.0 /24	vms_mgmt	Yes
PXE / OpenStack Mgmt	pxe-osmgmt	201	10.20.0.0 /20	vms_mgmt	Yes
Applications Mgmt	app-mgmt	202	10.10.2.0 /24	vms_mgmt	Yes
Orchestration Mgmt	orch-mgmt	203	10.10.3.0 /24	vms_mgmt	Yes
VNF Management	vnf-mgmt	204	10.20.16.0 /20	vms_mgmt	Yes

Figure 3-1 High-Level VMS Pod Network Overview**Note**

ESC creates host mapping pools for each of the compute nodes for the three vnf-xxx networks. These pools are at least 80 addresses, and are not configurable, therefore the vnf-xxx networks are required to be larger than a /24. A /20 is therefore recommended.

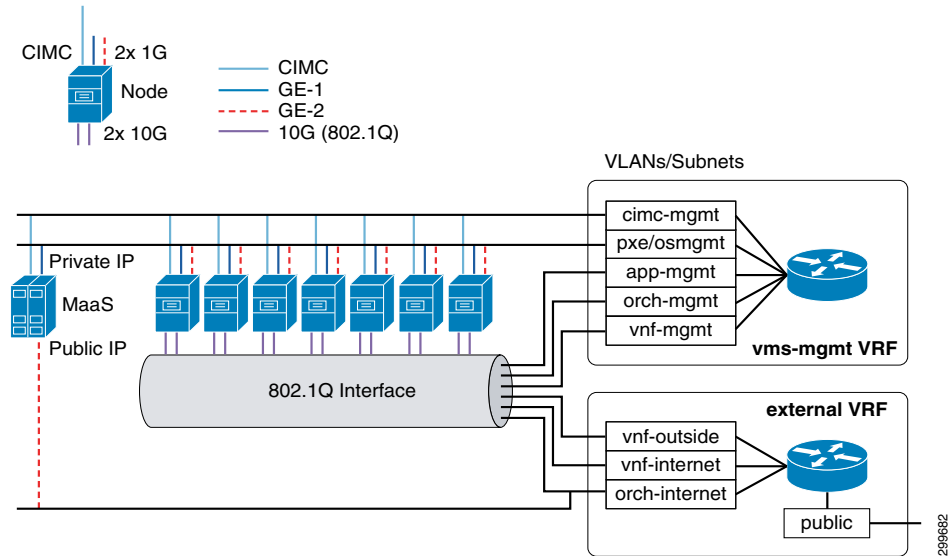
**Note**

A DHCP Server will need to be provided for the 1941 ISR CPE's to retrieve their IP Address.

As seen when cabling the UCS Servers, and shown in [Figure 3-2](#), each UCS has 5 cabled interfaces - one CIMC, two one-Gigabit Ethernet, and two ten-Gigabit Ethernet interfaces. The first 1GE interface on each UCS is dedicated to the PXE installation. With the exception of the MaaS/Bootstrap server, the

second 1GE interface is for the OpenStack management after installation. The two 10G interfaces are bundled with 802.1ad for redundancy and encapsulated with 802.1Q for transport of the multiple networks. The MaaS/Bootstrap server is dedicated for the bring up and installation of the system. The 2nd 1GE interface on the Maas/Bootstrap server is connected to the public network for the purpose of downloading the OpenStack software as well as related Cloud Foundry and VMS packages.

Figure 3-2 VMS Pod Logical Connectivity



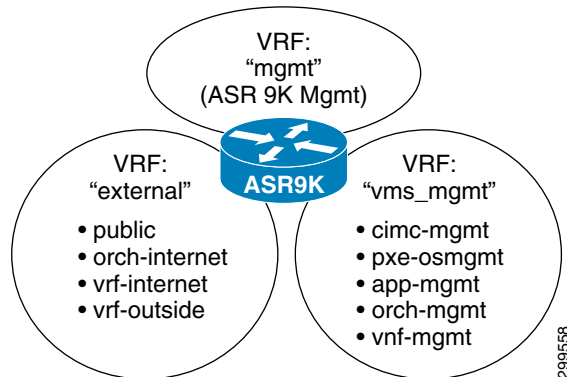
Note

IMPORTANT—The MaaS GE-2 interface requires connectivity to the public network for retrieving the OpenStack software and packages used in deploying the OpenStack nodes. [Figure 3-2](#) shows just one option for connecting the MaaS GE-2 interface to the public network.

Cisco ASR 9001

This section provides the basic configuration necessary to enable the Cisco ASR 9001 Router in the VMS Pod. It is expected that the user has prior experience with Cisco IOS-XR Command Line Interface.

Figure 3-3 ASR 9001 VRFs



**Note**

The ASR 9001 configuration actually has three (3) VRFs: one for ASR 9001 management (mgmt); one for VMS management (vms_mgmt); and one for external networks (external) as seen in [Figure 3-3](#). Special care must be taken in the configuration of the Cisco ASR 9001 Router to ensure there is no leakage between the two groups of VLANs (Internal Facing VMS Management VLANs versus External Facing VLANs).

ASR 9001 Configuration Management

Three primary commands will be helpful as you enter and terminate configuration mode, as well as commit the configuration changes. Recognize that any changes made to the configuration of an IOS-XR platform, such as the ASR 9001, do not become active until committed using the “commit” command.

Each of these three commands has defaults and optional parameters.

- **Configure**—To enter global configuration mode or administration configuration mode, use the configure command in EXEC or administration mode.
- **Commit**—To commit the target configuration to the active (running) configuration, use the commit command in any configuration mode.
- **End**—To terminate a configuration session and return directly to EXEC or administration EXEC, use the end command in any configuration mode.

Refer to the [Configuration Management Commands](#), document for command defaults, parameters, and detailed explanations.

ASR 9001 Management and Access

This section provides configuration guidance for configuring the ASR 9001 management access, including naming the router, configuring the clock, access authentication, console, management Ethernet, and some protocol configuration commands.

Note that this section contains guidelines and configuration snippets, and does not include every potential configuration option. Cisco has many guides available for further configuration. Refer to [Chapter B, “Reference Documentation”](#).

Once the following configuration – with IP addresses, subnets, and network masks modified appropriate to the installation network – has been applied you should be able to connect to the ASR 9001 for remote management.

Table 3-2 ASR 9001 Management Access Configuration

Configuration Section	Configuration Snippet Examples
Hostname & Clock	<pre>hostname ASR9K-1 clock timezone EST -5 clock summer-time EDT recurring clock set 18:25:00 august 15 2015</pre>
Local Authentication	<pre>username vmsadmin group sysadmin group root-system secret 0 ciscovms ! aaa authentication login default local line !</pre>

Table 3-2 ASR 9001 Management Access Configuration (*continued*)

Configuration Section	Configuration Snippet Examples
Console	<pre> line console secret 0 ciscosecret ! line default timestamp exec-timeout 60 0 session-timeout 60 0 transport input telnet ssh transport preferred ssh ! </pre>
ASR 9001 Management Ethernet, A9K Mgmt VRF, and static routing within A9K Mgmt VRF	<pre> vrf mgmt description ASR9k Management VRF address-family ipv4 unicast ! ! ipv4 virtual address vrf mgmt 10.100.0.6 255.255.255.0 ipv4 virtual address use-as-src-addr ! interface MgmtEth0/RSP0/CPU0/0 vrf mgmt ipv4 address 10.100.0.6 255.255.255.0 ! router static vrf mgmt address-family ipv4 unicast 0.0.0.0/0 10.100.0.1 ! ! ! </pre>
ASR 9001 Management Plane Protocol Configuration	<pre> telnet vrf mgmt ipv4 server max-servers 30 ! ftp client vrf mgmt passive ftp client vrf mgmt username vmsftpuser ftp client vrf mgmt password vmsftppassword ftp client vrf mgmt source-interface MgmtEth0/RSP0/CPU0/0 ! tftp client vrf mgmt source-interface MgmtEth0/RSP0/CPU0/0 ! ssh server v2 ssh server vrf mgmt ssh timeout 60 ! </pre>

**Note**

This section references the ASR 9001 Mgmt VRF created in the ASR 9001 Management VRF section above. Therefore the above section must be executed prior to this section.

ASR 9001 VMS Interfaces

This section provides configuration guidance for configuring the ASR 9001 interfaces to support proper inter-communication of the VMS devices as well as separation of VMS Management and External networks. This includes configuration of VRFs, physical Ethernet interfaces, as well as logical bundle interfaces and sub-interfaces.

If external reachability will be required, routing will need to be added to the configuration. The subnets associated with VMS External Facing VLANs in [Table 3-3](#) will need to be distributed, or statically added to the customer Lab Router (ie External Network in [Figure 3-1](#)). Likewise, the Routing section below will need to be modified to identify the Customer Lab Router as the next-hop default gateway. The Routing section below includes a sample static routing configuration.

Be sure to modify the various sub-interface IDs, 802.1Q IDs, interface IP address, IP subnets and network masks as appropriate for the installation network as noted in the reference matrix recommended in [Table 3-1](#).

Table 3-3 ASR 9001 VMS Interfaces

Configuration Section	Configuration Snippet Examples
Interconnection of ASR 9001 Router with Nexus 9300 Series Switch	<pre> vrf vms_mgmt description VMS Management Interfaces VRF address-family ipv4 unicast ! vrf external description VMS External Facing Interfaces VRF address-family ipv4 unicast ! ! interface Bundle-Ether1 description Inter-connection with ToR Nexus Switch mtu 9200 ! interface Bundle-Ether1.101 description orch-internet vrf external ipv4 address 11.17.1.1 255.255.255.0 encapsulation dot1q 101 ! interface Bundle-Ether1.102 description vnf-outside vrf external ipv4 address 11.17.16.1 255.255.240.0 encapsulation dot1q 102 ! interface Bundle-Ether1.103 description vnf-internet vrf external ipv4 address 11.17.32.1 255.255.240.0 encapsulation dot1q 103 ! interface Bundle-Ether1.150 description *** Customer Lab Internet Connection *** vrf external ipv4 address 11.17.0.2 255.255.255.252 encapsulation dot1q 150 ! interface Bundle-Ether1.200 description cimc-mgmt vrf vms_mgmt ipv4 address 10.10.1.1 255.255.255.0 encapsulation dot1q 200 ! interface Bundle-Ether1.201 description pxe-osmgmt vrf vms_mgmt ipv4 address 10.20.0.1 255.255.240.0 encapsulation dot1q 201 ! interface Bundle-Ether1.202 description app-mgmt vrf vms_mgmt ipv4 address 10.10.2.1 255.255.255.0 encapsulation dot1q 202 ! </pre>

Table 3-3 ASR 9001 VMS Interfaces (continued)

Configuration Section	Configuration Snippet Examples
Interconnection of ASR 9001 Router with Nexus 9300 Series Switch	<pre> interface Bundle-Ether1.203 description orch-mgmt vrf vms_mgmt ipv4 address 10.10.3.1 255.255.255.0 encapsulation dot1q 203 ! interface Bundle-Ether1.204 description vnf-mgmt vrf vms_mgmt ipv4 address 10.20.16.1 255.255.240.0 encapsulation dot1q 204 ! interface TenGigE0/0/2/0 description *** To ToR Nexus 9300 Switch Eth 1/45 *** bundle id 1 mode active carrier-delay up 10000 down 0 load-interval 30 ! interface TenGigE0/0/2/1 description *** To ToR Nexus 9300 Switch Eth 1/46 *** bundle id 1 mode active carrier-delay up 10000 down 0 load-interval 30 ! </pre>
Routing Section	<pre> router static vrf external address-family ipv4 unicast 0.0.0.0/0 11.17.0.1 ! ! vrf vms_mgmt address-family ipv4 unicast ! ! ! </pre>

Nexus 9396PX

This section provides the basic configuration necessary to enable the Cisco Nexus 9396PX Switch in the VMS Pod. It is expected that the user has prior experience with Cisco NX-OS Command Line Interface.

Nexus 9396PX Management and Access

This section provides configuration guidance for configuring the Nexus 9396PX management access, including naming the switch, configuring the clock, access authentication, console, management Ethernet, and some protocol configuration commands.

Note that this section contains guidelines and configuration snippets, and does not include every potential configuration option. Cisco has many guides available for further configuration. A few document references have been included in the Reference Documents section at the end of this chapter.

Once the following configuration has been applied you should be able to connect to the Nexus 9396PX for remote management.

Table 3-4 *Nexus 9396PX Management Access Configuration*

Configuration Section	Configuration Snippet Examples
Hostname & Clock	<pre>hostname N9396-1 clock timezone EDT -5 0 clock summer-time EDT clock set 18:25:00 15 August 2015</pre>
Local Authentication	<pre>username vmsadmin password 0 ciscovms role network-admin no password strength-check</pre>
N9K Management (Management VRF, static routing of Management VRF, Console, VTY, and Ethernet Management)	<pre>vrf context management ip route 0.0.0.0/0 10.100.0.1 ! interface mgmt0 vrf member management ip address 10.100.0.4/24 line console line vty</pre>
Management Plane Protocol Configuration	<pre>feature telnet copp profile lenient</pre>

Nexus 9396PX VMS Interfaces

This section provides configuration guidance for configuring the Nexus 9396PX interfaces to support proper inter-communication of the VMS devices, ASR 9001 and Customer lab external network. This includes configuration of VLANs, physical Ethernet interfaces, and logical port-channel interfaces.

Table 3-5 Nexus 9396PX VMS Interfaces Configuration

Configuration Section	Configuration Snippet Examples
Features, Protocols, and VLANs	<pre> feature udld feature lacp spanning-tree mode mst vlan 101-103,150,200-204 vlan 101 name orch-internet vlan 102 name vnf-outside vlan 103 name vnf-internet vlan 150 name public vlan 200 name cimc-mgmt vlan 201 name pxe-osmgmt vlan 202 name app-mgmt vlan 203 name orch-mgmt vlan 204 name vnf-mgmt spanning-tree mst configuration name vms-pod instance 1 vlan 1-4000 </pre>
Uplink to ASR9k N9K Ethernet 1/45-46	<pre> interface port-channel1 description Inter-connection with ToR ASR Router switchport mode trunk switchport trunk allowed vlan 101-103,150,200-204 logging event port link-status mtu 9216 interface Ethernet1/45 description *** To ToR ASR 9001 Te 0/0/2/0 *** switchport mode trunk logging event port link-status channel-group 1 mode active interface Ethernet1/46 description *** To ToR ASR 9001 Te 0/0/2/1 *** switchport mode trunk logging event port link-status channel-group 1 mode active </pre>
UCS 1G-1 & 1G-2 Interfaces [Except UCS C220 MaaS/Bootstrap 1G-2] N9K Ethernet 1/17,19-32	<pre> interface Ethernet1/x description UCS 1G-1, 1G-2, pxe-osmgmt switchport mode access switchport access vlan 201 spanning-tree port type edge logging event port link-status mtu 9216 </pre>

Table 3-5 Nexus 9396PX VMS Interfaces Configuration (continued)

Configuration Section	Configuration Snippet Examples
UCS C220 MaaS/Bootstrap 1G-2 Interface N9K Ethernet 1/18	<pre>interface Ethernet1/18 description UCS C220 MaaS/Bootstrap 1G-2, orch-internet switchport mode access switchport access vlan 101 spanning-tree port type edge logging event port link-status mtu 9216</pre>
UCS C220 Intf 10G 1-2 Ethernet 1/x x = 1, 3, 5, 7, 9 y = 2, 4, 6, 8, 10 z = 1, 2, 3, 4, 5	<pre>interface port-channel220z description To UCS C220-z 10Gs switchport mode trunk switchport trunk allowed vlan 101-103,202-204 spanning-tree port type edge trunk mtu 9216 logging event port link-status interface Ethernet1/x description To UCS C220-z 10G-1 switchport mode trunk mtu 9216 logging event port link-status channel-group 220z mode active interface Ethernet1/y description To UCS C220-z 10G-2 switchport mode trunk mtu 9216 logging event port link-status channel-group 220z mode active</pre>
UCS C240 Intf 10G 1-2 Ethernet 1/x x = 11, 13, 15 y = 12, 14, 16 z = 1, 2, 3	<pre>interface port-channel240z description To UCS C240-z 10Gs switchport mode trunk switchport trunk allowed vlan 101-103,202-204 spanning-tree port type edge trunk mtu 9216 logging event port link-status interface Ethernet1/x description To UCS C240-z 10G-1 switchport mode trunk spanning-tree port type edge trunk mtu 9216 logging event port link-status channel-group 240z mode active interface Ethernet1/y description To UCS C240-z 10G-2 switchport mode trunk spanning-tree port type edge trunk mtu 9216 logging event port link-status channel-group 240z mode active</pre>

Table 3-5 *Nexus 9396PX VMS Interfaces Configuration (continued)*

Configuration Section	Configuration Snippet Examples
UCS CIMC Interfaces N9K Ethernet 1/33-40	<pre>interface Ethernet1/x description UCS CIMC, cimc-mgmt switchport mode access switchport access vlan 200 spanning-tree port type edge logging event port link-status mtu 9216</pre>
Uplink to Cust Lab Inf 1/10G	<pre>interface port-channel3 description Interconnection to Customer Lab Router (Internet) switchport mode access switchport access vlan 150 spanning-tree port type edge spanning-tree bpduguard enable spanning-tree bpdufilter enable logging event port link-status interface Ethernet 1/48 description *** To Customer Lab Router (Internet) *** switchport mode access switchport access vlan 150 channel-group 3 mode active</pre>

