Cisco Catalyst 9800-CL Wireless Controller for Cloud Deployment Guide

Date: April 2022

Introduction

This document provides installation guidance for the virtual Cisco® Catalyst® 9800-CL Wireless Controller for Cloud with VMware ESXi, Linux KVM, Microsoft Hyper-V, and Cisco 5000 Series Enterprise Network Compute System (ENCS) Network Function Virtualization Infrastructure Software (NFVIS). The document:

- Provides an overview of the virtual deployment options
- Provides instructions for configuring and setting up the virtual wireless controller.

Supported hypervisor versions

For the supported hypervisor versions for the 9800-CL private cloud, please see the release notes for the required Cisco IOS® XE version here: https://www.cisco.com/c/en/us/support/wireless/catalyst-9800-series-wireless-controllers/products-release-notes-list.html

The table below shows an example of the Cisco IOS XE 17.6.x release train.

Table 1. Supported hypervisor versions for the 9800-CL private cloud running 17.6.x.

Hypervisor	Supported version
VMware ESXi	ESXi vSphere: 6.0, 6.7, and 7.0 ESXi vCenter: 6.0, 6.5, 6.7, and 7.0
KVM	Red Hat Enterprise Linux: 7.6, 7.8, and 8.2 Ubuntu: 16.04 LTS, 18.04 LTS, 20.04.5 LTS
Microsoft Hyper-V[1]	Microsoft Windows Server: 2016 or 2019 (Standard, Enterprise, and Datacenter) Hyper-V Manager: 10.0.14393
Cisco NFVIS	Release 3.8.1 and 3.9.1

[1] Supported only on Cisco IOS XE Amsterdam 17.1.1 or later

9800-CL virtual machine requirements

Scale and sizing suggest the minimum virtual resource requirements in the table below.

Table 2. Minimum virtual resource requirements for small, medium, and large configurations

	Existing supported templates pre Cisco IOS XE Release 17.3			Templates added as part of Cisco IOS XE Release 17.3		
Model configuration	**Small** **(Low throughput)**	**Medium** **(Low throughput)**	**Large** **(Low throughput)**	**Small** **(High throughput)**	**Medium** **(High throughput)**	**Large** **(High throughput)**
Minimum number of vCPUs[1] (hyperthreading is not supported)	4	6	10	7	9	13
Minimum CPU allocation (MHz)	4000	6000	10,000	4000	6000	10,000

	Existing supported templates pre Cisco IOS XE Release 17.3			Templates added as part of Cisco IOS XE Release 17.3		
Model configuration	**Small** **(Low throughput)**	**Medium** **(Low throughput)**	**Large** **(Low throughput)**	**Small** **(High throughput)**	**Medium** **(High throughput)**	**Large** **(High throughput)**
Minimum memory (GB)	8	16	32	8	16	32
Required storage[2] (GB)	16	16	16	16	16	16
Virtual NICs (vNICs) **(*) Third NIC is for High Availability**	2/(3)*	2/(3)*	2/(3)*	2/(3)*	2/(3)*	2/(3)*
ESXi vNIC	VMXNET3	VMXNET3	VMXNET3	VMXNET3	VMXNET3	VMXNET3
Linux KVM vNIC	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)
KVM NIC virtualization	Virtio	Virtio	Virtio	Virtio	Virtio	Virtio
Hyper-V vNIC	NETVSC	NETVSC	NETVSC	Not supported	Not supported	Not supported
Hyper-V NIC Virtualization	VMBus	VMBus	VMBus	Not supported	Not supported	Not supported
Maximum access points	1000	3000	6000	1000	3000	6000
Maximum clients supported	10,000	32,000	64,000	10,000	32,000	64,000
vMotion, vNIC teaming, Snapshot, DRS[3]	Supported	Supported	Supported	Supported	Supported	Supported

	Existing supported templates pre Cisco IOS XE Release 17.3			Templates added as part of Cisco IOS XE Release 17.3		
Model configuration	**Small** **(Low throughput)**	**Medium** **(Low throughput)**	**Large** **(Low throughput)**	**Small** **(High throughput)**	**Medium** **(High throughput)**	**Large** **(High throughput)**
VMware tools	Not supported	Not supported	Not supported	Not supported	Not supported	Not supported
Layer 2 link aggregation LAG[4]	Supported	Supported	Supported	Supported	Supported	Supported

[1] To avoid stability and performance issues, it's advisable to fully reserve the vCPU resources needed for the 9800-CL and never oversubscribe them. Hyperthreading is not supported and will need to be disabled on the host machine.

[2] Starting from Cisco IOS XE Amsterdam 17.3.1, the required storage has increased from 8 GB to 16 GB. If upgrading to Cisco IOS XE Amsterdam 17.3.x from a previous release, the existing storage can be kept at 8 GB. For all new installations, it is required to go to 16 GB.

[3] The VM operations are supported with some design considerations. Please see the section Design considerations with VMware VM operations.

[4] Support for Layer 2 LAG starts in Cisco IOS XE Bengaluru 17.5.1 and supports deployments with single-root I/O virtualization (SR-IOV).

9800-CL vCPU allocation

The 9800-CL vCPU allocation for control plane and data plane processes is shown in the table below.

Table 3. 9800-CL vCPU allocation for small, medium, and large configurations

		CPU allocation	
OVA template size	**Total number of vCPUs**	**Control plane**	**Data plane**
Small **(Low throughput)**	4	2	2
Small **(High throughput)**	7	2	5
Medium **(Low throughput)**	6	4	2
Medium **(High throughput)**	9	4	5
Large **(Low throughput)**	10	8	2
Large **(High throughput)**	13	8	5

High Availability

High Availability (HA) is supported on the 9800-CL VM hosts using virtual redundant ports, in a stateful switchover (SSO) configuration as well as in an N+1 configuration.

9800-CL file format options

Catalyst 9800-CL deployment OVA template (OVA)

```
C9800-CL-universalk9.BLD_V***.ova
```

Catalyst 9800-CL deployment image

```
C9800-CL-universalk9.BLD_V***.iso
```

Catalyst 9800-CL upgrade and patches (bin)

```
C9800-CL-universalk9.upgrade***.bin
```

9800-CL network interface mappings

The Catalyst 9800-CL maps the GigabitEthernet network interfaces to the logical vNIC name assigned by the VM. The VM in turn maps the logical vNIC name to a physical MAC address.

When the Catalyst 9800-CL is booted for the first time, the router interfaces are mapped to the logical vNIC interfaces that were added when the VM was created. The figure below shows the relationship between the vNICs and the Catalyst 9800-CL interfaces.

By default, the 9800-CL comes with three network interfaces. Below is an example of interface mapping:

- GigabitEthernet1 > Device management interface: Map it to the out-of-band management network. This is the equivalent of the service port on the physical appliance.
- GigabitEthernet2 > Wireless management interface: Map it to the network to reach APs and services. Usually, this interface is a trunk to carry multiple VLANs.
- GigabitEthernet3 > High Availability interface: Map it to a separate network for peer-to-peer communication for HA SSO. This is the equivalent of the RP port. This port is not needed if HA SSO is not going to be configured.

Note: Do not connect two interfaces to a single network, as that may cause network loops. When a trunk port is used, you must either prune VLANs from vCenter or have the GigabitEthernet interfaces in a different vSwitch.

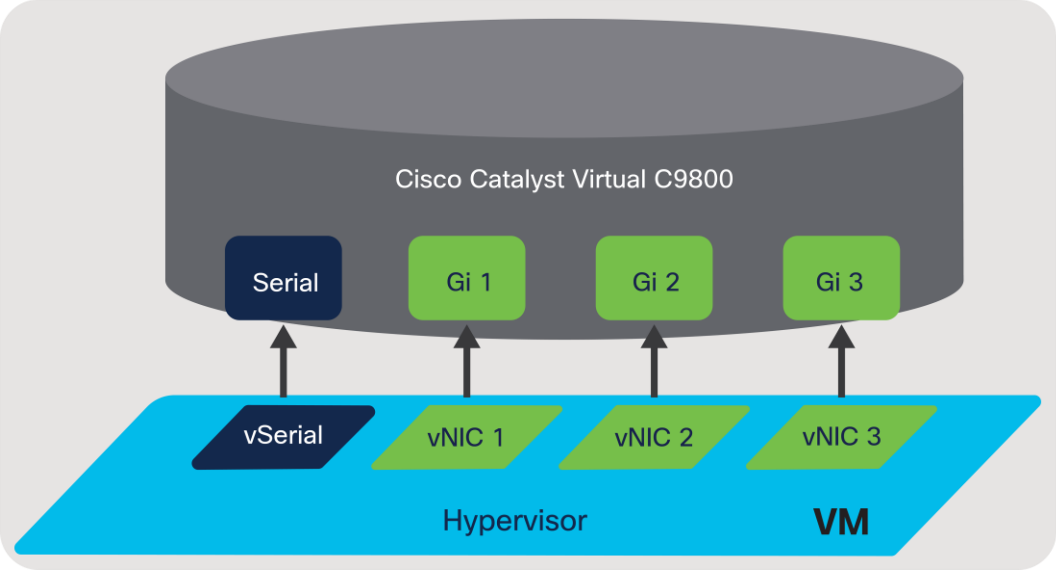
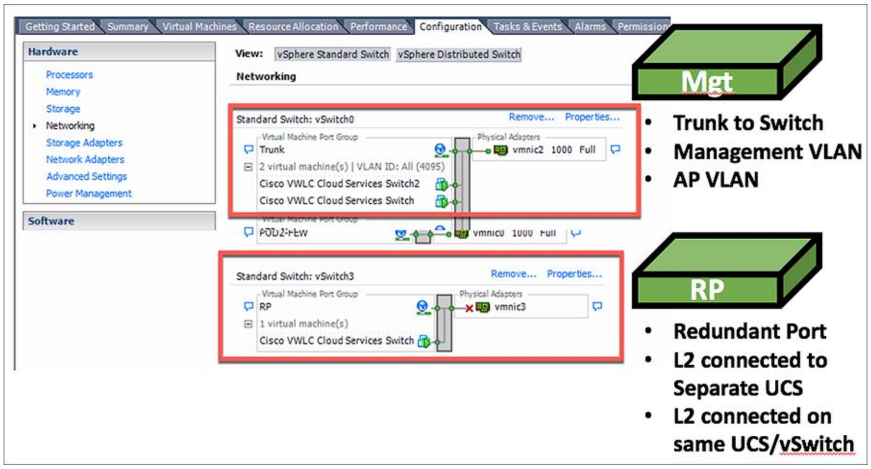


Figure 1.
Mapping the vNICs to the Catalyst 9800-CL interfaces

The figure below shows an example of mapping the hypervisor physical port (vmnic2, connected to a switch trunk) to **vSwitch0**, as intended for the 9800-CL VM management interface, in ESXi. An optional interface intended for use in the redundant HA configuration (vmnic3) is named **RP** and mapped to vSwitch3.

Note: When testing two 9800-CL controllers in the same Cisco UCS® server and using RP ports for HA, it is not necessary to connect the physical RP mapped physical adapters at all. However, if active and standby 9800-CL controllers are on separate hypervisors, the RP mapped physical ports need to be connected to the network and must be Layer 2 adjacent and reachable by each other.



Standard Switch: vSwitch0
Trunk
2 virtual machine(s) | VLAN ID: All (4095)
Cisco VWLC Cloud Services Switch2
Cisco VWLC Cloud Services Switch
vmnic2 1000 Full

POD2-FEW
vmnic0 1000 Full

Standard Switch: vSwitch3
RP
1 virtual machine(s)
Cisco VWLC Cloud Services Switch
vmnic3

- Trunk to Switch
- Management VLAN
- AP VLAN

- Redundant Port
- L2 connected to Separate UCS
- L2 connected on same UCS/vSwitch

Figure 2.
Mapping the hypervisor to the VM management interface in ESXi

By default, a hypervisor vSwitch is configured to reject promiscuous mode. If the 9800-CL is using tagged traffic (for a management VLAN, AP VLAN, etc.) via the management port, promiscuous mode needs to be set to accept in order for the vSwitch to carry tagged traffic.

Secure Boot

Starting with Cisco IOS XE 17.6.1, Secure Boot deployments of the 9800-CL VM hosts are supported.

For information on enabling Secure Boot, go to https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/9800-cloud/installation/b-c9800-cl-install-guide/controller_overview.html#concept_z44_fcm_cdb

Deploying the 9800-CL using VMware ESXi

Design considerations with VMware VM operations

When deploying VMware VM operations such as vMotion, DRS, Snapshot and vNIC teaming, there are a few design considerations to take into account.

Using SR-IOV interfaces

If SR-IOV interfaces are deployed with the 9800-CL, none of the VM operations are supported. This is due to how SR-IOV works within ESXi as documented at https://docs.vmware.com/en/VMware-vSphere/7.0/com.vmware.vsphere.networking.doc/GUID-E8E8D7B2-FE67-4B4F-921F-C3D6D7223869.html

Snapshot

When taking a snapshot, there is a chance the controller might crash. To avoid this, we recommend configuring RAID0 on the Cisco UCS for both SSD and HDD.

Note: Cloning from snapshots is not supported.

vMotion

When deploying vMotion on the 9800-CL in standalone mode, vMotion will work without caveats.

However, when the 9800-CL is deployed in HA SSO, there are a few considerations to take into account.

- Do not run vMotion on both the active and standby VMs at the same time. In the time it takes for the active and standby to move to the new hardware resource, the 9800-CL may be seen as going down.
- When using vMotion with 9800-CL in HA SSO, there will be an extended data outage if no packets originate from WLC. This is due to a limitation in ESXi for Virtual Guest Tagging (VGT mode). As a workaround, a continuous ping will need to be initiated from the 9800-CL to update the MAC address in the right port on the physical switch. For more details, see https://kb.vmware.com/s/article/2113783?lang=en_US.

Deploying the 9800-CL using the OVA

The provided OVA file package can be used to deploy the Cisco wireless controller to the VM. The OVA package includes an OVF file that contains a default VM configuration based on the Cisco IOS XE release and the supported hypervisor.

The following considerations apply when deploying the OVA package to the VM:

- The single OVA package creates a VM with options for three types of virtual wireless controllers, small, medium, and large. Selecting a profile specifies the required virtual CPU and memory. The hard disk requirement will be the same–16 GB–for any wireless controller type. We do not recommend changing the virtual CPU and memory configuration after deployment.
- When deploying using the OVA template, the VM will bootstrap with three interfaces: one is for out-of-band management, one is for wireless management (usually mapped to a trunk interface on the switch side), and the third is for HA to connect to the SSO peer.
- The installation process can be monitored using the virtual VGA console or the console on the virtual serial port. A virtual serial port is optional and can be added after deploying the OVA. At first customer shipment (FCS) the serial console port is not supported for large-scale deployments. If the serial port is required, please see **Appendix B: Adding a virtual serial port in ESXi**.

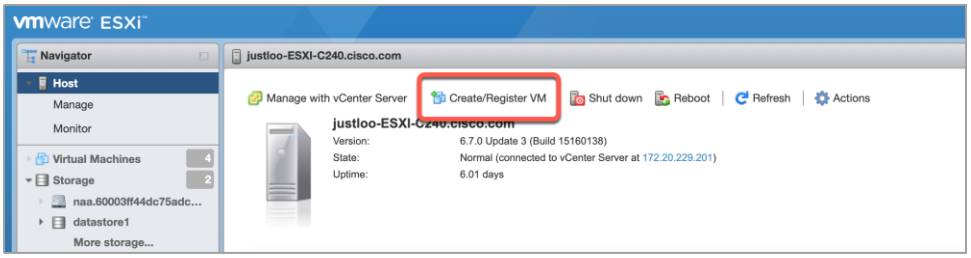
Using the ESXi embedded web GUI

VMware ESXi provides a direct deployment of the virtual Catalyst 9800-CL wireless controller without bootstrap customization (see **Deploying the OVA to ESXi with vCenter Server**).

Perform the following steps in the VMware GUI.

Step 1. Log in to the VMware embedded GUI at https://ESXi_Host_IP.

Step 2. From the Host page, choose **Create/Register VM.**



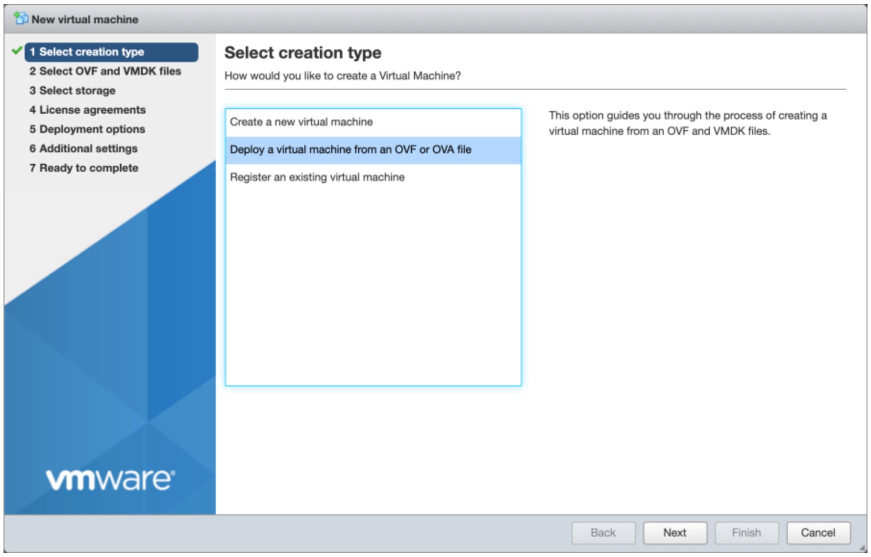
justloo-ESXI-C240.cisco.com

Version: 6.7.0 Update 3 (Build 15160138)

State: Normal (connected to vCenter Server at 172.20.229.201)

Uptime: 6.01 days

Step 3. In the New virtual machine wizard, select **Deploy a virtual machine from an OVF or OVA file**. Click **Next.**



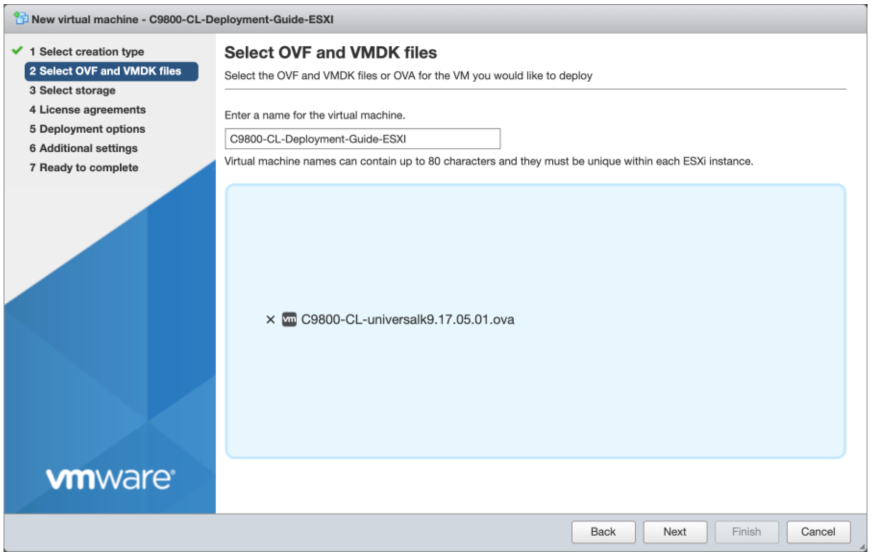
Select creation type

How would you like to create a Virtual Machine?

- Create a new virtual machine
- Deploy a virtual machine from an OVF or OVA file
- Register an existing virtual machine

This option guides you through the process of creating a virtual machine from an OVF and VMDK files.

Step 4. Enter a name for the 9800-CL VM and select the OVA file that will be deployed. Click **Next.**



Select OVF and VMDK files

Select the OVF and VMDK files or OVA for the VM you would like to deploy

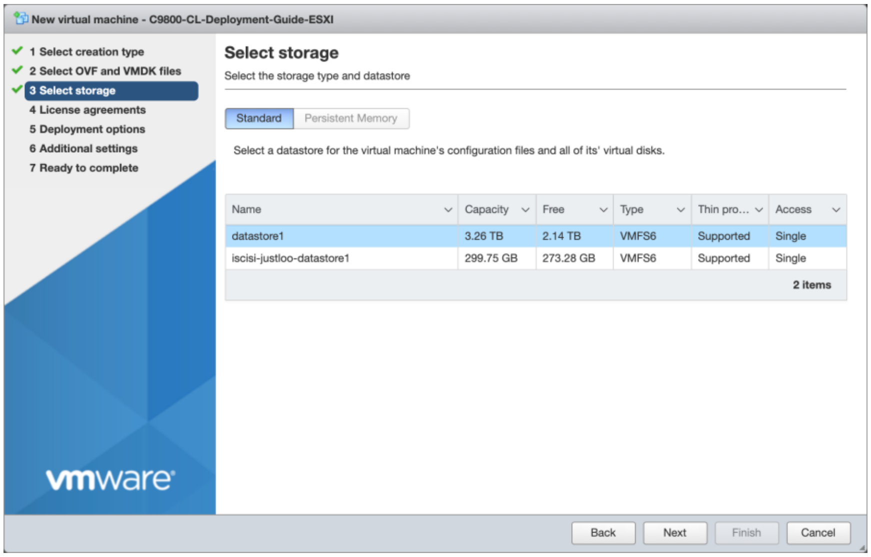
Enter a name for the virtual machine.

C9800-CL-Deployment-Guide-ESXI

Virtual machine names can contain up to 80 characters and they must be unique within each ESXi instance.

× C9800-CL-universalk9.17.05.01.ova

Step 5. Select the datastore for the VM's configuration files and virtual disks. Click **Next**.



New virtual machine - C9800-CL-Deployment-Guide-ESXI

- ✓ 1 Select creation type
- ✓ 2 Select OVF and VMDK files
- ✓ 3 Select storage
- 4 License agreements
- 5 Deployment options
- 6 Additional settings
- 7 Ready to complete

Select storage

Select the storage type and datastore

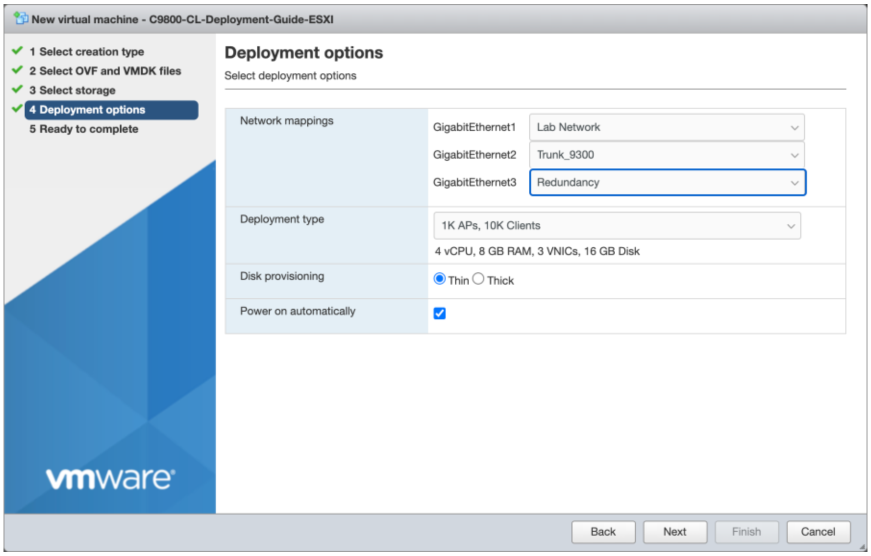
Standard | Persistent Memory

Select a datastore for the virtual machine's configuration files and all of its' virtual disks.

Name	Capacity	Free	Type	Thin pro...	Access
datastore1	3.26 TB	2.14 TB	VMFS6	Supported	Single
iscisi-justloo-datastore1	299.75 GB	273.28 GB	VMFS6	Supported	Single

2 items

Step 6. In the Network mappings section, allocate one port group for each of the required network interfaces.



New virtual machine - C9800-CL-Deployment-Guide-ESXI

- ✓ 1 Select creation type
- ✓ 2 Select OVF and VMDK files
- ✓ 3 Select storage
- ✓ 4 Deployment options
- 5 Ready to complete

Deployment options

Select deployment options

Network mappings
- GigabitEthernet1: Lab Network
- GigabitEthernet2: Trunk_9300
- GigabitEthernet3: Redundancy

Deployment type: 1K APs, 10K Clients

4 vCPU, 8 GB RAM, 3 VNICs, 16 GB Disk

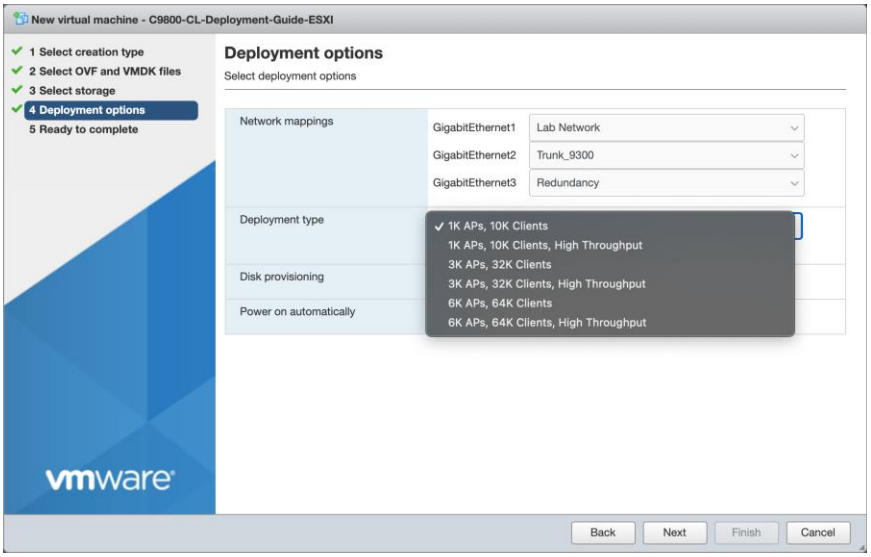
Disk provisioning: ● Thin ○ Thick

Power on automatically: ☑

Note: Please refer to **Appendix A: Creating a port group in ESXi** for steps to configure the port groups for the VM.

Note: SR-IOV interfaces are high-performance interfaces possible in certain Intel® NIC cards. Refer to **Appendix C: Enabling and using the SR-IOV NIC in ESXi** to see how to enable and attach them to the 9800-CL.

Step 7. In the Deployment type section, select the desired hardware configuration (AP and client scale) template from the drop-down menu.



Deployment options

Select deployment options

Network mappings

- GigabitEthernet1: Lab Network
- GigabitEthernet2: Trunk_9300
- GigabitEthernet3: Redundancy

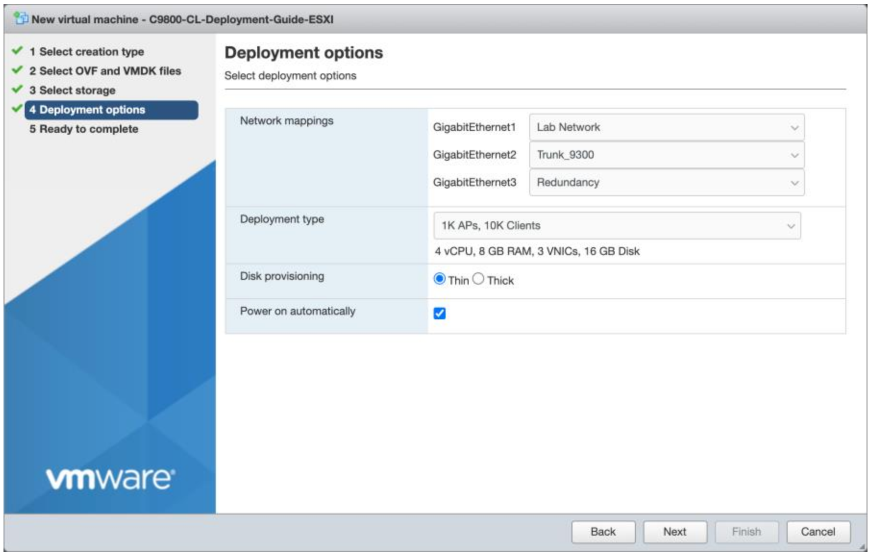
Deployment type

- ✓ 1K APs, 10K Clients
- 1K APs, 10K Clients, High Throughput
- 3K APs, 32K Clients
- 3K APs, 32K Clients, High Throughput
- 6K APs, 64K Clients
- 6K APs, 64K Clients, High Throughput

Disk provisioning

Power on automatically

Step 8. The rest of the settings in the Disk provisioning and Power on automatically sections can be left at their defaults. Click **Next.**



Deployment options

Select deployment options

Network mappings

- GigabitEthernet1: Lab Network
- GigabitEthernet2: Trunk_9300
- GigabitEthernet3: Redundancy

Deployment type: 1K APs, 10K Clients

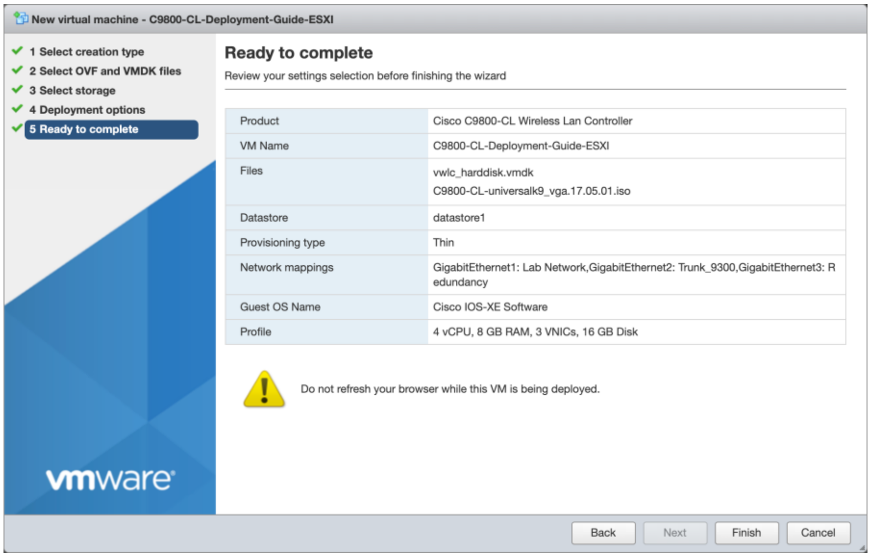
4 vCPU, 8 GB RAM, 3 VNICs, 16 GB Disk

Disk provisioning: ● Thin ○ Thick

Power on automatically: ☑

Note: If using the virtual serial port, uncheck the box for Power on automatically, and refer to **Appendix B: Adding a virtual serial port in ESXi** (optional).

Step 9. Confirm the configured settings. Click **Finish** to deploy the OVA.

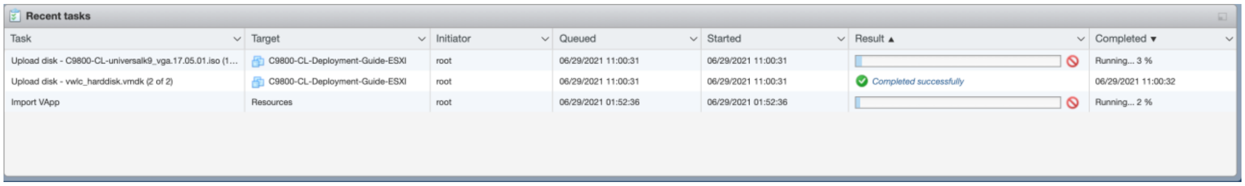


Ready to complete

Review your settings selection before finishing the wizard

Product	Cisco C9800-CL Wireless Lan Controller
VM Name	C9800-CL-Deployment-Guide-ESXI
Files	vwlc_harddisk.vmdk C9800-CL-universalk9_vga.17.05.01.iso
Datastore	datastore1
Provisioning type	Thin
Network mappings	GigabitEthernet1: Lab Network,GigabitEthernet2: Trunk_9300,GigabitEthernet3: Redundancy
Guest OS Name	Cisco IOS-XE Software
Profile	4 vCPU, 8 GB RAM, 3 VNICs, 16 GB Disk

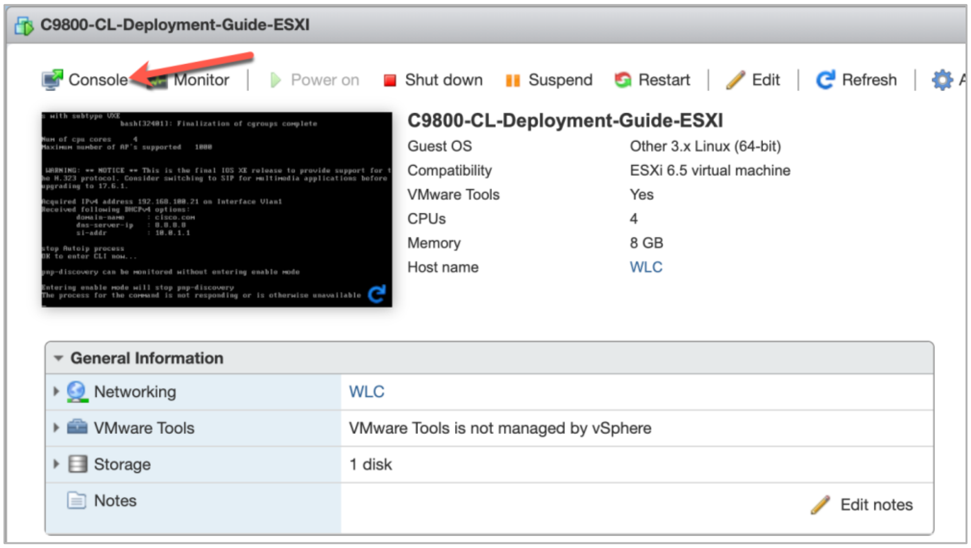
Do not refresh your browser while this VM is being deployed.



Recent tasks

Task	Target	Initiator	Queued	Started	Result ▲	Completed ▼
Upload disk - C9800-CL-universalk9_vga.17.05.01.iso (1…	C9800-CL-Deployment-Guide-ESXI	root	06/29/2021 11:00:31	06/29/2021 11:00:31		Running... 3 %
Upload disk - vwlc_harddisk.vmdk (2 of 2)	C9800-CL-Deployment-Guide-ESXI	root	06/29/2021 11:00:31	06/29/2021 11:00:31	✓ Completed successfully	06/29/2021 11:00:32
Import VApp	Resources	root	06/29/2021 01:52:36	06/29/2021 01:52:36		Running... 2 %

Step 10. Once the VM is finished deploying, select the 9800-CL VM and open the console.



```
s with subtype UXE
                  bash[32401]: Finalization of cgroups complete

Num of cpu cores     4
Maximum number of AP's supported   1000


 WARNING: ** NOTICE ** This is the final IOS XE release to provide support for t
he H.323 protocol. Consider switching to SIP for multimedia applications before
upgrading to 17.6.1.

Acquired IPv4 address 192.168.100.21 on Interface Vlan1
Received following DHCPv4 options:
        domain-name      : cisco.com
        dns-server-ip    : 8.8.8.8
        si-addr          : 10.0.1.1

stop Autoip process
OK to enter CLI now...

pnp-discovery can be monitored without entering enable mode

Entering enable mode will stop pnp-discovery
The process for the command is not responding or is otherwise unavailable
```

C9800-CL-Deployment-Guide-ESXI

Guest OS	Other 3.x Linux (64-bit)
Compatibility	ESXi 6.5 virtual machine
VMware Tools	Yes
CPUs	4
Memory	8 GB
Host name	WLC

General Information

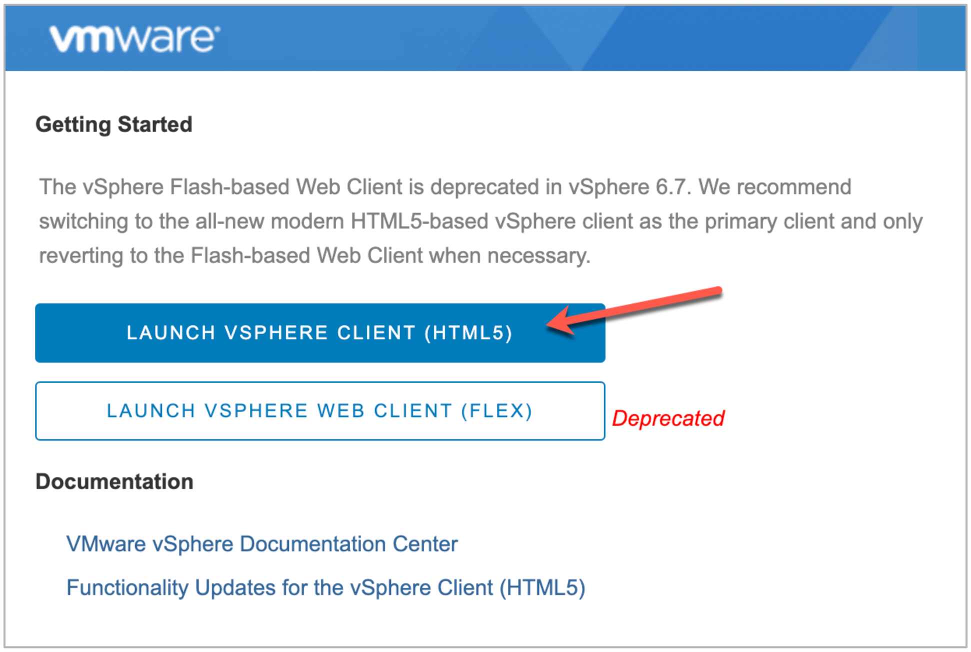
Networking	WLC
VMware Tools	VMware Tools is not managed by vSphere
Storage	1 disk
Notes	Edit notes

Step 11. Go to the **Configuring the 9800-CL** section.

Deploying the OVA to ESXi with vCenter Server

VMware vCenter has a flow similar to that of standalone ESXi, except for the ability to customize and bootstrap the virtual wireless controller with login and network information so that the Command-Line Interface (CLI) is not needed at all.

Step 1. Log in to vCenter and choose **Launch vSphere Web Client (HTML5)**.



Getting Started

The vSphere Flash-based Web Client is deprecated in vSphere 6.7. We recommend switching to the all-new modern HTML5-based vSphere client as the primary client and only reverting to the Flash-based Web Client when necessary.

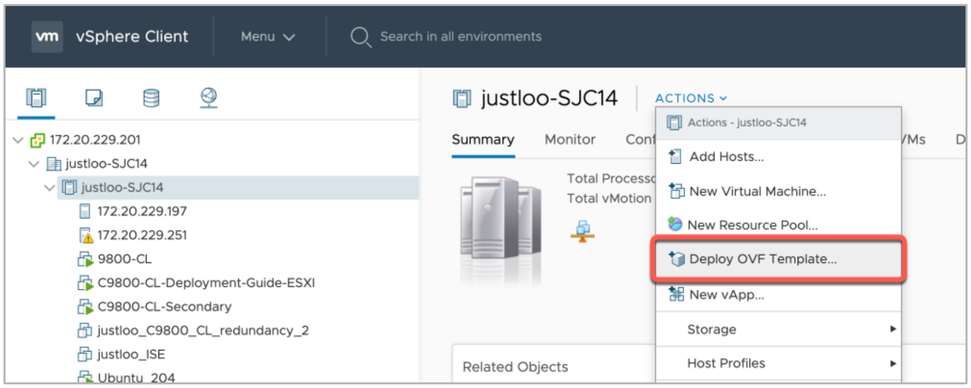
vmware
LAUNCH VSPHERE CLIENT (HTML5)
LAUNCH VSPHERE WEB CLIENT (FLEX)
Deprecated

Documentation

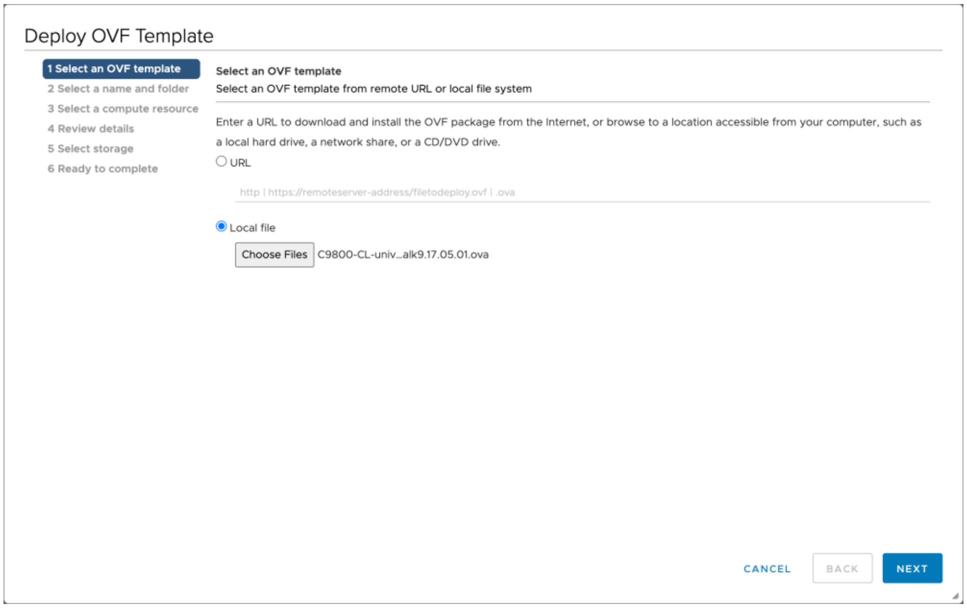
VMware vSphere Documentation Center

Functionality Updates for the vSphere Client (HTML5)

Step 2. Select **Actions → Deploy OVF Template.**



Step 3. Enter the **URL** where the OVA file can be downloaded or select **Local file** and choose a file. Click **Next.**



Deploy OVF Template

Select an OVF template

Select an OVF template from remote URL or local file system

Enter a URL to download and install the OVF package from the Internet, or browse to a location accessible from your computer, such as a local hard drive, a network share, or a CD/DVD drive.

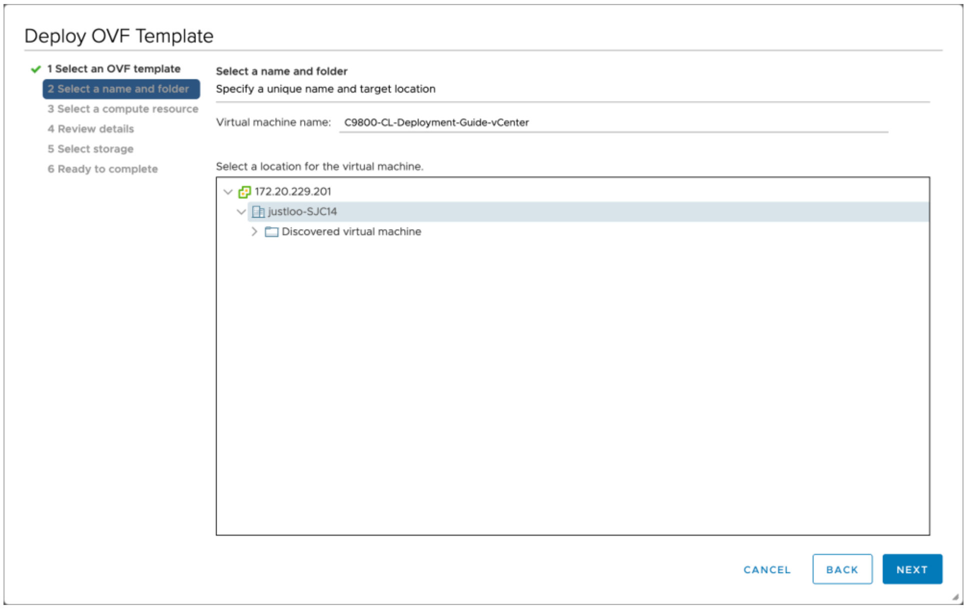
○ URL

http | https://remoteserver-address/filetodeploy.ovf | .ova

● Local file

Choose Files C9800-CL-univ...alk9.17.05.01.ova

Step 4. Enter a name and select a location for the VM. Click **Next.**



Deploy OVF Template

Select a name and folder

Specify a unique name and target location

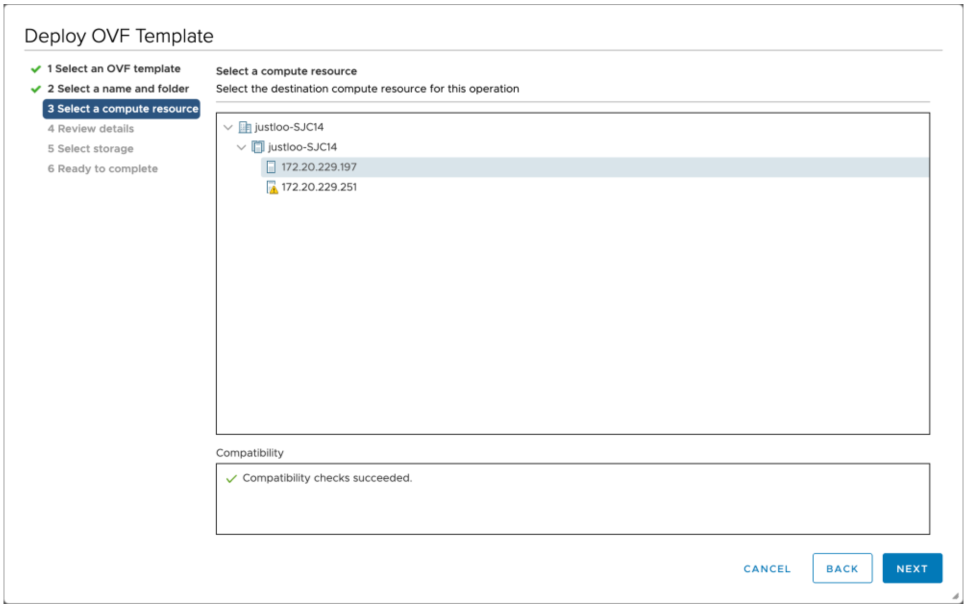
Virtual machine name: C9800-CL-Deployment-Guide-vCenter

Select a location for the virtual machine.

- 172.20.229.201
  - justloo-SJC14
    - Discovered virtual machine

✓ 1 Select an OVF template
2 Select a name and folder
3 Select a compute resource
4 Review details
5 Select storage
6 Ready to complete
CANCEL
BACK
NEXT

Step 5. Select which ESXi host to deploy the 9800-CL on. Click **Next.**



Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 Select storage
- 6 Ready to complete

Select a compute resource

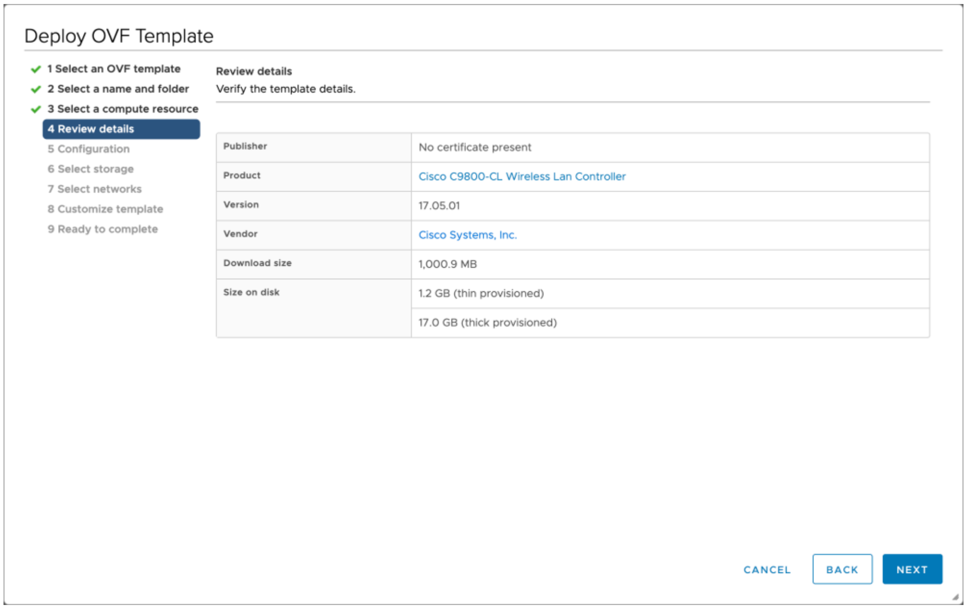
Select the destination compute resource for this operation

- justloo-SJC14
  - justloo-SJC14
    - 172.20.229.197
    - 172.20.229.251

Compatibility

✓ Compatibility checks succeeded.

Step 6. Verify the details of the template. Click **Next.**



Deploy OVF Template

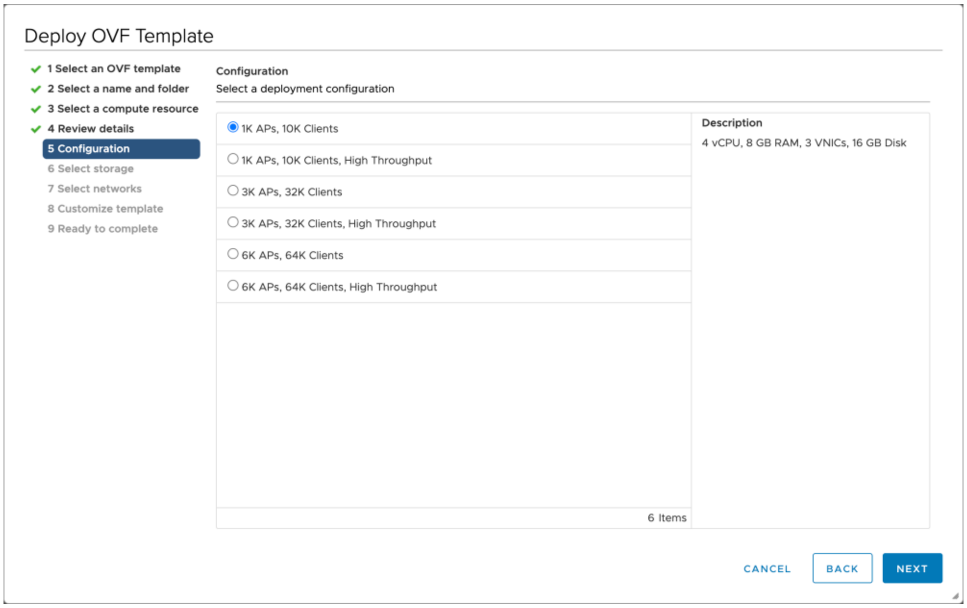
- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- 4 Review details
- 5 Configuration
- 6 Select storage
- 7 Select networks
- 8 Customize template
- 9 Ready to complete

Review details

Verify the template details.

Publisher	No certificate present
Product	Cisco C9800-CL Wireless Lan Controller
Version	17.05.01
Vendor	Cisco Systems, Inc.
Download size	1,000.9 MB
Size on disk	1.2 GB (thin provisioned) 17.0 GB (thick provisioned)

Step 7. Select the configuration (AP and client scale) template. Click **Next**.



Deploy OVF Template

Configuration

Select a deployment configuration

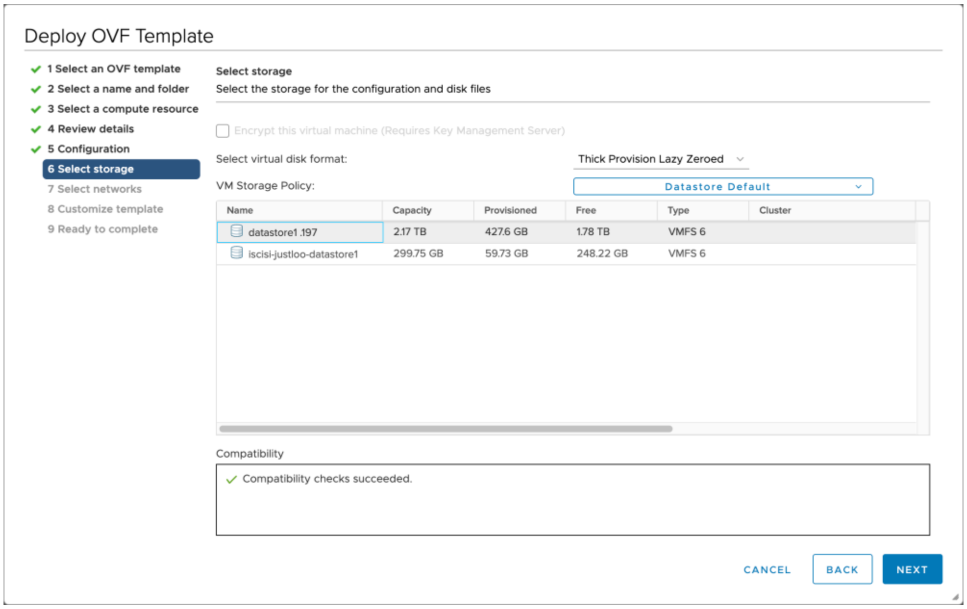
● 1K APs, 10K Clients
○ 1K APs, 10K Clients, High Throughput
○ 3K APs, 32K Clients
○ 3K APs, 32K Clients, High Throughput
○ 6K APs, 64K Clients
○ 6K APs, 64K Clients, High Throughput

6 Items

Description

4 vCPU, 8 GB RAM, 3 VNICs, 16 GB Disk

Step 8. Select the storage. Click **Next**.



Deploy OVF Template

Select storage

Select the storage for the configuration and disk files

□ Encrypt this virtual machine (Requires Key Management Server)

Select virtual disk format: Thick Provision Lazy Zeroed

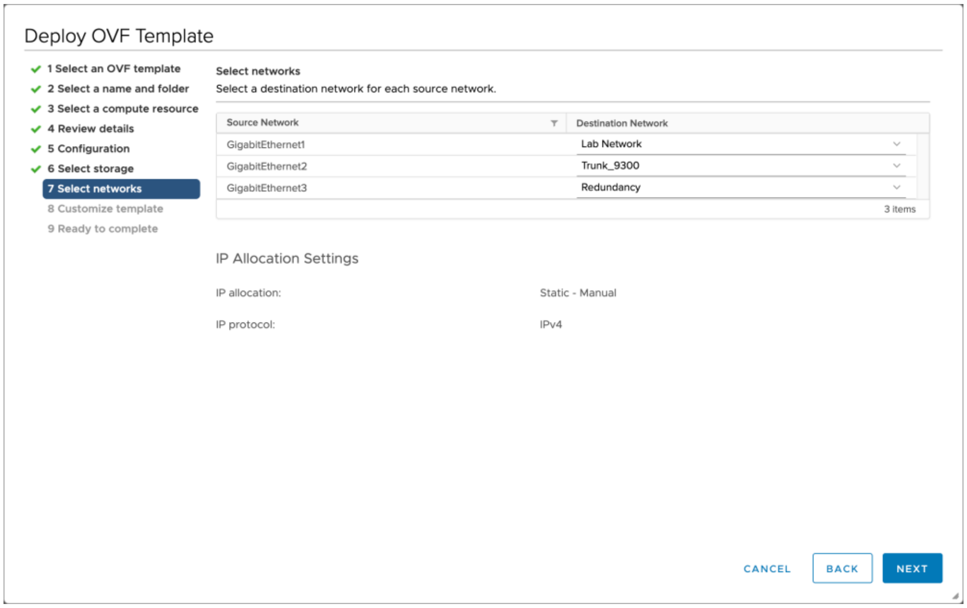
VM Storage Policy: Datastore Default

Name	Capacity	Provisioned	Free	Type	Cluster
datastore1 .197	2.17 TB	427.6 GB	1.78 TB	VMFS 6	
iscisi-justloo-datastore1	299.75 GB	59.73 GB	248.22 GB	VMFS 6	

Compatibility

✓ Compatibility checks succeeded.

Step 9. Map the virtual network interface(s) and click **Next**.



Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- ✓ 5 Configuration
- ✓ 6 Select storage
- 7 Select networks
- 8 Customize template
- 9 Ready to complete

Select networks

Select a destination network for each source network.

Source Network	Destination Network
GigabitEthernet1	Lab Network
GigabitEthernet2	Trunk_9300
GigabitEthernet3	Redundancy

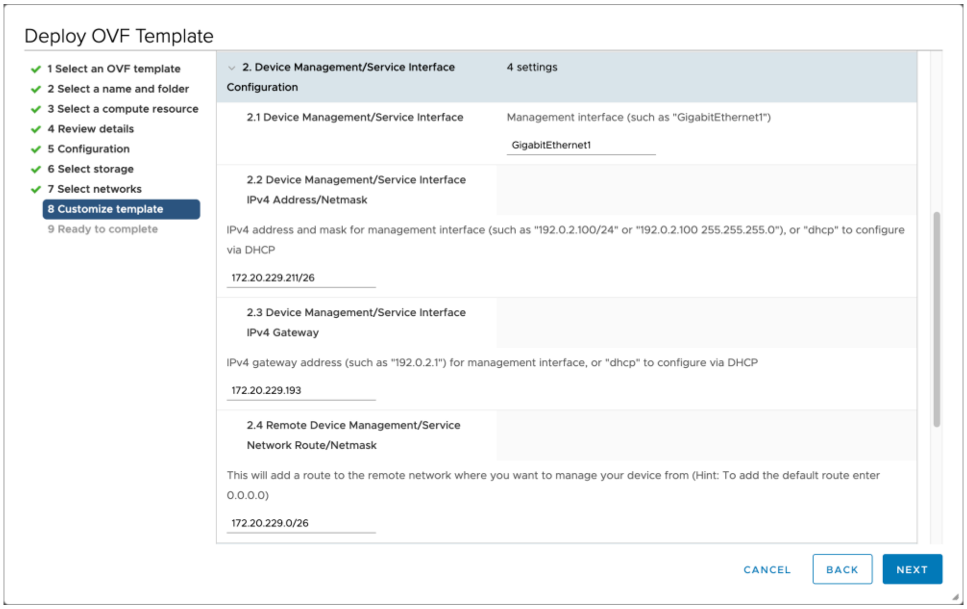
3 items

IP Allocation Settings

IP allocation: Static - Manual

IP protocol: IPv4

Step 10. As was mentioned earlier, vCenter deployment provides an option to customize or bootstrap the Catalyst 9800-CL wireless controller with a hostname, network configuration, and login. Go through the steps to provide any necessary information using the provided template, and click **Next**.



Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- ✓ 5 Configuration
- ✓ 6 Select storage
- ✓ 7 Select networks
- 8 Customize template
- 9 Ready to complete

2. Device Management/Service Interface Configuration — 4 settings

2.1 Device Management/Service Interface — Management interface (such as "GigabitEthernet1")

GigabitEthernet1

2.2 Device Management/Service Interface IPv4 Address/Netmask

IPv4 address and mask for management interface (such as "192.0.2.100/24" or "192.0.2.100 255.255.255.0"), or "dhcp" to configure via DHCP

172.20.229.211/26

2.3 Device Management/Service Interface IPv4 Gateway

IPv4 gateway address (such as "192.0.2.1") for management interface, or "dhcp" to configure via DHCP

172.20.229.193

2.4 Remote Device Management/Service Network Route/Netmask

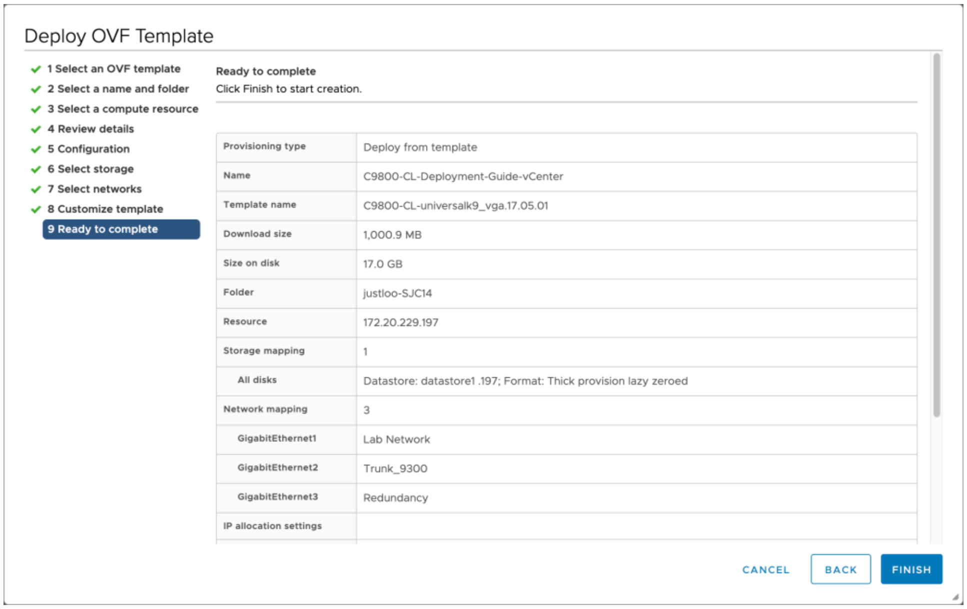
This will add a route to the remote network where you want to manage your device from (Hint: To add the default route enter 0.0.0.0)

172.20.229.0/26

Note: When specifying the device management interface, choose the interface mapped to the out-of-band management network. It will be configured as a Layer 3 routed interface with the IP address provided in this step. The network entered in step 2.4 is the remote network from which the 9800-CL will be managed. This will create a static route to that specified network.

Note: When deploying the OVA via vCenter, the configuration bootstrap will always get applied, so "`wr erase`" and "`reload`" will not bring the box to the default configuration. If the deployment does not require bootstrapping or if the 9800-CL needs to be reset to the factory default, please do not power on the 9800-CL after deploying, and refer to the steps in **Appendix E: Resetting the 9800-CL to the factory default**.

Step 11. Finally, review the configuration data. Click **Finish** to deploy the 9800-CL in vCenter.



Deploy OVF Template

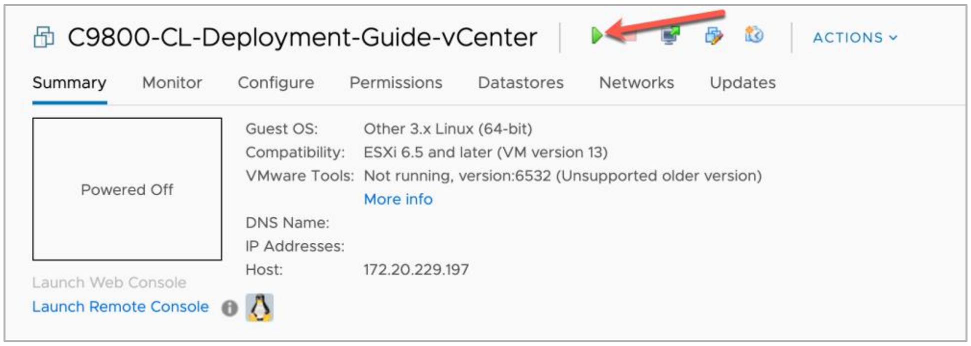
Ready to complete

Click Finish to start creation.

Provisioning type	Deploy from template
Name	C9800-CL-Deployment-Guide-vCenter
Template name	C9800-CL-universalk9_vga.17.05.01
Download size	1,000.9 MB
Size on disk	17.0 GB
Folder	justloo-SJC14
Resource	172.20.229.197
Storage mapping	1
All disks	Datastore: datastore1 .197; Format: Thick provision lazy zeroed
Network mapping	3
GigabitEthernet1	Lab Network
GigabitEthernet2	Trunk_9300
GigabitEthernet3	Redundancy
IP allocation settings	

Step 12. Select Power on after deployment.

Note: If you are removing the configuration bootstrap, please do not power on the 9800-CL after deploying and refer to the steps in **Appendix E: Resetting the 9800-CL to the factory default**.



Guest OS: Other 3.x Linux (64-bit)
Compatibility: ESXi 6.5 and later (VM version 13)
VMware Tools: Not running, version:6532 (Unsupported older version)
More info
DNS Name:
IP Addresses:
Host: 172.20.229.197

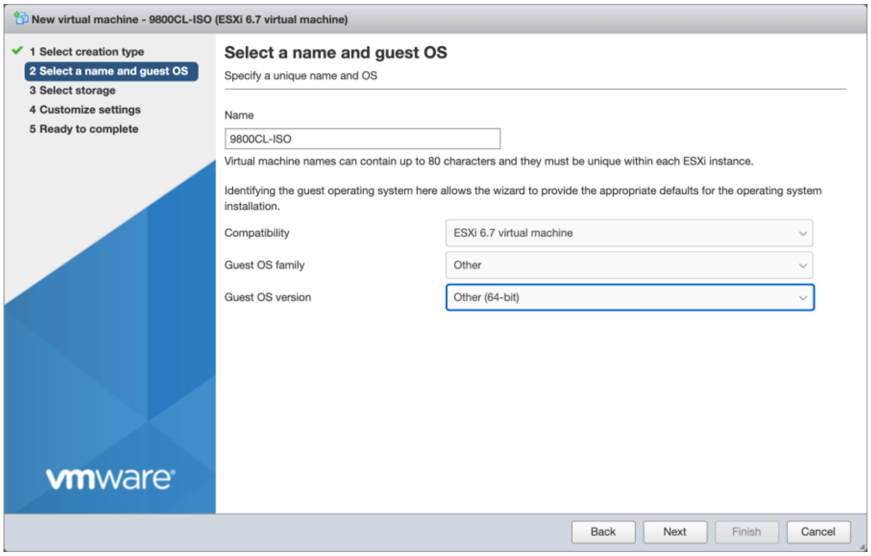
Step 13. Go to the **Configuring the 9800-CL** section.

Deploying the 9800-CL using the ISO

Step 1. Copy the 9800-CL ISO file into the datastore.

Step 2. Create a new virtual machine and choose the OS family/version as suggested below.

- Compatibility: **Required ESXi version**
- Guest OS family: **Other**
- Guest OS version: **Other (64-bit)**



New virtual machine - 9800CL-ISO (ESXi 6.7 virtual machine)

✓ 1 Select creation type
2 Select a name and guest OS
3 Select storage
4 Customize settings
5 Ready to complete

Select a name and guest OS

Specify a unique name and OS

Name

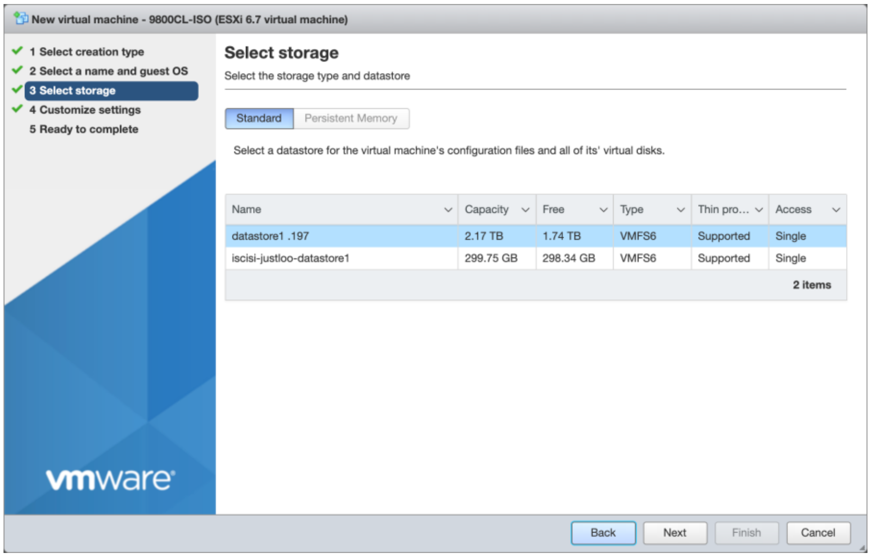
9800CL-ISO

Virtual machine names can contain up to 80 characters and they must be unique within each ESXi instance.

Identifying the guest operating system here allows the wizard to provide the appropriate defaults for the operating system installation.

Compatibility	ESXi 6.7 virtual machine
Guest OS family	Other
Guest OS version	Other (64-bit)

Step 3. Select the datastore for deploying the 9800-CL.



New virtual machine - 9800CL-ISO (ESXi 6.7 virtual machine)

✓ 1 Select creation type
✓ 2 Select a name and guest OS
✓ 3 Select storage
✓ 4 Customize settings
5 Ready to complete

Select storage

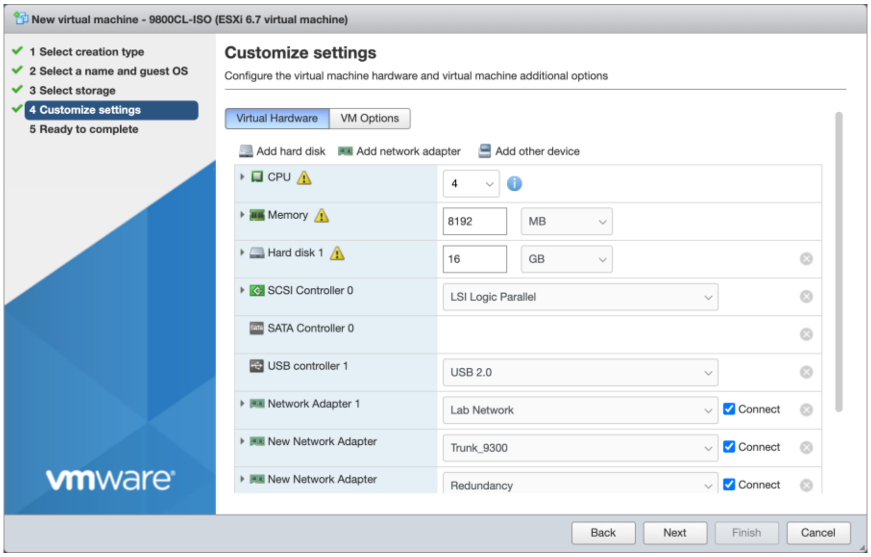
Select the storage type and datastore

Standard | Persistent Memory

Select a datastore for the virtual machine's configuration files and all of its' virtual disks.

Name	Capacity	Free	Type	Thin pro...	Access
datastore1 .197	2.17 TB	1.74 TB	VMFS6	Supported	Single
iscisi-justloo-datastore1	299.75 GB	298.34 GB	VMFS6	Supported	Single
					2 items

Step 4. Choose the CPU, memory, and hard disk size depending on the deployment requirements. Refer to the virtual machine requirement and scale shown earlier in Table 2.



New virtual machine - 9800CL-ISO (ESXi 6.7 virtual machine)

- ✓ 1 Select creation type
- ✓ 2 Select a name and guest OS
- ✓ 3 Select storage
- ✓ 4 Customize settings
- 5 Ready to complete

Customize settings

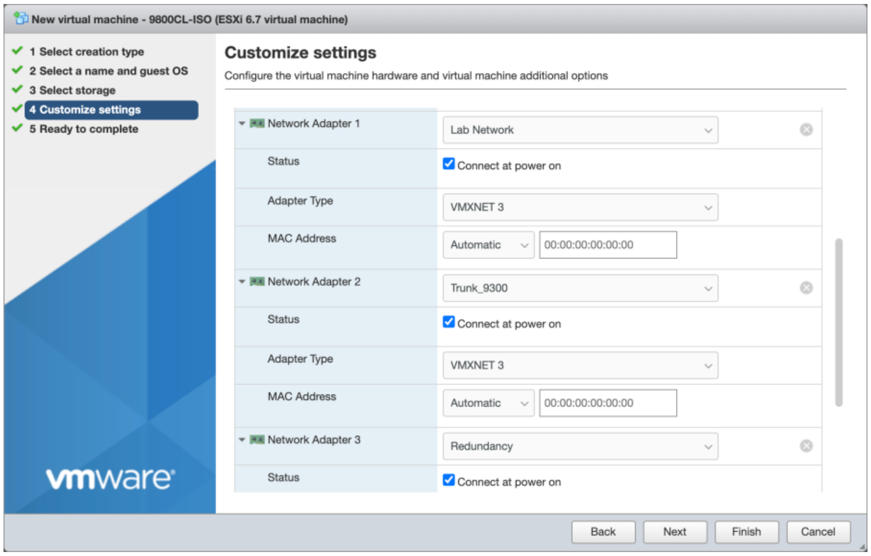
Configure the virtual machine hardware and virtual machine additional options

Virtual Hardware | VM Options

Add hard disk | Add network adapter | Add other device

CPU ⚠	4	
Memory ⚠	8192 MB	
Hard disk 1 ⚠	16 GB	
SCSI Controller 0	LSI Logic Parallel	
SATA Controller 0		
USB controller 1	USB 2.0	
Network Adapter 1	Lab Network	☑ Connect
New Network Adapter	Trunk_9300	☑ Connect
New Network Adapter	Redundancy	☑ Connect

Step 5. Add the required network adapters and select the port groups needed. Ensure that the network adapter type is **VMXNET 3**.



New virtual machine - 9800CL-ISO (ESXi 6.7 virtual machine)

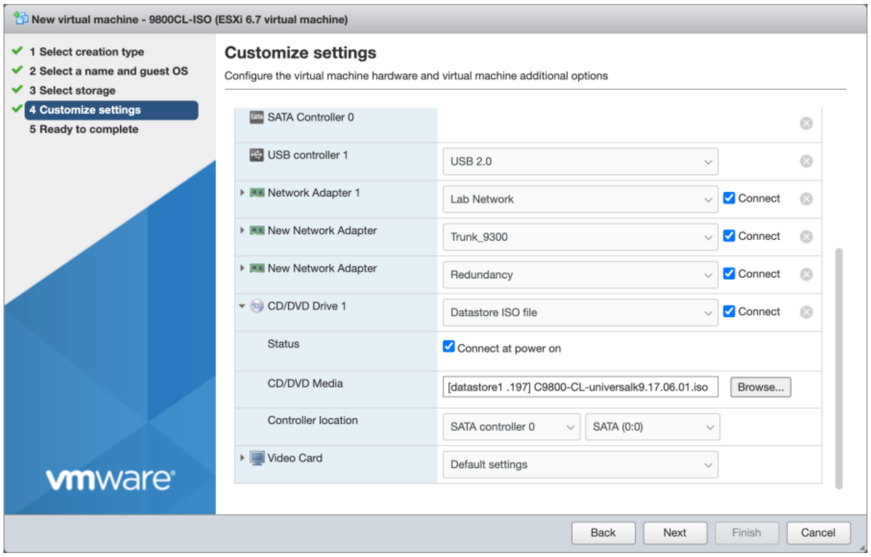
- ✓ 1 Select creation type
- ✓ 2 Select a name and guest OS
- ✓ 3 Select storage
- ✓ 4 Customize settings
- ✓ 5 Ready to complete

Customize settings

Configure the virtual machine hardware and virtual machine additional options

Network Adapter 1	Lab Network
Status	☑ Connect at power on
Adapter Type	VMXNET 3
MAC Address	Automatic 00:00:00:00:00:00
Network Adapter 2	Trunk_9300
Status	☑ Connect at power on
Adapter Type	VMXNET 3
MAC Address	Automatic 00:00:00:00:00:00
Network Adapter 3	Redundancy
Status	☑ Connect at power on

Step 6. Ensure that the CD/DVD drive is set to **Datastore ISO File** and that the Status is checked for **Connect at power on**. Select the ISO file for the 9800-CL. Click **Next**.



New virtual machine - 9800CL-ISO (ESXi 6.7 virtual machine)

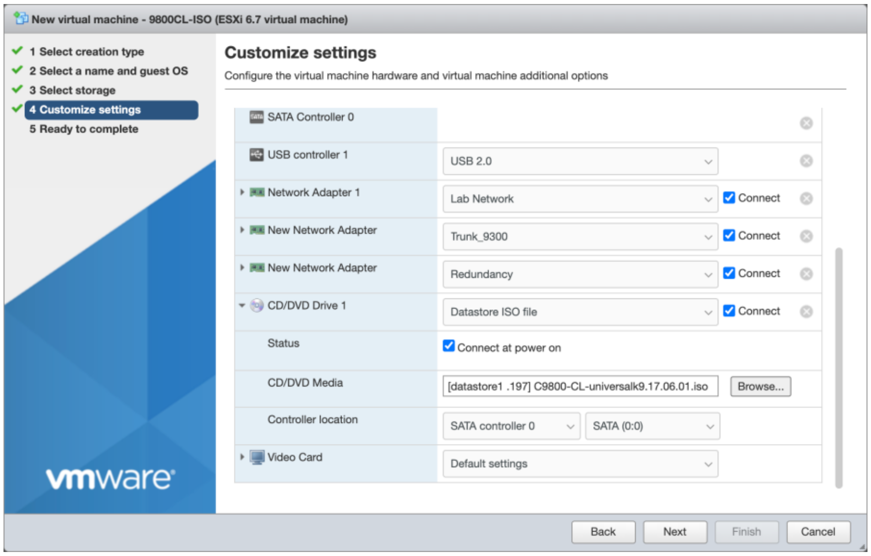
1 Select creation type
2 Select a name and guest OS
3 Select storage
4 Customize settings
5 Ready to complete

Customize settings

Configure the virtual machine hardware and virtual machine additional options

SATA Controller 0		
USB controller 1	USB 2.0	
Network Adapter 1	Lab Network	☑ Connect
New Network Adapter	Trunk_9300	☑ Connect
New Network Adapter	Redundancy	☑ Connect
CD/DVD Drive 1	Datastore ISO file	☑ Connect
Status	☑ Connect at power on	
CD/DVD Media	[datastore1 .197] C9800-CL-universalk9.17.06.01.iso	Browse...
Controller location	SATA controller 0	SATA (0:0)
Video Card	Default settings	

Step 7. Review the configuration and click **Finish**. Start the VM.



New virtual machine - 9800CL-ISO (ESXi 6.7 virtual machine)

1 Select creation type
2 Select a name and guest OS
3 Select storage
4 Customize settings
5 Ready to complete

Customize settings

Configure the virtual machine hardware and virtual machine additional options

SATA Controller 0		
USB controller 1	USB 2.0	
Network Adapter 1	Lab Network	☑ Connect
New Network Adapter	Trunk_9300	☑ Connect
New Network Adapter	Redundancy	☑ Connect
CD/DVD Drive 1	Datastore ISO file	☑ Connect
Status	☑ Connect at power on	
CD/DVD Media	[datastore1 .197] C9800-CL-universalk9.17.06.01.iso	Browse...
Controller location	SATA controller 0	SATA (0:0)
Video Card	Default settings	

Step 8. After ISO installation, walk through the initial setup wizard and configure SVIs, wireless interface, trustpoint, etc. (Review the previous sections, as these will be the same.)

Step 9. Go to the **Configuring the 9800-CL** section.

Deploying the 9800-CL on Linux KVM

The virtual Cisco Catalyst 9800-CL Wireless Controller for Cloud can be deployed in Linux KVM using an ISO file (downloaded from the Cisco website), with support for the following distribution:

- Red Hat Enterprise Linux (RHEL) 7.1 or higher
- Ubuntu 16.04 LTS or higher

This guide will not cover every aspect of Linux or KVM components, only the general set of instructions needed to deploy a virtual wireless controller on KVM.

Scale for the virtual 9800-CL on Linux KVM

Table 4. Minimum virtual resource requirements for small, medium, and large configurations

	Existing supported templates pre Cisco IOS XE Release 17.3			**Templates added as part of Cisco IOS XE Release 17.3**		
Model configuration	**Small** **(Low throughput)**	**Medium** **(Low throughput)**	**Large[1]** **(Low throughput)**	**Small** **(High throughput)**	**Medium** **(High throughput)**	**Large[1]** **(High throughput)**
Minimum number of vCPUs	4	6	10	7	9	13
Minimum CPU allocation (MHz)	4000	6000	10,000	4000	6000	10,000
Minimum memory (GB)	8	16	32	8	16	32
Required storage (GB)	16	16	16	16	16	16
Virtual NICs (vNICs) **(*) Third NIC is for High Availability**	2/(3)*	2/(3)*	2/(3)*	2/(3)*	2/(3)*	2/(3)*
Linux KVM vNIC	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)	OVS Linux bridge (brctl)
NIC virtualization	Virtio	Virtio	Virtio	Virtio	Virtio	Virtio
Maximum access points	1000	3000	6000	1000	3000	6000
Maximum clients supported	10,000	32,000	64,000	10,000	32,000	64,000
Layer 2 LAG, SR-IOV	Supported	Supported	Supported	Supported	Supported	Supported

[1] At FCS, the large image will support the full scale with Cisco FlexConnect® local switching and fabric deployment mode. For local and Cisco Flex® central switching deployment modes, the scale is 3000 APs and 32,000 clients, the same as for the medium configuration.

Prerequisites before installing KVM

To run KVM, a processor that supports hardware virtualization is required. Intel and AMD both have developed extensions for their processors, deemed, respectively, Intel VT-x (code name Vanderpool) and AMD-V (code name Pacifica).

To see if the processor supports one of these extensions, issue the following command and review the output:

```
egrep -c '(vmx|svm)' /proc/cpuinfo
```

If the result is 0, it means the CPU doesn't support hardware virtualization.

If it is 1 or more, it does support hardware virtualization, but virtualization needs to be enabled in the BIOS.

Required packages for KVM

The following KVM packages are required for installation:

- `Qemu-kvm`

- Qemu-utils
- Uml-utilities
- Bridge-utils
- Socat
- Kvm
- Libvirt-bin
- Virtinst

The following are Ubuntu sample commands to install the packages:

```
# apt-get install qemu-kvm qemu-utils uml-utilities bridge-utils socat
# apt-get install kvm libvirt-bin virtinst
```

Use the following command to install the packages in RHEL:

```
# yum install kvm libvirt
```

KVM networking

Networking options vary within Linux. Effectively, KVM supports the following:

Linux bridge

OVS switch

The following are sample network settings, where br0 and br1 can be mapped to the virtual wireless controller interface(s):

```
[root@localhost ~]# vim /etc/network/interfaces

interfaces(5) file used by ifup(8) and ifdown(8)
auto lo
iface lo inet loopback

auto br0
iface br0 inet static
        address 10.104.170.99
        netmask 255.255.255.0
        network 10.104.170.0
        broadcast 10.104.170.255
        #gateway 10.104.170.1
        #up route add default gw 10.104.170.1
        # dns-* options are implemented by the resolvconf package, if installed
        bridge_ports eth0
        bridge_stp off
        bridge_fd 0
        bridge_maxwait 0
        dns-nameservers 72.163.128.140

auto br1
iface br1 inet static
        address 9.11.124.44
        network 9.11.124.0
        netmask 255.255.255.0
        bridge_ports eth1
        bridge_stp off
        bridge_fd 0
        bridge_maxwait 0
```

For how to configure the SR-IOV interfaces for KVM, see **Appendix D: Enabling and using the SR-IOV NIC in KVM**.

Creating and launching a VM

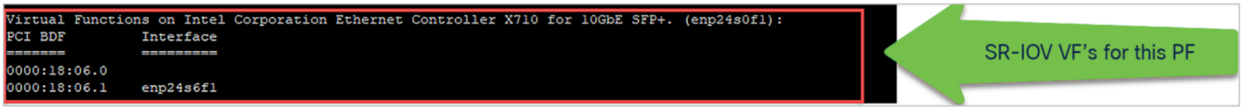
```
sudo virt-install   --virt-type=kvm   --name C9800_sriov_3-18  --ram 16384  --vcpus=9     -
-hvm  --cdrom=/home/C9800-CL-universalk9.BLD_POLARIS_DEV_LATEST_20200318_062819-serial.iso
--network none  --host-device=pci_0000_18_06_0 --host-device=pci_0000_18_06_1 --graphics
vnc  --disk path=/var/lib/libvirt/images/C9800_sriov_3-
18.qcow2,size=8,bus=virtio,format=qcow2
```

Verify this on the 9800-CL console after launching:

```
C9800> en
C9800#show platform software vnic-if interface-mapping
-------------------------------------------------------------
 Interface Name         Driver Name          Mac Addr
-------------------------------------------------------------
 GigabitEthernet2        net_i40e_vf         3cfd.fede.ccbd
 GigabitEthernet1        net_i40e_vf         3cfd.fede.ccbc
-------------------------------------------------------------
```

Attaching to an existing VM using the CLI

Adding the PCI device number:



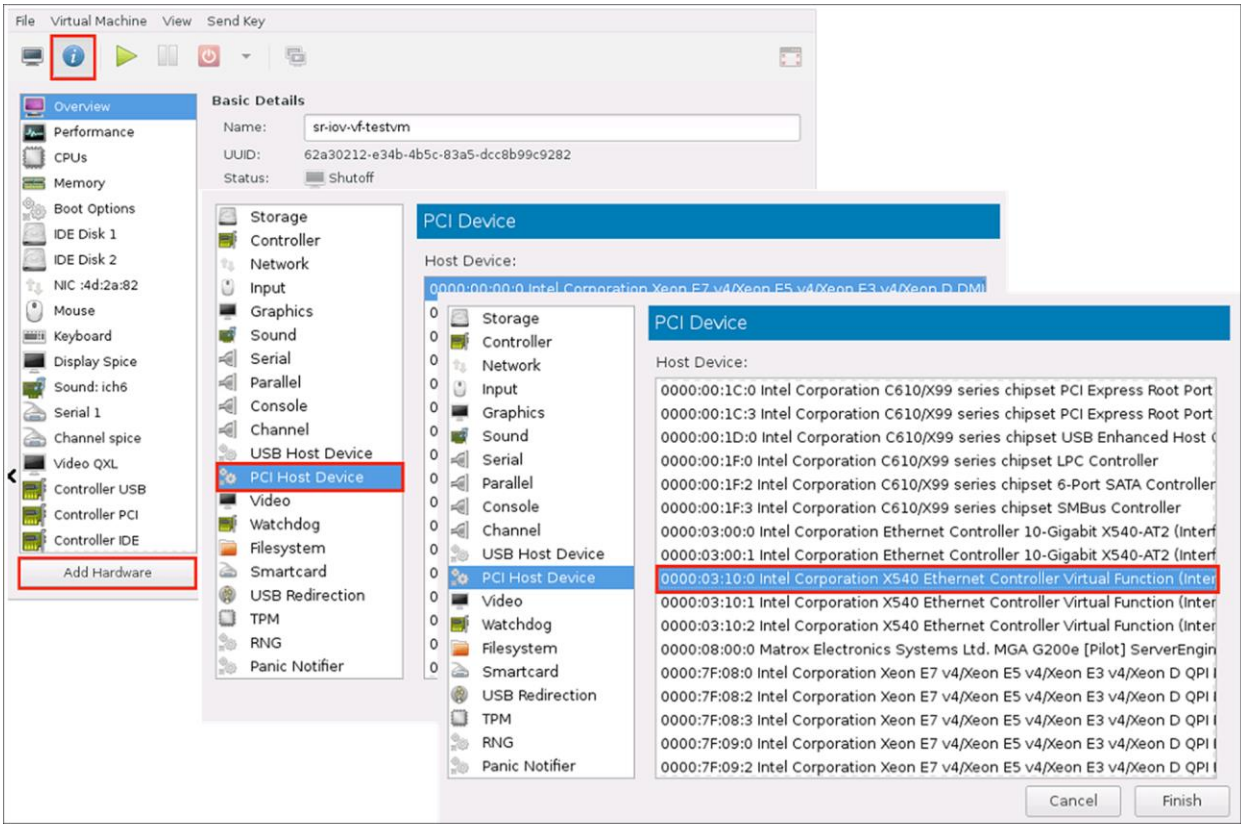
```
Virtual Functions on Intel Corporation Ethernet Controller X710 for 10GbE SFP+. (enp24s0f1):
PCI BDF         Interface
=======         =========
0000:18:06.0
0000:18:06.1    enp24s6f1
```

causes the address domain, bus, slot, and function to be derived from the PCI BDF by the script in step 1.

```
# virsh edit <VM name>
# virsh edit <name of virtual machine>
# virsh dump <name of virtual machine>
<domain>
…
<devices>
…
<hostdev mode='subsystem' type='pci' managed='yes'>
      <source>
        <address domain='0x0000' bus='0x18' slot='0x06' function='0x0'/>
      </source>
</hostdev>
…
</devices>
…
</domain>
```

Attaching to the 9800-CL using the Virtual Machine Manager

In the Virtual Machine Manager (virt-manager), use the Add Hardware button to add the PCI host device. Navigate to the NIC and choose the VF that needs to be attached to the VM.



Basic Details

Name: sr-iov-vf-testvm

UUID: 62a30212-e34b-4b5c-83a5-dcc8b99c9282

Status: Shutoff

PCI Device

Host Device:

```
0000:00:00:0 Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D DMI
```

PCI Device

Host Device:

```
0000:00:1C:0 Intel Corporation C610/X99 series chipset PCI Express Root Port
0000:00:1C:3 Intel Corporation C610/X99 series chipset PCI Express Root Port
0000:00:1D:0 Intel Corporation C610/X99 series chipset USB Enhanced Host C
0000:00:1F:0 Intel Corporation C610/X99 series chipset LPC Controller
0000:00:1F:2 Intel Corporation C610/X99 series chipset 6-Port SATA Controller
0000:00:1F:3 Intel Corporation C610/X99 series chipset SMBus Controller
0000:03:00:0 Intel Corporation Ethernet Controller 10-Gigabit X540-AT2 (Interf
0000:03:00:1 Intel Corporation Ethernet Controller 10-Gigabit X540-AT2 (Interf
0000:03:10:0 Intel Corporation X540 Ethernet Controller Virtual Function (Inter
0000:03:10:1 Intel Corporation X540 Ethernet Controller Virtual Function (Inter
0000:03:10:2 Intel Corporation X540 Ethernet Controller Virtual Function (Inter
0000:08:00:0 Matrox Electronics Systems Ltd. MGA G200e [Pilot] ServerEngin
0000:7F:08:0 Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D QPI I
0000:7F:08:2 Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D QPI I
0000:7F:08:3 Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D QPI I
0000:7F:09:0 Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D QPI I
0000:7F:09:2 Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D QPI I
```

Once the PCI is added to the VM, start the VM.

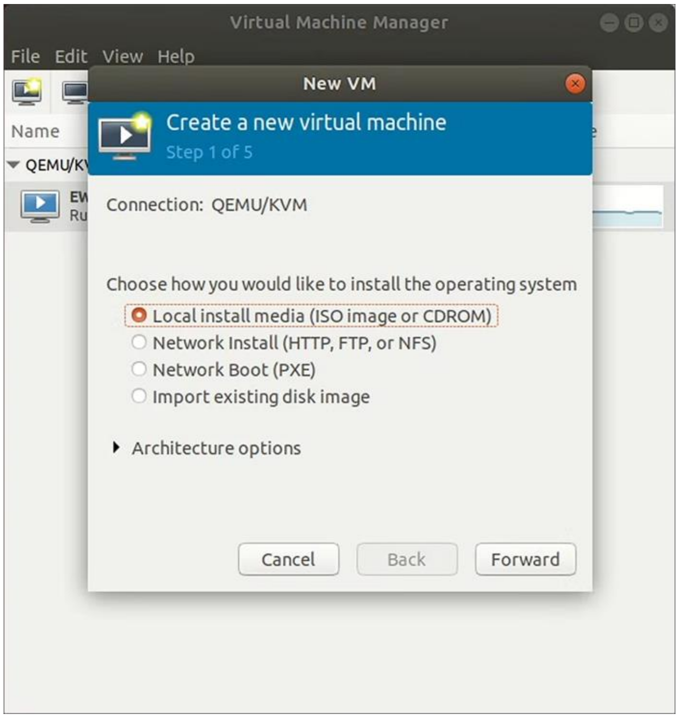
Table 5. Verified and recommended software versions for SR-IOV

Guest OS	NIC	Driver version	Firmware
KVM RedHat Version 7.5	Intel x710	I40e 2.10.19.82	7.10
KVM RedHat Version 7.4	Ciscoized x710	I40e 2.10.19.82	7.0

Creating the Catalyst 9800-CL VM using the virt-manager GUI tool

Once the Linux KVM requirement is met, the packages have been installed, and networking has been configured, download the ISO from Cisco for use with the virt-manager. This GUI tool is the easiest method for deploying the virtual 9800-CL wireless controller. The following examples are based on Ubuntu/Gnome as a desktop environment.

Step 1. Start Virtual Machine Manager and choose Create a new virtual machine. Select Local install media (ISO image) and click Forward.



Virtual Machine Manager

New VM

Create a new virtual machine

Step 1 of 5

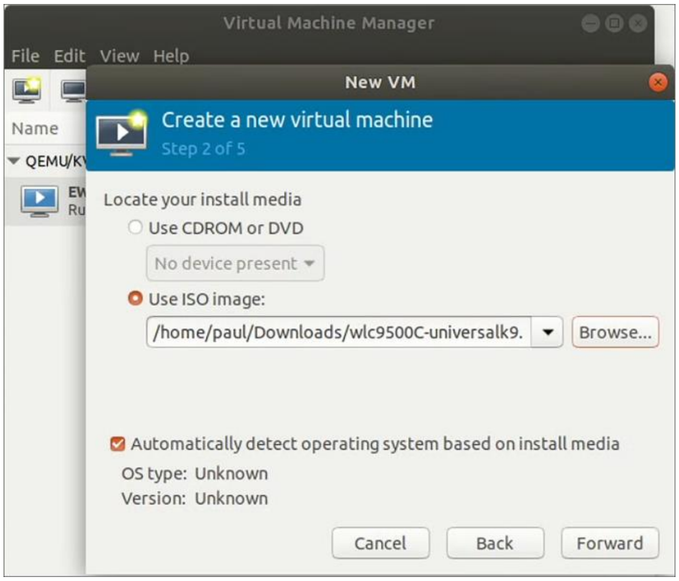
Connection: QEMU/KVM

Choose how you would like to install the operating system

- ● Local install media (ISO image or CDROM)
- ○ Network Install (HTTP, FTP, or NFS)
- ○ Network Boot (PXE)
- ○ Import existing disk image

▸ Architecture options

Step 2. Browse and select the Catalyst 9800-CL ISO file.



Virtual Machine Manager

New VM

Create a new virtual machine

Step 2 of 5

Locate your install media

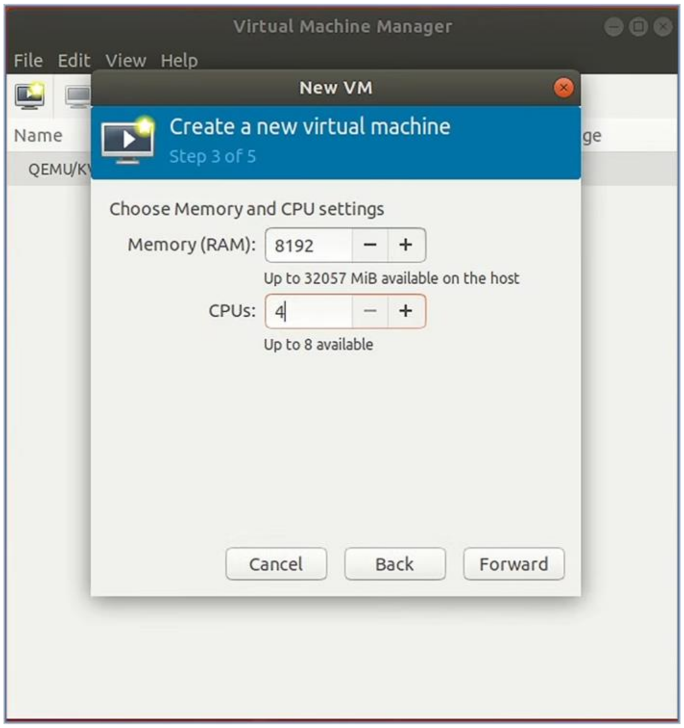
- ○ Use CDROM or DVD
  - No device present
- ● Use ISO image:
  - /home/paul/Downloads/wlc9500C-universalk9.

☑ Automatically detect operating system based on install media

OS type: Unknown

Version: Unknown

Step 3. Using the AP and client scale guide in Table 4, set the CPU and memory requirements. For example, four CPUs and 8 GB RAM are recommended for small deployments with 1000 APs and 6000 clients. Click Forward.



Create a new virtual machine
Step 3 of 5

Choose Memory and CPU settings

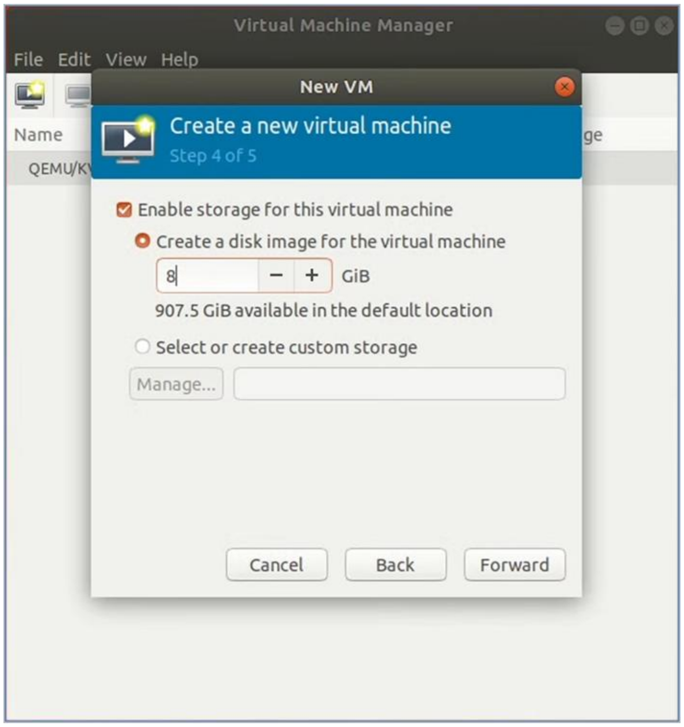
Memory (RAM): 8192

Up to 32057 MiB available on the host

CPUs: 4

Up to 8 available

Step 4. Create a disk of 8 GB (standard for all deployment sizes). Click Forward.



Create a new virtual machine
Step 4 of 5

☑ Enable storage for this virtual machine

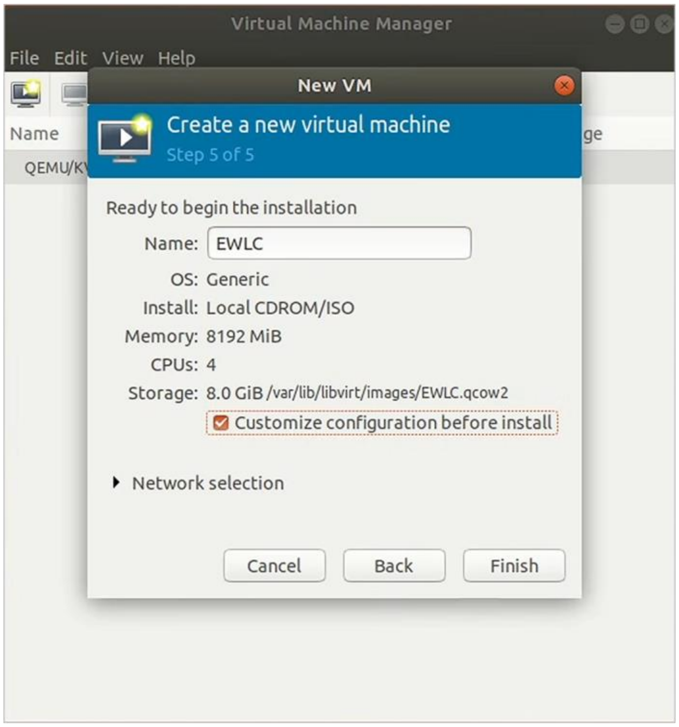
● Create a disk image for the virtual machine

8 GiB

907.5 GiB available in the default location

○ Select or create custom storage

Step 5. Provide a name for the VM and select **Customize configuration before install.** (Note: This setting is important.) Click Forward.



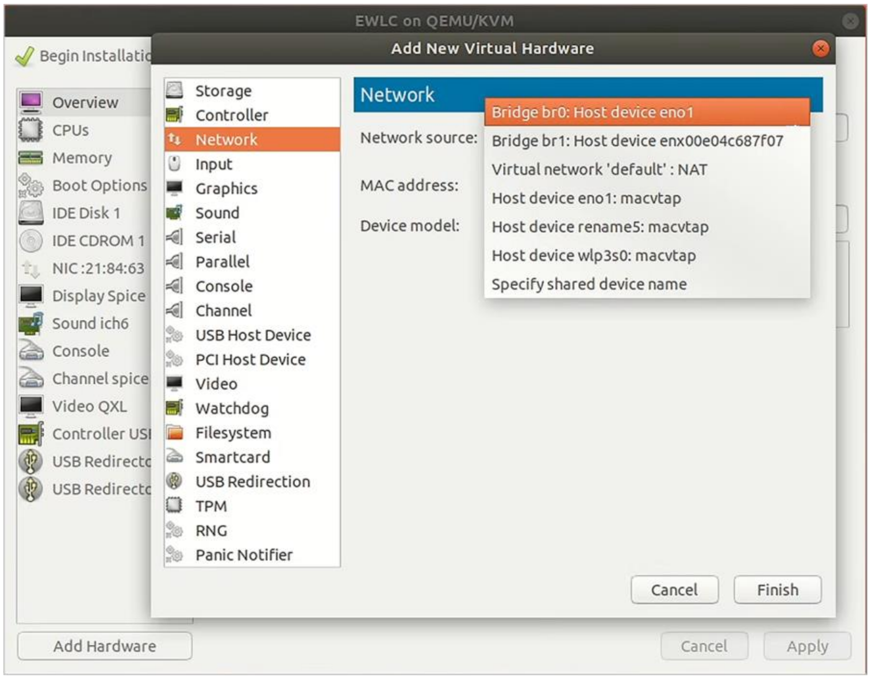
Create a new virtual machine
Step 5 of 5

Ready to begin the installation

Name: EWLC
OS: Generic
Install: Local CDROM/ISO
Memory: 8192 MiB
CPUs: 4
Storage: 8.0 GiB /var/lib/libvirt/images/EWLC.qcow2
☑ Customize configuration before install

The default is a single interface at the time of VM creation. This can be used as any of the functional virtual 9800-CL interfaces, for example, the wireless management interface. However, if an additional interface (or serial port) is needed, use the Add New Virtual Hardware tool.

Step 6. Go to Add New Virtual Hardware > Network interface. Map each of the vNICs to the target bridge interface defined in the Linux network configuration.

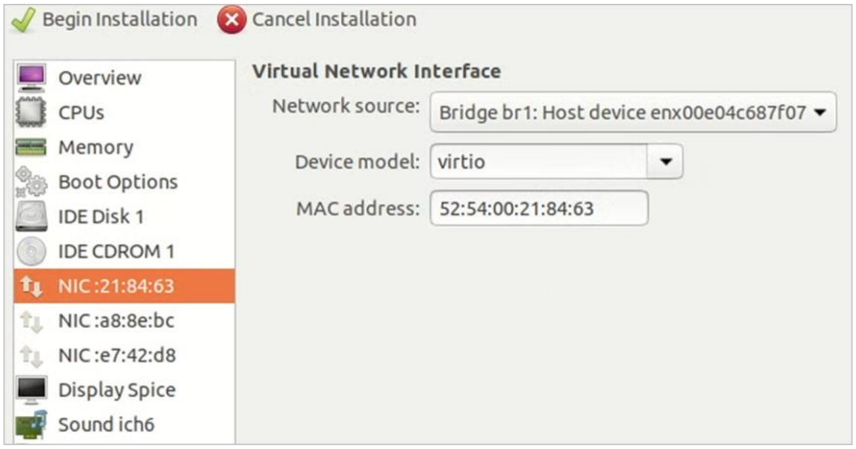


Network

Network source: Bridge br0: Host device eno1
MAC address:
Device model:

Bridge br0: Host device eno1
Bridge br1: Host device enx00e04c687f07
Virtual network 'default' : NAT
Host device eno1: macvtap
Host device rename5: macvtap
Host device wlp3s0: macvtap
Specify shared device name

Step 7. For each vNIC, set the Device model to virtio. Click Finish.



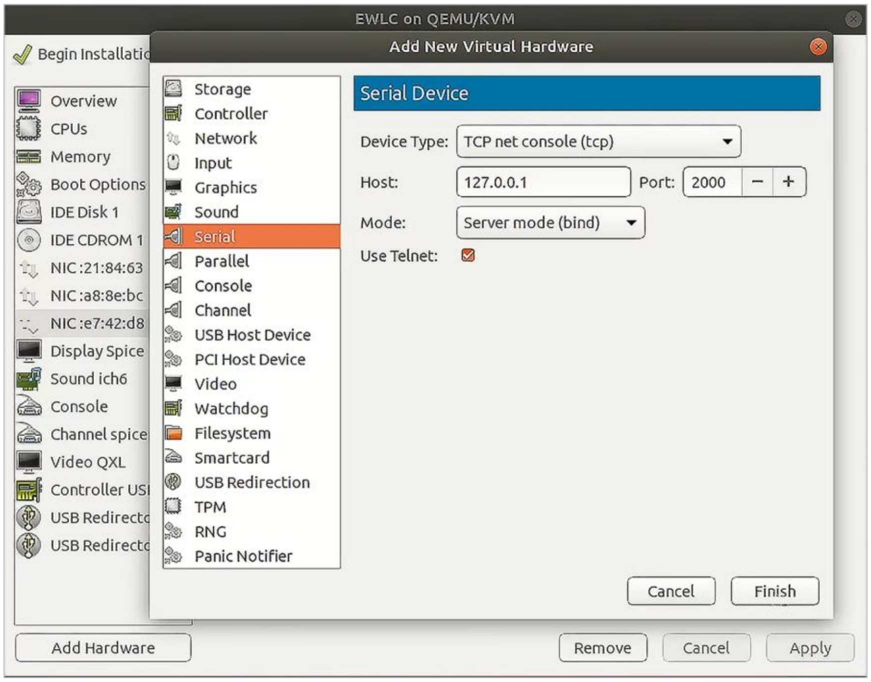
Virtual Network Interface

Network source: Bridge br1: Host device enx00e04c687f07

Device model: virtio

MAC address: 52:54:00:21:84:63

Step 8. A virtual serial console also exists for KVM. Simply add the virtual hardware, select Serial, Host = 127.0.0.1 (local host), and the port number (user-defined), and check Use Telnet. Click Finish.



Serial Device

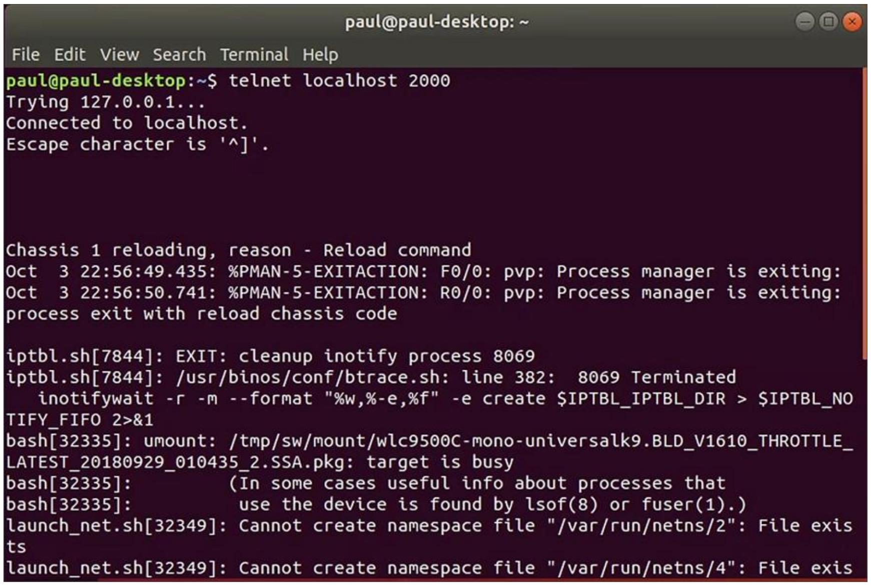
Device Type: TCP net console (tcp)

Host: 127.0.0.1 Port: 2000 − +

Mode: Server mode (bind)

Use Telnet: ☑

Below is an example of a console using Telnet to connect to the KVM hypervisor at a user-defined port.



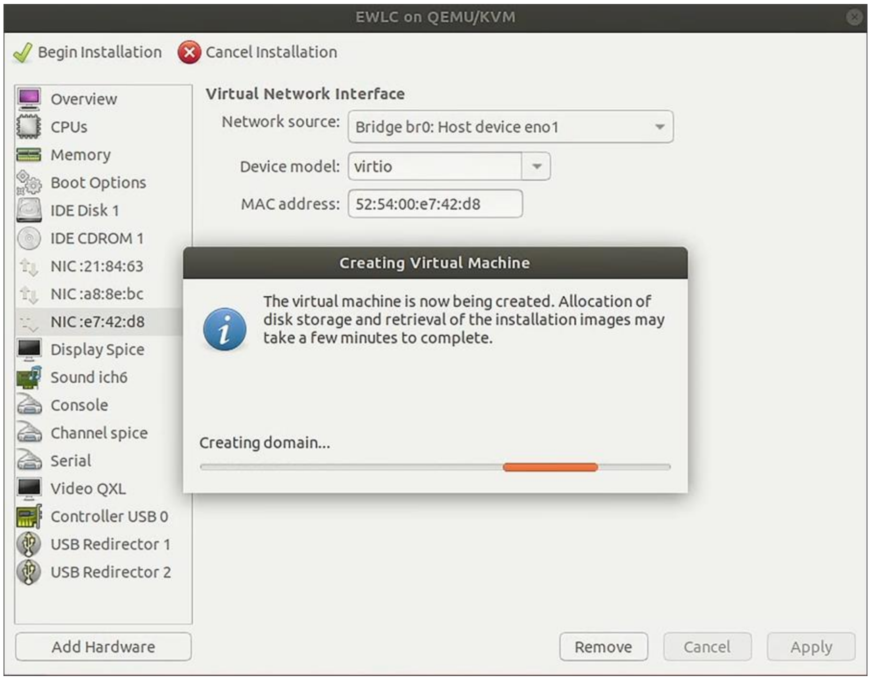
```
paul@paul-desktop:~$ telnet localhost 2000
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.




Chassis 1 reloading, reason - Reload command
Oct  3 22:56:49.435: %PMAN-5-EXITACTION: F0/0: pvp: Process manager is exiting:
Oct  3 22:56:50.741: %PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting:
process exit with reload chassis code

iptbl.sh[7844]: EXIT: cleanup inotify process 8069
iptbl.sh[7844]: /usr/binos/conf/btrace.sh: line 382:  8069 Terminated
   inotifywait -r -m --format "%w,%-e,%f" -e create $IPTBL_IPTBL_DIR > $IPTBL_NO
TIFY_FIFO 2>&1
bash[32335]: umount: /tmp/sw/mount/wlc9500C-mono-universalk9.BLD_V1610_THROTTLE_
LATEST_20180929_010435_2.SSA.pkg: target is busy
bash[32335]:         (In some cases useful info about processes that
bash[32335]:          use the device is found by lsof(8) or fuser(1).)
launch_net.sh[32349]: Cannot create namespace file "/var/run/netns/2": File exis
ts
launch_net.sh[32349]: Cannot create namespace file "/var/run/netns/4": File exis
```

Step 9. Next, click Begin Installation. The VM will boot and progress through the installation process.



Virtual Network Interface

Network source: Bridge br0: Host device eno1

Device model: virtio

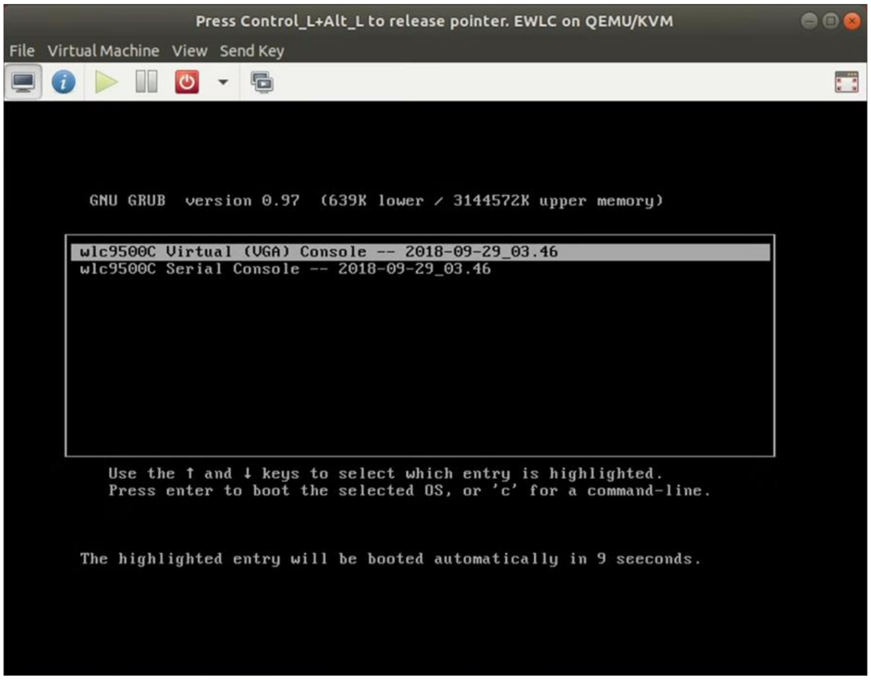
MAC address: 52:54:00:e7:42:d8

Creating Virtual Machine

The virtual machine is now being created. Allocation of disk storage and retrieval of the installation images may take a few minutes to complete.

Creating domain...

Step 10. Progress can be monitored through the KVM VM console.



```
    GNU GRUB  version 0.97  (639K lower / 3144572K upper memory)

  wlc9500C Virtual (VGA) Console -- 2018-09-29_03.46
  wlc9500C Serial Console -- 2018-09-29_03.46

      Use the ↑ and ↓ keys to select which entry is highlighted.
      Press enter to boot the selected OS, or 'c' for a command-line.

   The highlighted entry will be booted automatically in 9 seeconds.
```

Step 11. Go to the **Configuring the 9800-CL** section.

Deploying the 9800-CL on Microsoft Hyper-V

Starting with Cisco IOS XE Release 17.1.1, the virtual Cisco Catalyst 9800-CL Wireless Controller for Cloud can be deployed in Microsoft Hyper-V, using an ISO file (downloaded from the Cisco website). Hyper-V is supported on the following Windows installations:

- Windows Server 2016 or later – Standard, Enterprise, and Datacenter edition
- Hyper-V Manager – Version 10.0.14393 or later

This guide will not cover every aspect of Hyper-V and Windows components, only the general set of instructions needed to deploy a virtual wireless controller on Hyper-V.

For more information on getting started with Hyper-V, see https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/about/

Scale for the Virtual 9800-CL on Hyper-V

Table 6. Minimum virtual resource requirements for small, medium, and large configurations on Hyper-V

	Existing supported templates pre Cisco IOS XE Release 17.3		
Model configuration	**Small** **(Low throughput)**	**Medium** **(Low throughput)**	**Large** **(Low throughput)**
Minimum number of vCPUs	4	6	10

	Existing supported templates pre Cisco IOS XE Release 17.3		
Model configuration	**Small** **(Low throughput)**	**Medium** **(Low throughput)**	**Large** **(Low throughput)**
Minimum CPU allocation (MHz)	4000	6000	10,000
Minimum memory (GB)	8	16	32
Required storage (GB)	16	16	16
Virtual NICs (vNICs) **(*) Third NIC is for High Availability**	2/(3)*	2/(3)*	2/(3)*
Hyper-V vNIC	NETVSC	NETVSC	NETVSC
NIC virtualization	VMBus	VMBus	VMBus
Maximum access points	1000	3000	6000
Maximum clients supported	10,000	32,000	64,000

9800-CL file format options

Catalyst 9800-CL deployment image – Requires Cisco IOS XE Release 17.1.1 or higher

```
C9800-CL-universalk9.***.iso
```

Catalyst 9800-CL upgrade and patches (bin)

```
    C9800-CL-universalk9.***.bin
```

Bring up Hyper-V

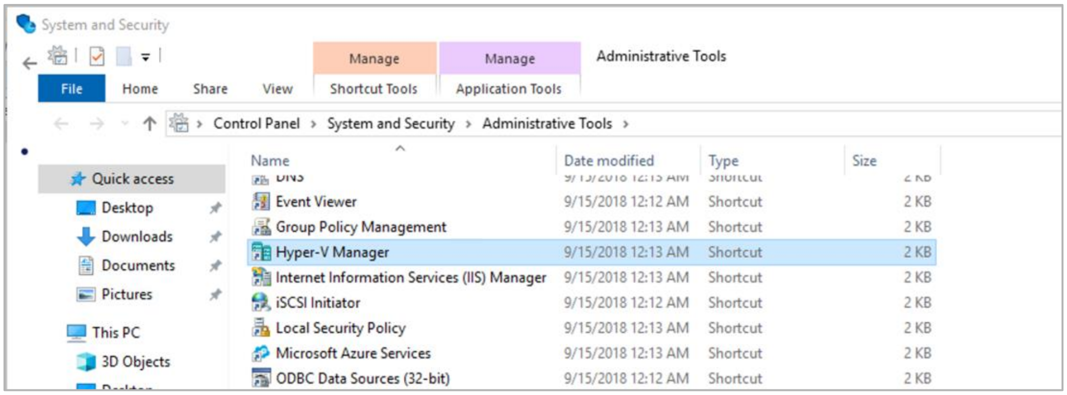
If Hyper-V is not already installed, follow the steps here to install it: https://docs.microsoft.com/en-us/windows-server/virtualization/hyper-v/hyper-v-on-windows-server

Hyper-V networking

Hyper-V supports mapping the physical network interfaces to a virtual switch. The virtual switch is used by the VM network adapter to send traffic to the rest of the network.

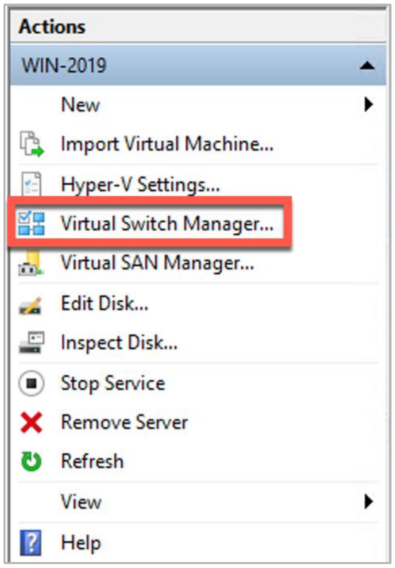
The easiest method to create the virtual switch is done using the Hyper-V Manager GUI tool.

Step 1. Open Hyper-V Manager by going to Control Panel > System & Security > Administrative Tools.

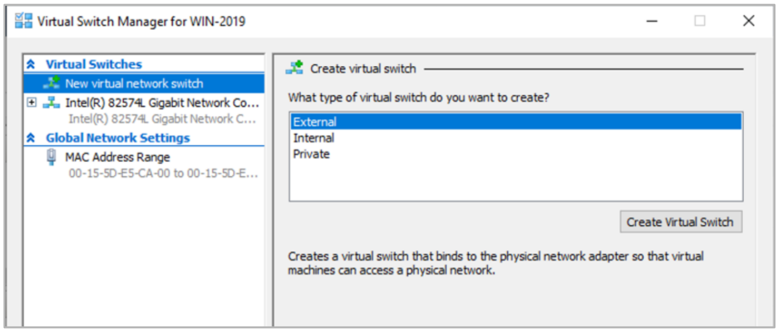


Name	Date modified	Type	Size
DNS	9/15/2018 12:13 AM	Shortcut	2 KB
Event Viewer	9/15/2018 12:12 AM	Shortcut	2 KB
Group Policy Management	9/15/2018 12:13 AM	Shortcut	2 KB
Hyper-V Manager	9/15/2018 12:13 AM	Shortcut	2 KB
Internet Information Services (IIS) Manager	9/15/2018 12:13 AM	Shortcut	2 KB
iSCSI Initiator	9/15/2018 12:12 AM	Shortcut	2 KB
Local Security Policy	9/15/2018 12:13 AM	Shortcut	2 KB
Microsoft Azure Services	9/15/2018 12:13 AM	Shortcut	2 KB
ODBC Data Sources (32-bit)	9/15/2018 12:12 AM	Shortcut	2 KB

Step 2. In the Actions pane, click **Virtual Switch Manager**.



Step 3. In the New virtual network switch section, select an **External** virtual switch. Click **Create Virtual Switch**.

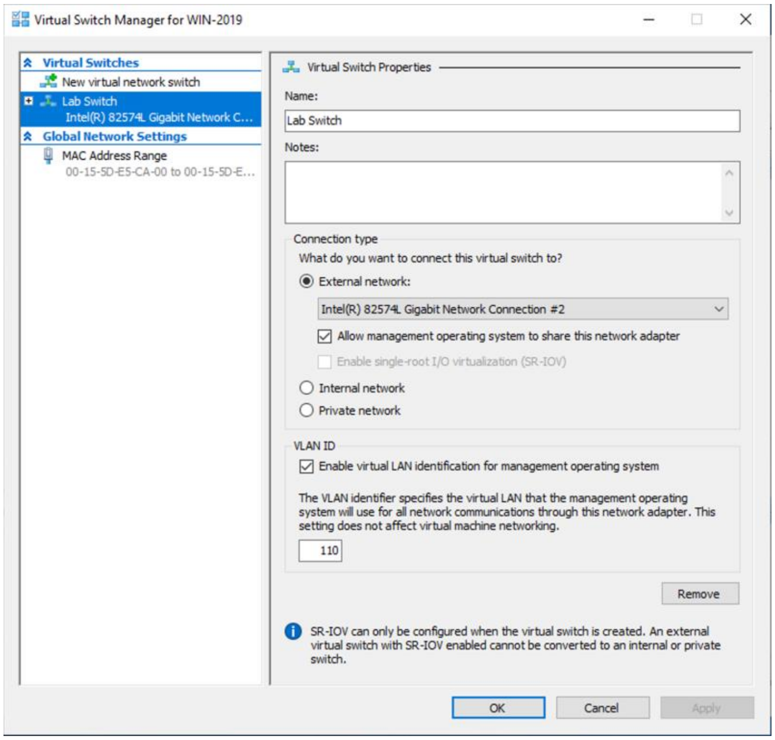

Virtual Switch Manager for WIN-2019
Virtual Switches
New virtual network switch
Intel(R) 82574L Gigabit Network Co...
Intel(R) 82574L Gigabit Network C...
Global Network Settings
MAC Address Range
00-15-5D-E5-CA-00 to 00-15-5D-E...
Create virtual switch
External
Internal
Private
Create Virtual Switch

What type of virtual switch do you want to create?

External

Creates a virtual switch that binds to the physical network adapter so that virtual machines can access a physical network.

Step 4. Set the name of the virtual switch. In the drop-down menu, select the physical NIC that will be connected to the virtual switch, and, if the Windows host uses the NIC to connect to the network, check **Allow management operating system to share this network adapter**. If the Windows host requires VLAN ID, check **Enable virtual LAN identification for management operating system** and enter the VLAN ID. Click Apply.



Virtual Switch Manager for WIN-2019

Virtual Switches
- New virtual network switch
- Lab Switch
  Intel(R) 82574L Gigabit Network C...

Global Network Settings
- MAC Address Range
  00-15-5D-E5-CA-00 to 00-15-5D-E...

Virtual Switch Properties

Name: Lab Switch

Notes:

Connection type

What do you want to connect this virtual switch to?

● External network:

Intel(R) 82574L Gigabit Network Connection #2

☑ Allow management operating system to share this network adapter

□ Enable single-root I/O virtualization (SR-IOV)

○ Internal network

○ Private network

VLAN ID

☑ Enable virtual LAN identification for management operating system

The VLAN identifier specifies the virtual LAN that the management operating system will use for all network communications through this network adapter. This setting does not affect virtual machine networking.

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Remove

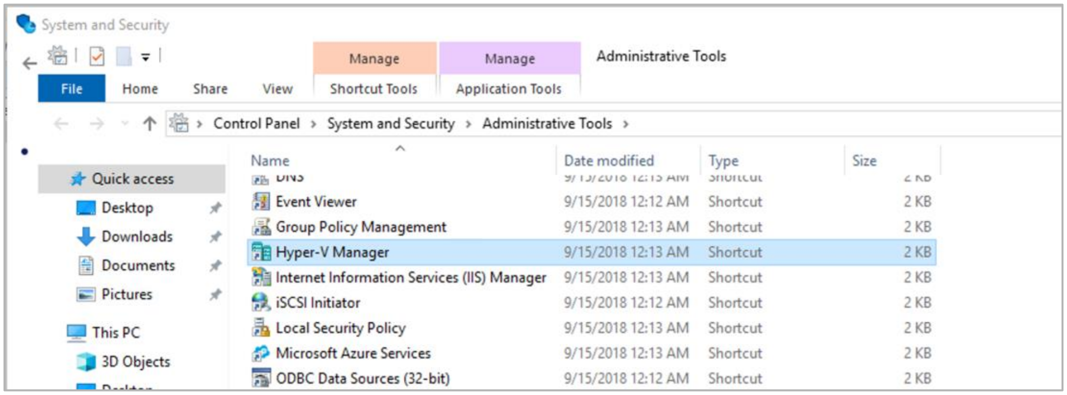
SR-IOV can only be configured when the virtual switch is created. An external virtual switch with SR-IOV enabled cannot be converted to an internal or private switch.

Step 5. Repeat steps 3 and 4 for any other physical NICs.

Creating the Catalyst 9800-CL VM using the Hyper-V Manager GUI tool

Download the ISO from Cisco for use with the Hyper-V Manager. This GUI tool is the easiest method for deploying the virtual 9800-CL wireless controller.

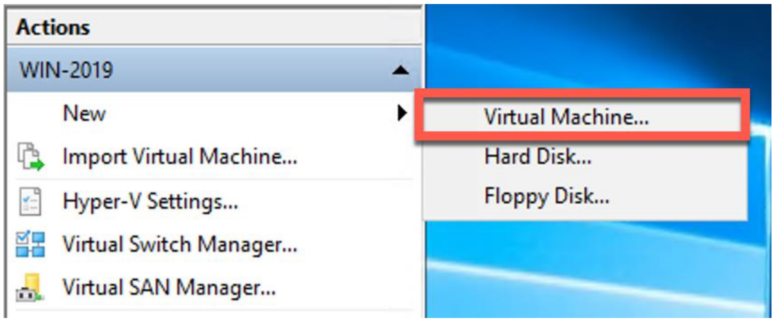
Step 1. Open Hyper-V Manager by going to **Control Panel > System & Security > Administrative Tools**.



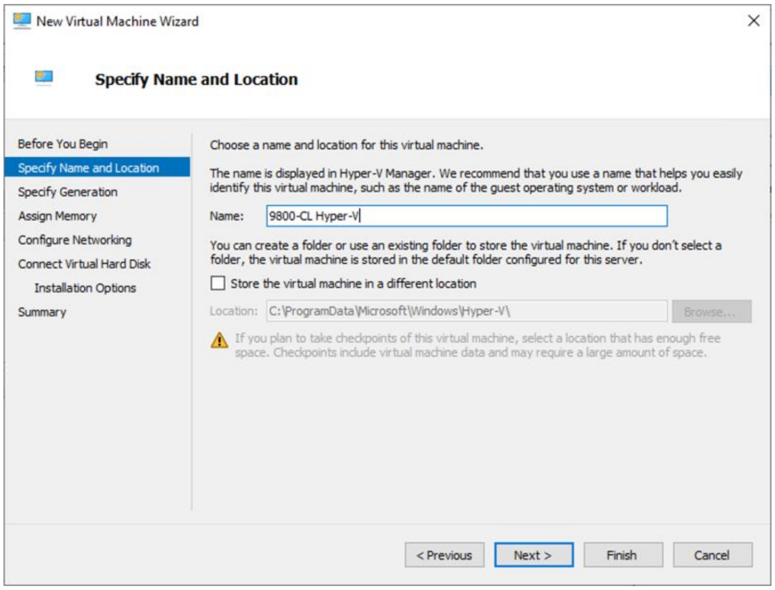
Control Panel > System and Security > Administrative Tools >

Name	Date modified	Type	Size
DNS	9/15/2018 12:13 AM	Shortcut	2 KB
Event Viewer	9/15/2018 12:12 AM	Shortcut	2 KB
Group Policy Management	9/15/2018 12:13 AM	Shortcut	2 KB
Hyper-V Manager	9/15/2018 12:13 AM	Shortcut	2 KB
Internet Information Services (IIS) Manager	9/15/2018 12:13 AM	Shortcut	2 KB
iSCSI Initiator	9/15/2018 12:12 AM	Shortcut	2 KB
Local Security Policy	9/15/2018 12:13 AM	Shortcut	2 KB
Microsoft Azure Services	9/15/2018 12:13 AM	Shortcut	2 KB
ODBC Data Sources (32-bit)	9/15/2018 12:12 AM	Shortcut	2 KB

Step 2. In the Actions pane, click **New > Virtual Machine**.



Step 3. Provide a name for the VM and specify a location to store it. Click **Next**.



Choose a name and location for this virtual machine.

The name is displayed in Hyper-V Manager. We recommend that you use a name that helps you easily identify this virtual machine, such as the name of the guest operating system or workload.

Name: 9800-CL Hyper-V

You can create a folder or use an existing folder to store the virtual machine. If you don't select a folder, the virtual machine is stored in the default folder configured for this server.

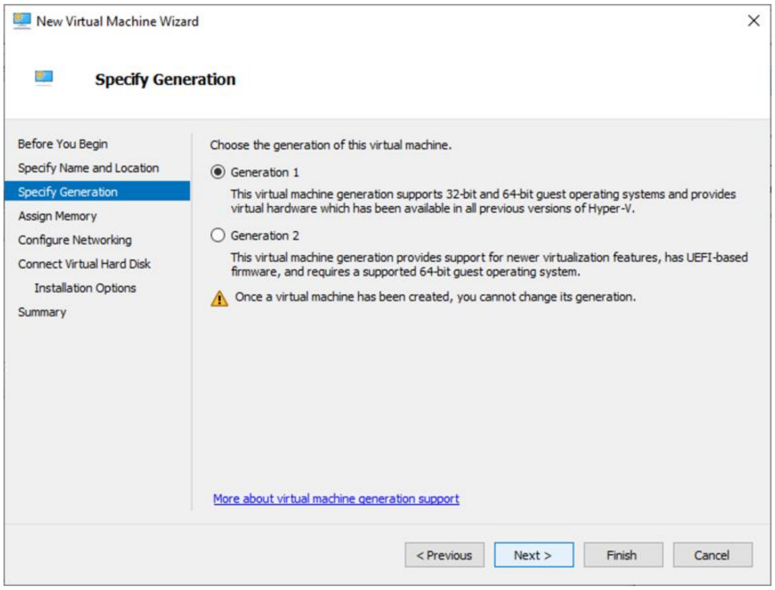
□ Store the virtual machine in a different location

Location: C:\ProgramData\Microsoft\Windows\Hyper-V\

If you plan to take checkpoints of this virtual machine, select a location that has enough free space. Checkpoints include virtual machine data and may require a large amount of space.

Step 4. Specify either generation of the VM. This can be either Generation 1 or Generation 2. Click **Next.**

Note: The generation cannot be changed after the VM has been created.



Choose the generation of this virtual machine.

● Generation 1

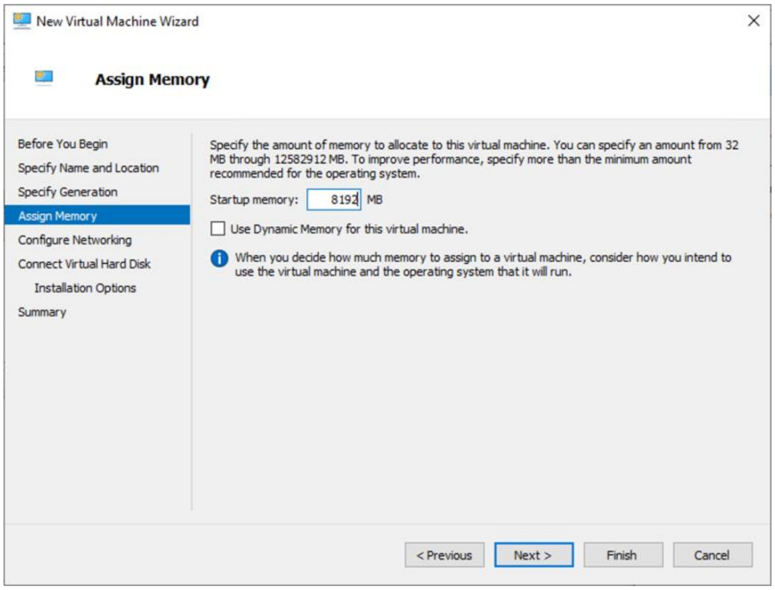
This virtual machine generation supports 32-bit and 64-bit guest operating systems and provides virtual hardware which has been available in all previous versions of Hyper-V.

○ Generation 2

This virtual machine generation provides support for newer virtualization features, has UEFI-based firmware, and requires a supported 64-bit guest operating system.

Once a virtual machine has been created, you cannot change its generation.

Step 5. Set the memory requirements of the VM based on the AP and client scale in Table 6. The example below is for small deployments with 1000 APs and 6000 clients. Click **Next.**



New Virtual Machine Wizard

Assign Memory

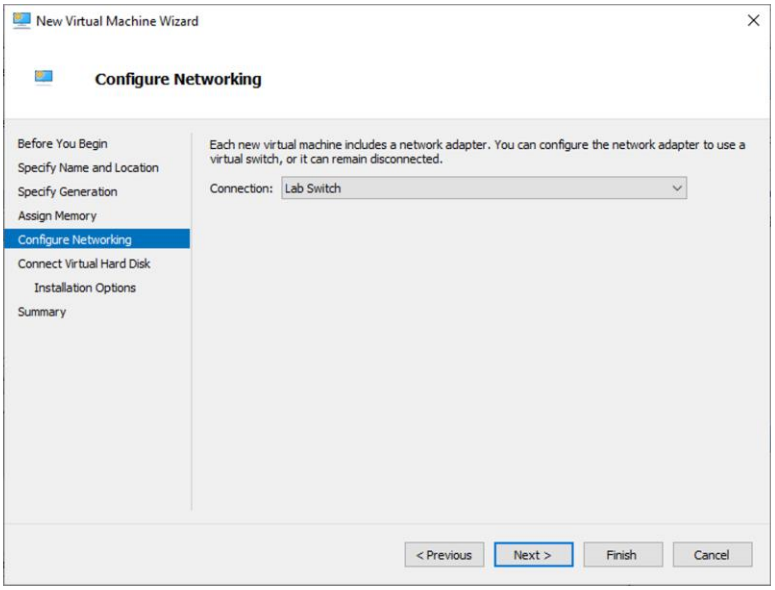
Specify the amount of memory to allocate to this virtual machine. You can specify an amount from 32 MB through 12582912 MB. To improve performance, specify more than the minimum amount recommended for the operating system.

Startup memory: 8192 MB

□ Use Dynamic Memory for this virtual machine.

When you decide how much memory to assign to a virtual machine, consider how you intend to use the virtual machine and the operating system that it will run.

Step 6. Specify the network connection for the included network adapter, or this can be done later. This network adapter will correspond to **GigabitEthernet1** within the 9800-CL VM.



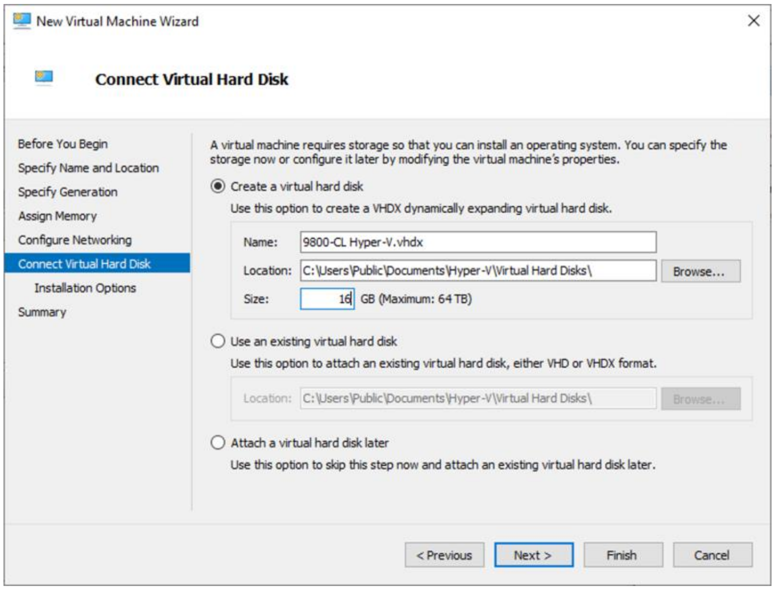
New Virtual Machine Wizard

Configure Networking

Each new virtual machine includes a network adapter. You can configure the network adapter to use a virtual switch, or it can remain disconnected.

Connection: Lab Switch

Step 7. Create a new virtual disk with a size of 16 GB (standard for all deployment sizes). Click **Next.**



New Virtual Machine Wizard

Connect Virtual Hard Disk

A virtual machine requires storage so that you can install an operating system. You can specify the storage now or configure it later by modifying the virtual machine's properties.

● Create a virtual hard disk

Use this option to create a VHDX dynamically expanding virtual hard disk.

Name: 9800-CL Hyper-V.vhdx

Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\ Browse...

Size: 16 GB (Maximum: 64 TB)

○ Use an existing virtual hard disk

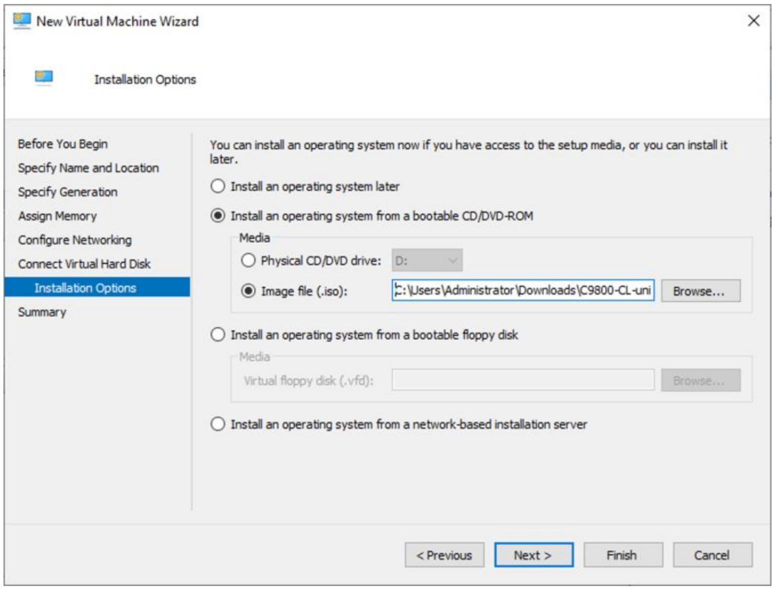
Use this option to attach an existing virtual hard disk, either VHD or VHDX format.

Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\ Browse...

○ Attach a virtual hard disk later

Use this option to skip this step now and attach an existing virtual hard disk later.

Step 8. To boot from the ISO file for the 9800-CL, select **Install an operating system from a bootable CD/DVD-ROM** and enter the location for the required ISO file of the 9800-CL image.



New Virtual Machine Wizard

Installation Options

You can install an operating system now if you have access to the setup media, or you can install it later.

○ Install an operating system later

● Install an operating system from a bootable CD/DVD-ROM

Media

○ Physical CD/DVD drive: D:

● Image file (.iso): C:\Users\Administrator\Downloads\C9800-CL-uni Browse...

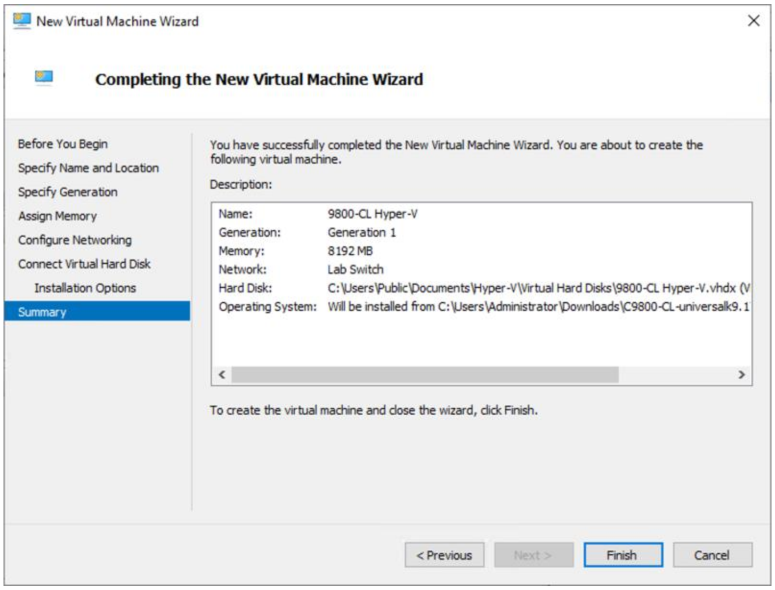
○ Install an operating system from a bootable floppy disk

Media

Virtual floppy disk (.vfd): Browse...

○ Install an operating system from a network-based installation server

Step 9. Click **Finish** to complete the VM creation.



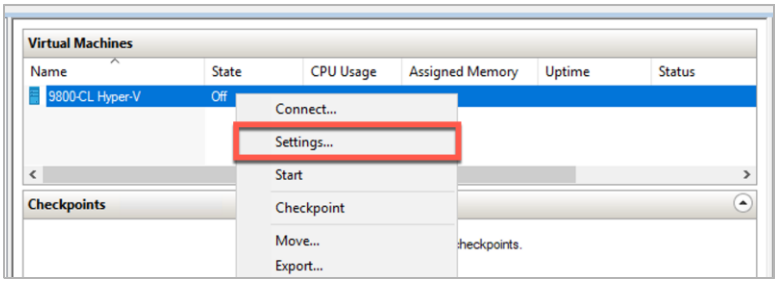
You have successfully completed the New Virtual Machine Wizard. You are about to create the following virtual machine.

Description:

```
Name:              9800-CL Hyper-V
Generation:        Generation 1
Memory:            8192 MB
Network:           Lab Switch
Hard Disk:         C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\9800-CL Hyper-V.vhdx (V
Operating System:  Will be installed from C:\Users\Administrator\Downloads\C9800-CL-universalk9.1
```

To create the virtual machine and close the wizard, click Finish.

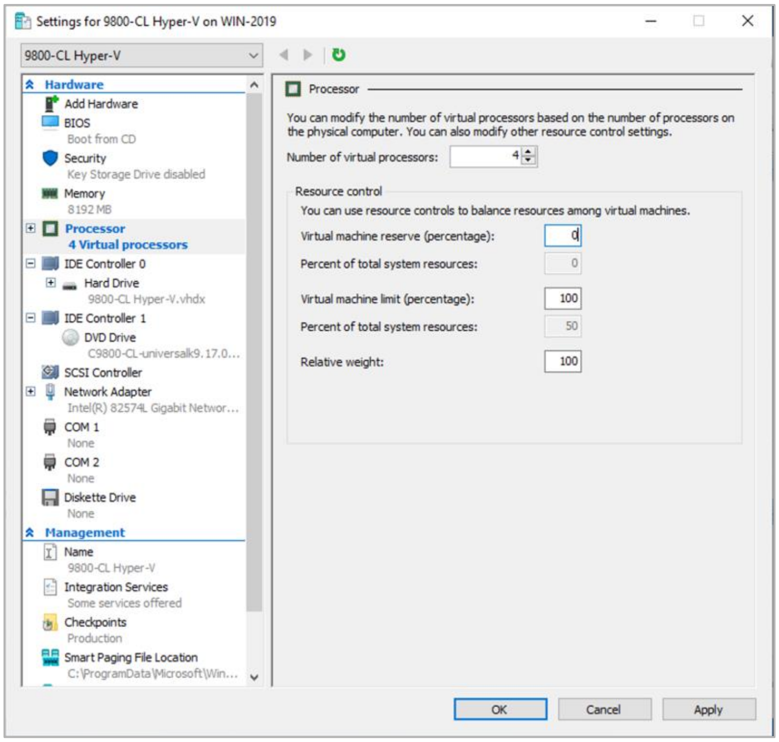
Step 10. Navigate to the settings page for the VM. Right-click the 9800-CL VM and select settings.



Name	State	CPU Usage	Assigned Memory	Uptime	Status
9800-CL Hyper-V	Off				

heckpoints.

Step 11. Go to the Processor section. Set the number of processors based on the AP and client scale in Table 6. The example below shows four virtual processors for a small deployment with 1000 APs and 6000 clients.



Settings for 9800-CL Hyper-V on WIN-2019

9800-CL Hyper-V

Processor

You can modify the number of virtual processors based on the number of processors on the physical computer. You can also modify other resource control settings.

Number of virtual processors: 4

Resource control

You can use resource controls to balance resources among virtual machines.

Virtual machine reserve (percentage): 0

Percent of total system resources: 0

Virtual machine limit (percentage): 100

Percent of total system resources: 50

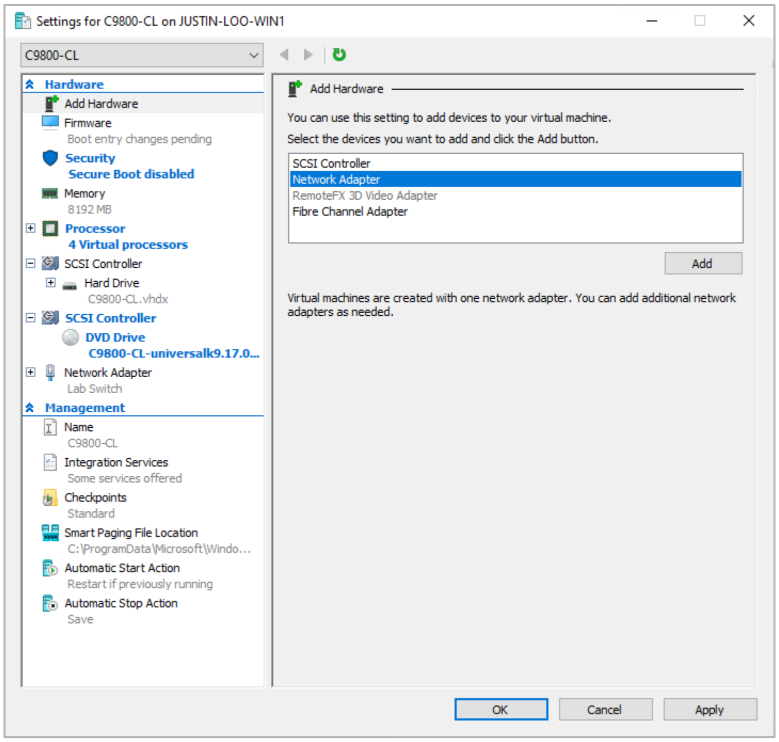
Relative weight: 100

Step 12. The default is a single network adapter at the time of VM creation. This can be used as any of the functional virtual 9800-CL interfaces, such as the wireless management interface.

However, if additional adapters are required, you will need to use either PowerShell or the Hyper-V GUI, depending on whether the traffic for the network adapters will be tagged or untagged or trunked. These options are described below.

The network adapter will have traffic that is untagged or tagged with a single VLAN ID (GigabitEthernet1 and GigabitEthernet3):

Go to Add Hardware and select **Network Adapter**. Click **Add**.



Settings for C9800-CL on JUSTIN-LOO-WIN1

C9800-CL

Hardware
- Add Hardware
- Firmware
  Boot entry changes pending
- **Security**
  Secure Boot disabled
- Memory
  8192 MB
- **Processor**
  4 Virtual processors
- SCSI Controller
  - Hard Drive
    C9800-CL.vhdx
- **SCSI Controller**
  - **DVD Drive**
    C9800-CL-universalk9.17.0...
- Network Adapter
  Lab Switch

Management
- Name
  C9800-CL
- Integration Services
  Some services offered
- Checkpoints
  Standard
- Smart Paging File Location
  C:\ProgramData\Microsoft\Windo...
- Automatic Start Action
  Restart if previously running
- Automatic Stop Action
  Save

Add Hardware

You can use this setting to add devices to your virtual machine.

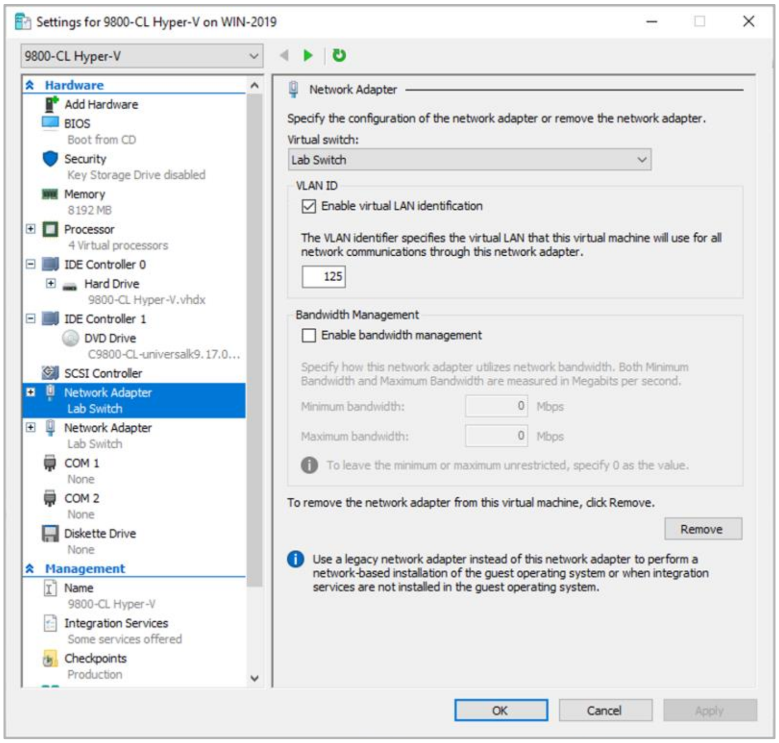
Select the devices you want to add and click the Add button.

SCSI Controller
Network Adapter
RemoteFX 3D Video Adapter
Fibre Channel Adapter

Virtual machines are created with one network adapter. You can add additional network adapters as needed.

Repeat for any additional network adapters.

For each network adapter, go to the required Network Adapter section. Select the required **Virtual switch.** If VLAN tagging is required, check **Enable virtual LAN identification** and enter the required **VLAN ID.** Click **OK.**



Settings for 9800-CL Hyper-V on WIN-2019

9800-CL Hyper-V

Hardware
- Add Hardware
- BIOS
  Boot from CD
- Security
  Key Storage Drive disabled
- Memory
  8192 MB
- Processor
  4 Virtual processors
- IDE Controller 0
  - Hard Drive
    9800-CL Hyper-V.vhdx
- IDE Controller 1
  - DVD Drive
    C9800-CL-universalk9.17.0...
- SCSI Controller
- Network Adapter
  Lab Switch
- Network Adapter
  Lab Switch
- COM 1
  None
- COM 2
  None
- Diskette Drive
  None

Management
- Name
  9800-CL Hyper-V
- Integration Services
  Some services offered
- Checkpoints
  Production

Network Adapter

Specify the configuration of the network adapter or remove the network adapter.

Virtual switch:
Lab Switch

VLAN ID
☑ Enable virtual LAN identification

The VLAN identifier specifies the virtual LAN that this virtual machine will use for all network communications through this network adapter.

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Bandwidth Management
☐ Enable bandwidth management

Specify how this network adapter utilizes network bandwidth. Both Minimum Bandwidth and Maximum Bandwidth are measured in Megabits per second.

Minimum bandwidth: 0 Mbps

Maximum bandwidth: 0 Mbps

To leave the minimum or maximum unrestricted, specify 0 as the value.

To remove the network adapter from this virtual machine, click Remove.

Use a legacy network adapter instead of this network adapter to perform a network-based installation of the guest operating system or when integration services are not installed in the guest operating system.

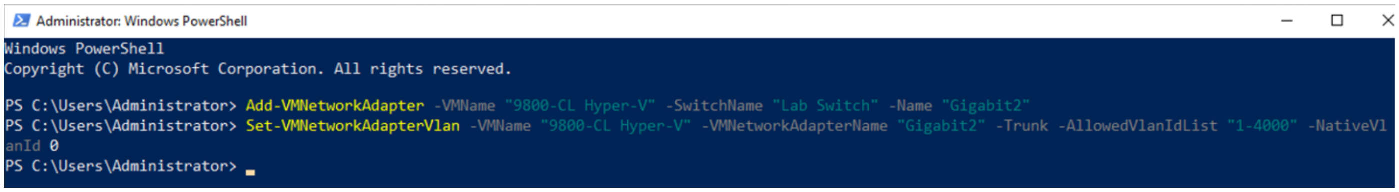
The network adapter needs to be configured as a trunk port (normally for GigabitEthernet2):

Open the PowerShell application as administrator.

Enter the following commands:

```
Add-VMNetworkAdapter -VMName <VM Name> -SwitchName <Virtual Switch Name> Name <Network
Adapter Name>

Set-VMNetworkAdapterVlan -VMName <VM Name> -VMNetworkAdapterName <Network Adapter Name> -
Trunk -AllowedVlanIdList <VLAN Range> -NativeVlanId <VLAN ID>
```

Example: Creating the network adapter for GigabitEthernet2 on the 9800-CL. It is configured as a trunk port with a native VLAN ID of 0 that allows traffic with VLAN IDs between 1 and 4000.

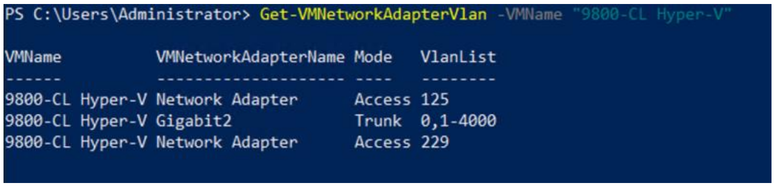


```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\Administrator> Add-VMNetworkAdapter -VMName "9800-CL Hyper-V" -SwitchName "Lab Switch" -Name "Gigabit2"
PS C:\Users\Administrator> Set-VMNetworkAdapterVlan -VMName "9800-CL Hyper-V" -VMNetworkAdapterName "Gigabit2" -Trunk -AllowedVlanIdList "1-4000" -NativeVl
anId 0
PS C:\Users\Administrator> _
```

To verify the VLAN settings for the VM adapters, type the command:

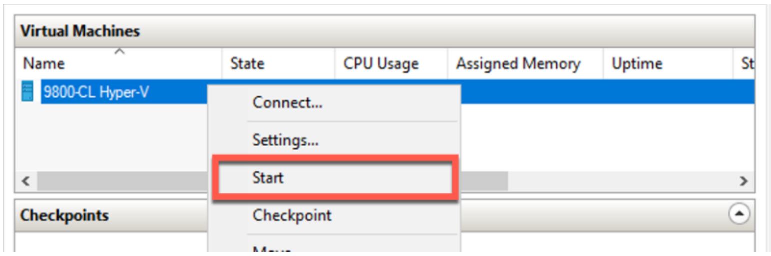
```
Get-VMNetworkAdapterVlan -VMName <VM Name>
```

Example:

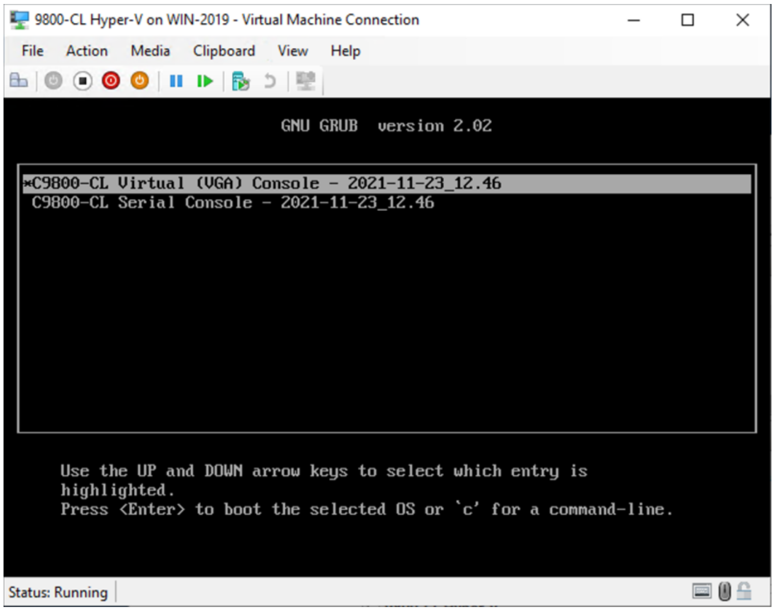


```
PS C:\Users\Administrator> Get-VMNetworkAdapterVlan -VMName "9800-CL Hyper-V"

VMName          VMNetworkAdapterName Mode   VlanList
------          -------------------- ----   --------
9800-CL Hyper-V Network Adapter      Access 125
9800-CL Hyper-V Gigabit2             Trunk  0,1-4000
9800-CL Hyper-V Network Adapter      Access 229
```

Step 13. Start the 9800-CL VM by right clicking the VM and selecting **Start**.



Step 14. The installation progress can be monitored through the Hyper-V console.



```
GNU GRUB  version 2.02

*C9800-CL Virtual (VGA) Console - 2021-11-23_12.46
 C9800-CL Serial Console - 2021-11-23_12.46

   Use the UP and DOWN arrow keys to select which entry is
   highlighted.
   Press <Enter> to boot the selected OS or `c' for a command-line.
```

Step 15. Go to the **Configuring the 9800-CL** section.

Creating the Catalyst 9800-CL VM in Hyper-V with the CLI using PowerShell

In addition to the Hyper-V Manager GUI, the 9800-CL can be deployed using PowerShell. This can help in automating the deployment process of 9800-CL VMs.

Step 1. Open a PowerShell window as **Administrator**.

Step 2. Create the VM using the following command:

```
New-VM -Name <VMName> -Path <VMPath> -MemoryStartupBytes <Startup Memory> -NewVHDPath <VHD
Path> -NewVHDSizeBytes <VHD(X) size> -SwitchName <VM Switch Name> -Generation <VM Gen (1 or
2)>
```

Example:

```
PS C:\Windows\system32> New-VM -Name C9800-CL-CLI -Path
"C:\ProgramData\Microsoft\Windows\Hyper-V\Virtual Machines" -MemoryStartupBytes 8GB -
NewVHDPath "C:\Users\Public\Documents\Hyper-V\Virtual hard disks\C9800-CL-CLI.vhdx" -
NewVHDSizeBytes 17179869184 -SwitchName "Lab Switch" -Generation 1


Name         State CPUUsage(%) MemoryAssigned(M) Uptime   Status             Version
----         ----- ----------- ----------------- ------   ------             -------
C9800-CL-CLI Off   0           0                 00:00:00 Operating normally 9.0
```

Step 3. Set the number of processors required for the VM deployment.

```
Set-VM -Name <VMName> -ProcessorCount <Number of Processors>
```

Example:

```
PS C:\Windows\system32> Set-VM -Name C9800-CL-CLI -ProcessorCount 4
PS C:\Windows\system32>
```

Step 4. Map the virtual DVD drive to the ISO image path.

```
Set-VMDvdDrive -VMName <VMName> -Path <ISO Image Path>
```

Example:

```
PS C:\Windows\system32> Set-VMDvdDrive -VMName C9800-CL-CLI -Path
"C:\Users\netadmin\Downloads\C9800-CL-universalk9.17.06.02.iso"

PS C:\Windows\system32>
```

Step 5. If needed, create additional network interfaces.

```
Add-VMNetworkAdapter -VMName <VM Name> -SwitchName <Virtual Switch Name> Name <Network
Adapter Name>
```

If the interface needs to be tagged with a single VLAN ID, enter the following command to set the interface as an access port with traffic tagged with the configured VLAN.

```
Set-VMNetworkAdapterVlan -VMName <VM Name> -Access -VlanId <VLAN ID>
```

Example:

Create access port

```
PS C:\Windows\system32> Set-VMNetworkAdapterVlan -VMName C9800-CL-CLI -VMNetworkAdapterName
"Network Adapter" -Access -VlanID 125
```

If the interface needs to be configured as a trunk port, enter the following command:

```
Set-VMNetworkAdapterVlan -VMName <VM Name> -VMNetworkAdapterName <Network Adapter Name> -
Trunk -AllowedVlanIdList <VLAN Range> -NativeVlanId <VLAN ID>
```

Example:

```
PS C:\Windows\system32> Add-VMNetworkAdapter -VMName C9800-CL-CLI -SwitchName "Lab Switch"
-Name "Gigabit2"

PS C:\Windows\system32> Set-VMNetworkAdapterVlan -VMName C9800-CL-CLI -VMNetworkAdapterName
"Gigabit2" -Trunk -AllowedVlanIdList "1-4000" -NativeVlanID 0

PS C:\Windows\system32> Get-VMNetworkAdapterVlan -VMName C9800-CL-CLI

VMName       VMNetworkAdapterName Mode   VlanList

------       -------------------- ----   --------

C9800-CL-CLI Network Adapter      Access 125

C9800-CL-CLI Gigabit2             Trunk  0,1-4000
```

To verify the interfaces, enter the following command:

```
Get-VMNetworkAdapterVlan -VMName <VM Name>
```

Example:

```
PS C:\Windows\system32> Get-VMNetworkAdapterVlan -VMName C9800-CL-CLI

VMName       VMNetworkAdapterName Mode   VlanList

------       -------------------- ----   --------

C9800-CL-CLI Network Adapter      Access 125

C9800-CL-CLI Gigabit2             Trunk  0,1-4000
```

Step 6. Start the 9800-CL VM.

```
Start-VM <VM Name>
```

Example:

```
PS C:\Windows\system32> Start-VM C9800-CL-CLI

PS C:\Windows\system32> Get-VM

Name          State   CPUUsage(%) MemoryAssigned(M) Uptime           Status
Version

----          -----   ----------- ----------------- ------           ------             ----
---

C9800-CL-CLI Running 16          8192              00:00:12.7660000 Operating normally 9.0
```

Step 7. Go to the **Configuring the 9800-CL** section.

Deploying the 9800-CL on the Cisco ENCS NFVIS platform

Overview of Cisco NFVIS software

Cisco Enterprise Network Function Virtualization Infrastructure Software (NFVIS) is Linux-based infrastructure software designed to help service providers and enterprises dynamically deploy virtualized network functions, such as a virtual router, firewall, and WAN acceleration, on a supported Cisco device. The addition of a physical device for every network function is not required; automated provisioning and centralized management can be used.

The Cisco Enterprise NFVIS solution helps convert critical network functions into software, making it possible to deploy network services in minutes across dispersed locations. It provides a fully integrated platform that can run on top of a diverse network of both virtual and physical devices.

The Cisco 5400 Enterprise Network Compute System (ENCS) combines routing, switching, storage, processing, and a host of other computing and networking activities into a compact 1-Rack-Unit (1RU) box. This high-performance unit achieves this goal by providing the infrastructure to deploy virtualized network functions and acting as a server that addresses processing, workload, and storage challenges.

The virtual Catalyst 9800-CL Wireless Controller for Cloud can be deployed on a Cisco ENCS NFVIS platform using an ISO file or tar.gz (download from the Cisco website).

The NFVIS software version should be higher than 3.8. If the NFVIS software version is lower than 3.8, it should be upgraded to any version higher than 3.8. To upgrade the NFVIS software, refer to the "Upgrading Cisco NFVIS" section in the following document:

https://www.cisco.com/c/en/us/td/docs/routers/nfvis/config/3-10-1/nfvis-config-guide-3-10-1.html

Scale for the virtual 9800-CL on Cisco ENCS NFVIS

The virtual Catalyst 9800-CL Wireless Controller for Cloud on the ENCS NFVIS platform supports:

- 1000 access points
- 10,000 wireless clients

It needs four CPUs, 8 GB of RAM, 8 GB of storage space, and three vNICs. (The third vNIC is for HA/SSO.)

Note: Other sizes (medium and large) for the 9800-CL are not supported on the Cisco ENCS NFVIS platform.

Installation procedure

Log in to the WebUI of NFVIS with the username (admin) and the password that was set up.

Uploading the image on NFVIS

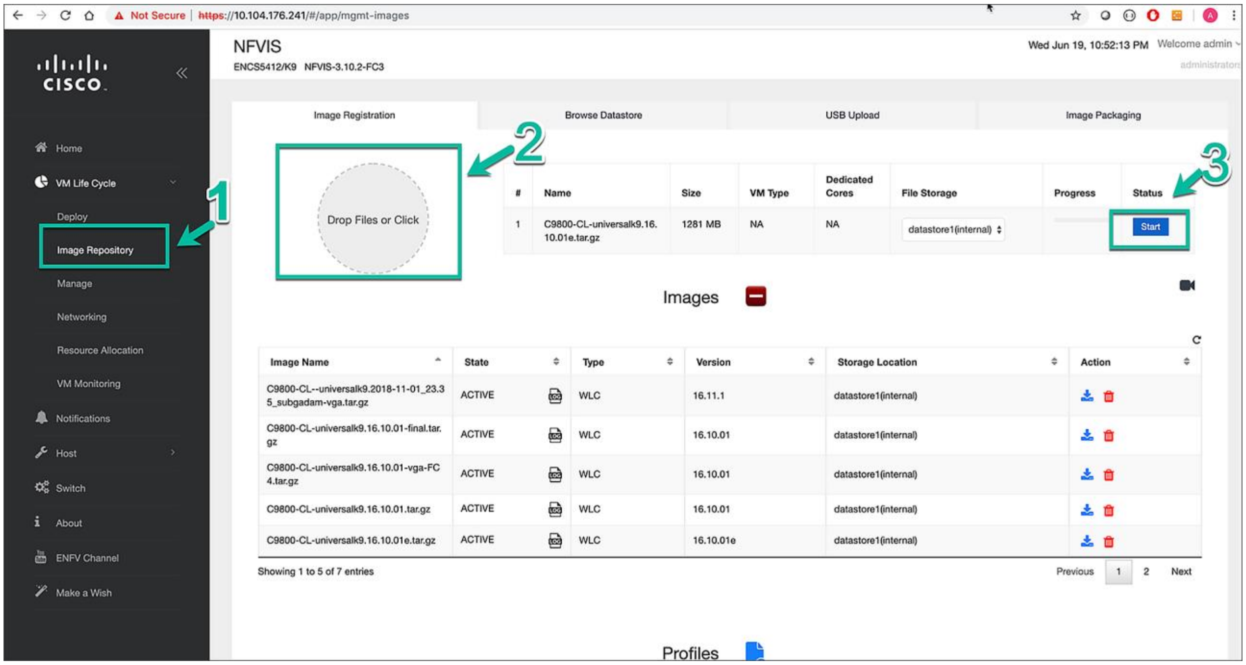
Follow the procedure below to upload an image to NFVIS (a screenshot highlighting the procedure described is given below for reference).

Step 1. Select **VM Life Cycle > Image Repository**.

Step 2. Select the **Image Registration** tab, click **Drop Files or Click**, and select the 9800-CL virtual image file for NFVIS from a local machine to be uploaded (for example, C9800-CL-universalk9.16.10.01e.tar.gz).

Step 3. Click **Start** to upload the image.

After the image is uploaded, NFVIS creates respective profiles and registers the image. The file can be found listed in the Images section on the same page.



#	Name	Size	VM Type	Dedicated Cores	File Storage	Progress	Status
1	C9800-CL-universalk9.16.10.01e.tar.gz	1281 MB	NA	NA	datastore1(internal)		Start

Image Name	State	Type	Version	Storage Location	Action
C9800-CL--universalk9.2018-11-01_23.35_subgadam-vga.tar.gz	ACTIVE	WLC	16.11.1	datastore1(internal)	
C9800-CL-universalk9.16.10.01-final.tar.gz	ACTIVE	WLC	16.10.01	datastore1(internal)	
C9800-CL-universalk9.16.10.01-vga-FC4.tar.gz	ACTIVE	WLC	16.10.01	datastore1(internal)	
C9800-CL-universalk9.16.10.01.tar.gz	ACTIVE	WLC	16.10.01	datastore1(internal)	
C9800-CL-universalk9.16.10.01e.tar.gz	ACTIVE	WLC	16.10.01e	datastore1(internal)	

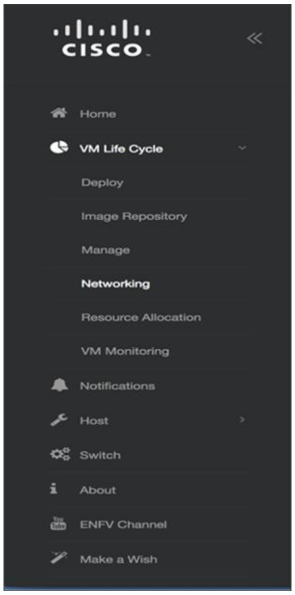
Showing 1 to 5 of 7 entries

Previous 1 2 Next

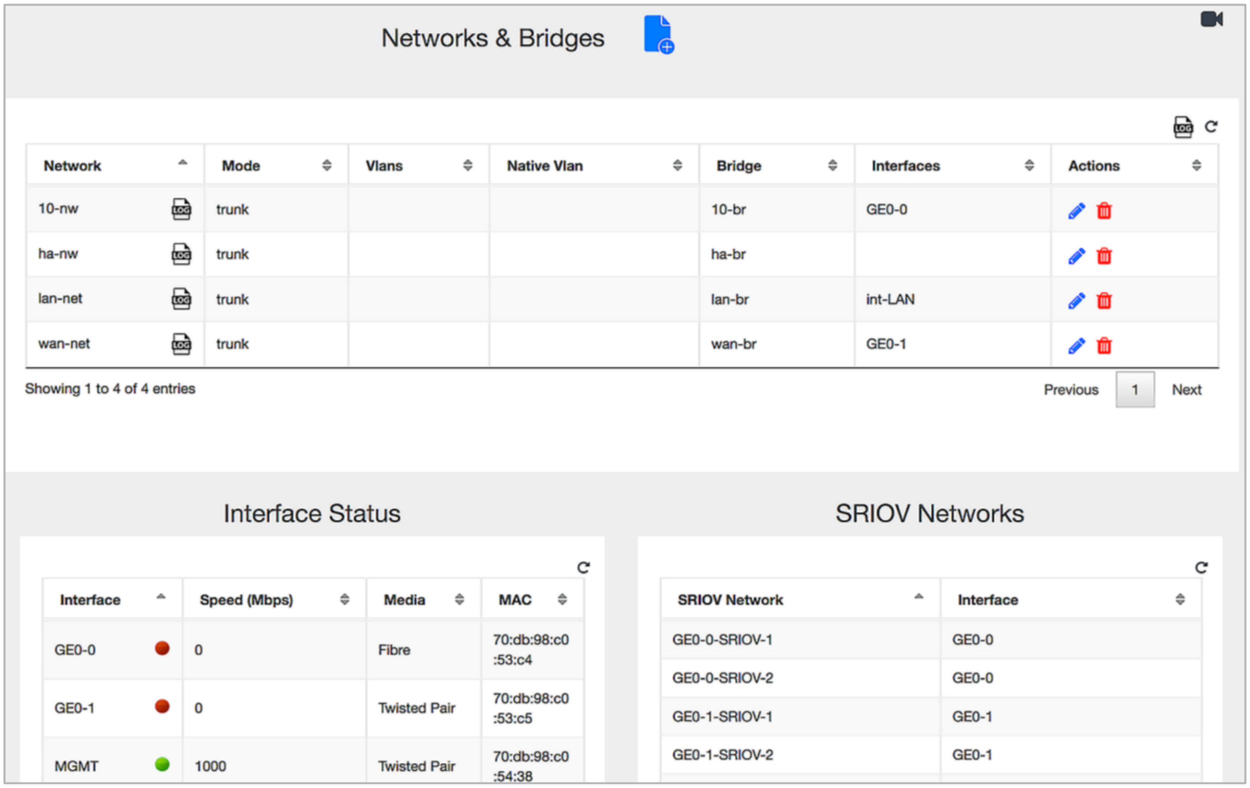
Creating a network

Follow the procedure below to create a network.

Step 1. Select **VM Life Cycle > Networking**.



Step 2. Click the **+ (Create) icon** next to Networks & Bridges.



Networks & Bridges

Network	Mode	Vlans	Native Vlan	Bridge	Interfaces	Actions
10-nw	trunk			10-br	GE0-0	✎ 🗑
ha-nw	trunk			ha-br		✎ 🗑
lan-net	trunk			lan-br	int-LAN	✎ 🗑
wan-net	trunk			wan-br	GE0-1	✎ 🗑

Showing 1 to 4 of 4 entries

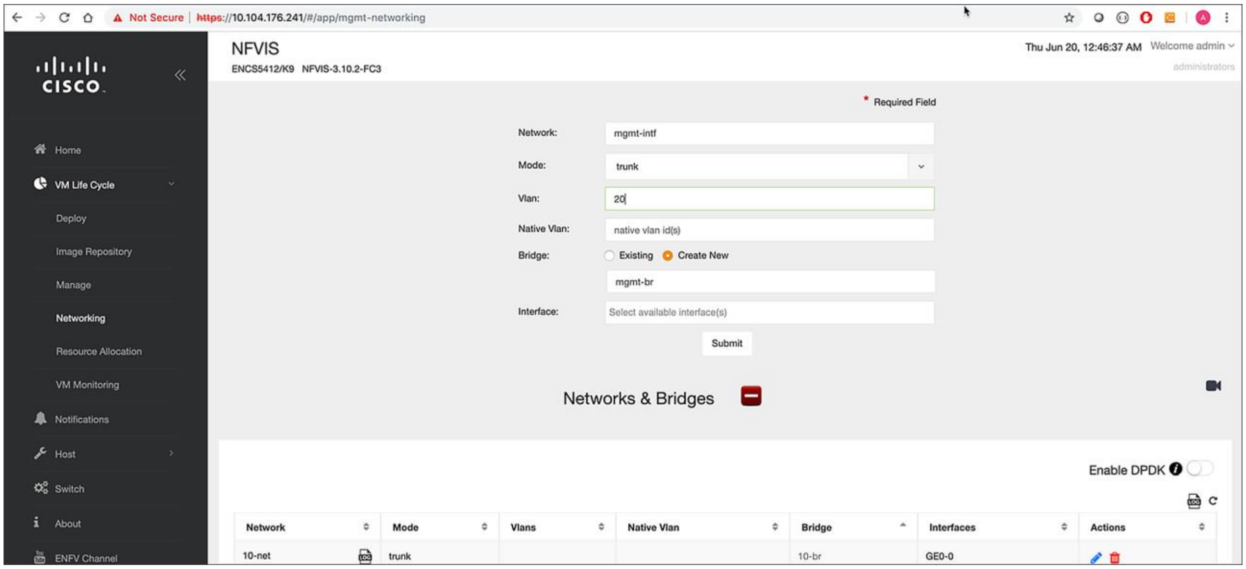
Interface Status

Interface	Speed (Mbps)	Media	MAC
GE0-0 ●	0	Fibre	70:db:98:c0 :53:c4
GE0-1 ●	0	Twisted Pair	70:db:98:c0 :53:c5
MGMT ●	1000	Twisted Pair	70:db:98:c0 :54:38

SRIOV Networks

SRIOV Network	Interface
GE0-0-SRIOV-1	GE0-0
GE0-0-SRIOV-2	GE0-0
GE0-1-SRIOV-1	GE0-1
GE0-1-SRIOV-2	GE0-1

Step 3. Populate the fields with values (Network, Mode, VLAN, Bridge, and Interface).



NFVIS
ENCS5412/K9 NFVIS-3.10.2-FC3

Thu Jun 20, 12:46:37 AM

* Required Field

Network: mgmt-intf
Mode: trunk
Vlan: 20
Native Vlan: native vlan id(s)
Bridge: ○ Existing ● Create New
mgmt-br
Interface: Select available interface(s)

Networks & Bridges

Network	Mode	Vlans	Native Vlan	Bridge	Interfaces	Actions
10-net	trunk			10-br	GE0-0	

Note: Create separate network interfaces for the wireless management network, service interface, and HA, and map them to separate bridge interfaces. Each bridge interface maps to a physical interface.

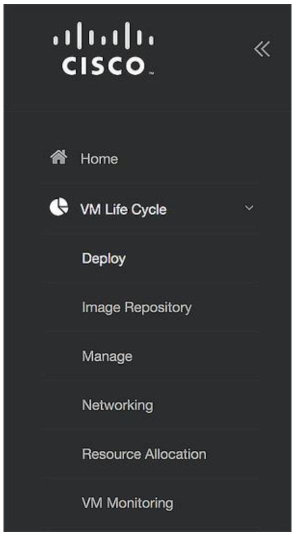
Example:

- A wireless management network named mgmt-intf with the Mode set to Trunk, carrying multiple VLANs, mapped to a bridge interface named mgmt-br tied to physical interface GE0-0.
- An HA network named ha-intf with the Mode set to access, mapped to a bridge interface named ha-br tied to physical interface GE0-1.

Deploying the 9800-CL virtual controller on NFVIS

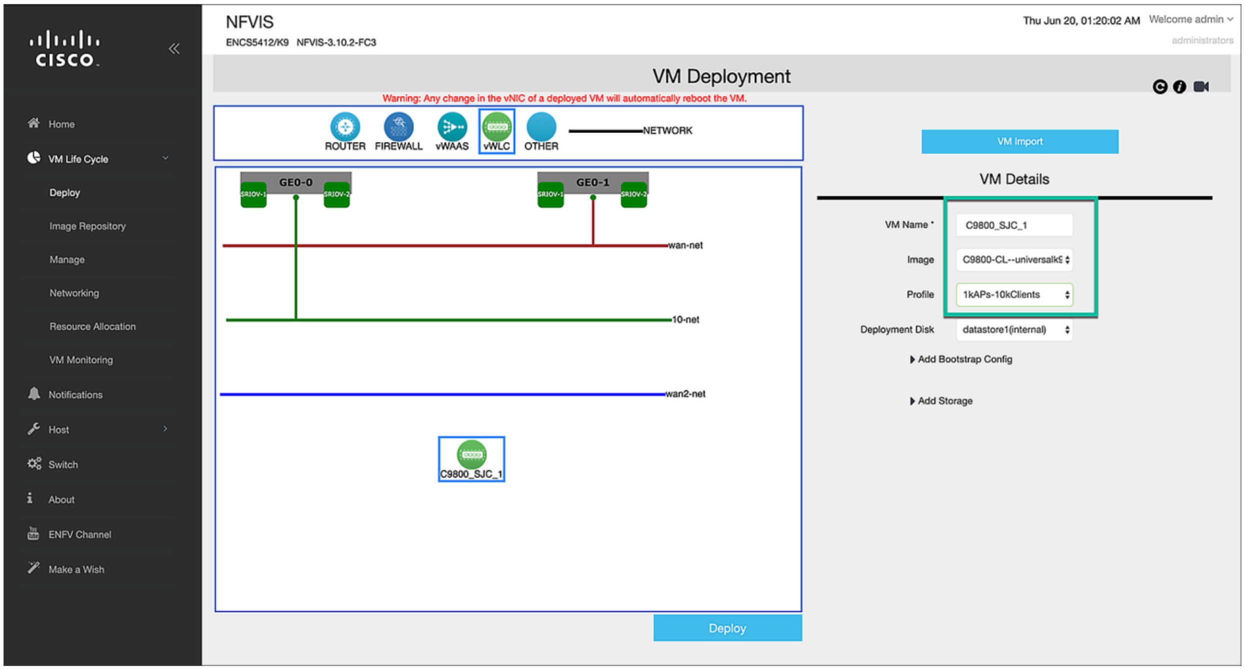
Follow the procedure below to deploy the 9800-CL virtual controller on NFVIS.

Step 1. Select **VM Life Cycle > Deploy**.



Step 2. From the VM Deployment window, drag and drop the controller icon to the pane below and map it to the desired networks as required. In the VM Details area, enter a name for the 9800-CL controller. Select the image and profile from the drop-down menu.

Note: Only 1000 APs and 10,000 clients are supported.



NFVIS
ENCS5412/K9 NFVIS-3.10.2-FC3

Thu Jun 20, 01:20:02 AM Welcome admin
administrators

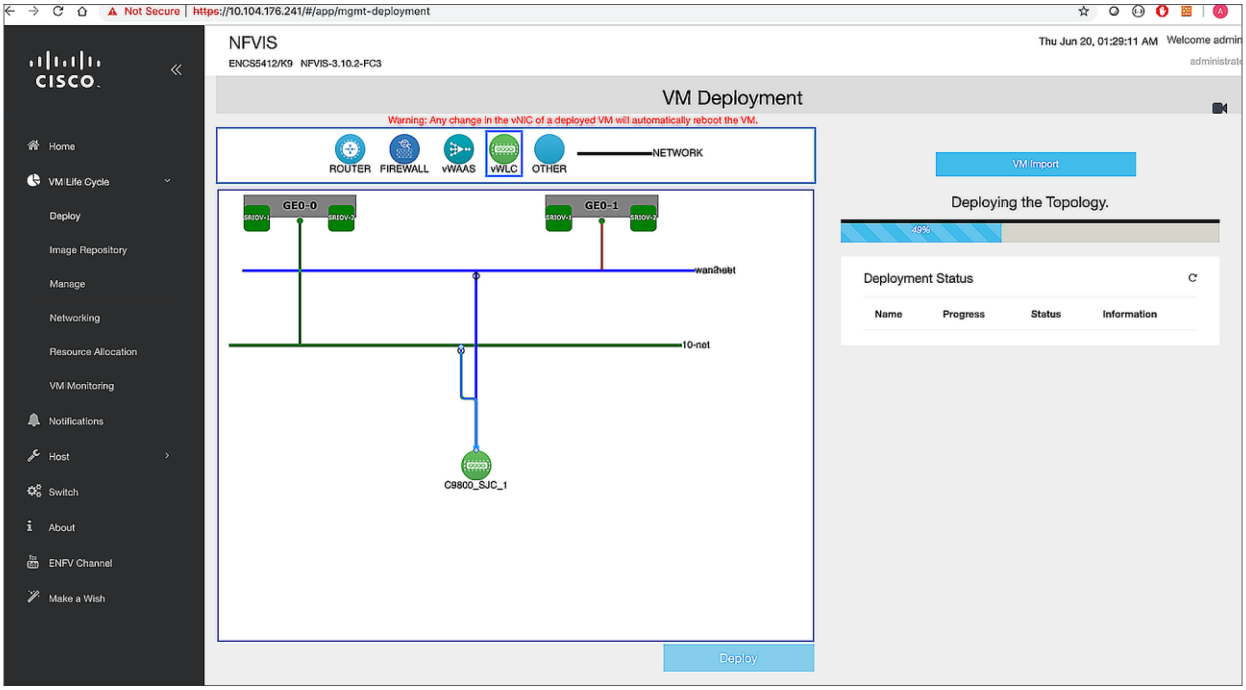
VM Deployment

Warning: Any change in the vNIC of a deployed VM will automatically reboot the VM.

VM Details

VM Name * C9800_SJC_1
Image C9800-CL--universalk9
Profile 1kAPs-10kClients
Deployment Disk datastore1(internal)

Step 3. Map the network interfaces and click **Deploy**.



https://10.104.176.241/#/app/mgmt-deployment

NFVIS
ENCS5412/K9 NFVIS-3.10.2-FC3

Thu Jun 20, 01:29:11 AM Welcome admin
administrato

VM Deployment

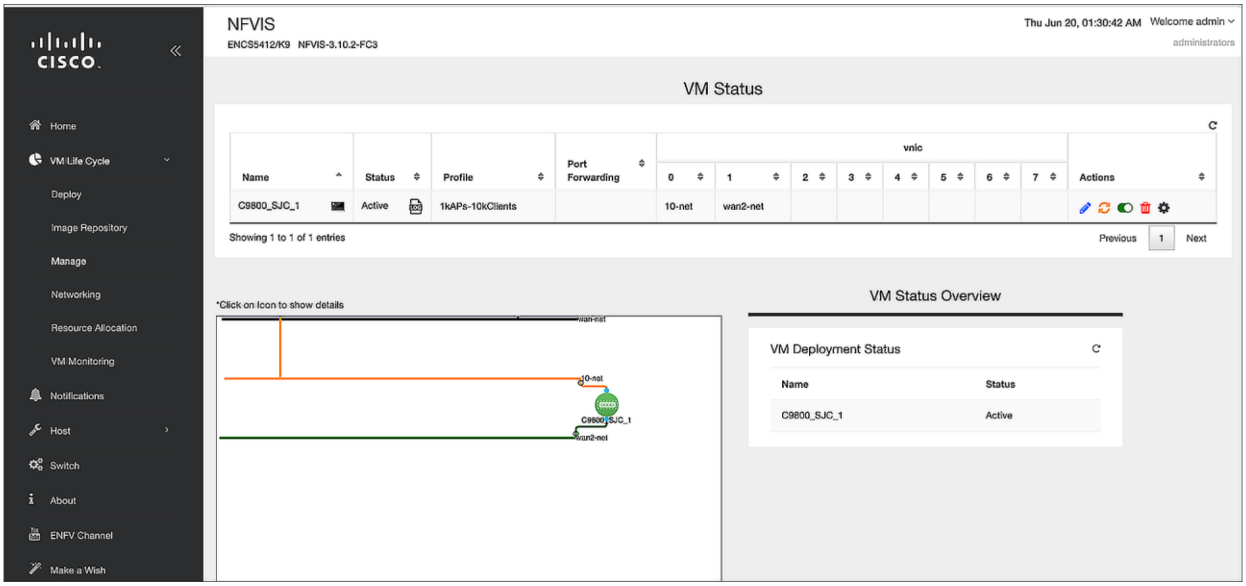
Warning: Any change in the vNIC of a deployed VM will automatically reboot the VM.

Deploying the Topology.

Deployment Status

Name	Progress	Status	Information

Step 4. Once deployed, check the 9800-CL's status in **VM Life Cycle > Manage > VM Status**.



NFVIS
ENCS5412/K9 NFVIS-3.10.2-FC3

Thu Jun 20, 01:30:42 AM Welcome admin
administrators

VM Status

Name	Status	Profile	Port Forwarding	vnic								Actions
				0	1	2	3	4	5	6	7	
C9800_SJC_1	Active	1kAPs-10kClients		10-net	wan2-net							

Showing 1 to 1 of 1 entries

Previous 1 Next

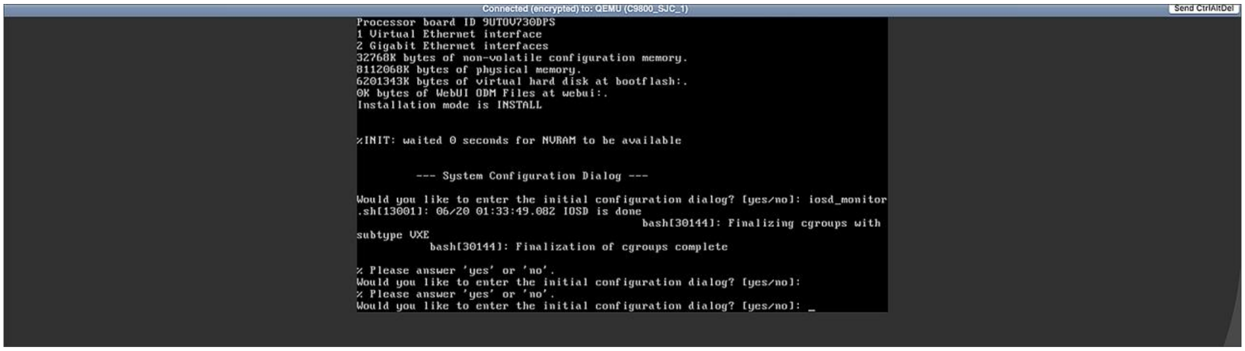
*Click on Icon to show details

VM Status Overview

VM Deployment Status

Name	Status
C9800_SJC_1	Active

Step 5. Click the console symbol next to the VM name to open the console to the 9800-CL virtual controller that is deployed.



Connected (encrypted) to: QEMU (C9800_SJC_1)

Send CtrlAltDel

```
Processor board ID 9UTOV730DPS
1 Virtual Ethernet interface
2 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
8112068K bytes of physical memory.
6201343K bytes of virtual hard disk at bootflash:.
0K bytes of WebUI ODM Files at webui:.
Installation mode is INSTALL


%INIT: waited 0 seconds for NVRAM to be available


         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: iosd_monitor
.sh[13001]: 06/20 01:33:49.082 IOSD is done
                                             bash[30144]: Finalizing cgroups with
subtype VXE
           bash[30144]: Finalization of cgroups complete

% Please answer 'yes' or 'no'.
Would you like to enter the initial configuration dialog? [yes/no]:
% Please answer 'yes' or 'no'.
Would you like to enter the initial configuration dialog? [yes/no]: _
```

Step 6. Go to the **Configuring the 9800-CL** section.

Enable serial console access

Step 1. Issue the following command on the 9800-CL VM:

```
C9800_SJC_1# configure terminal
C9800-SJC_1(config)# platform console serial
```

Step 2. SSH to the management interface of ENCS to access the 9800-CL console.

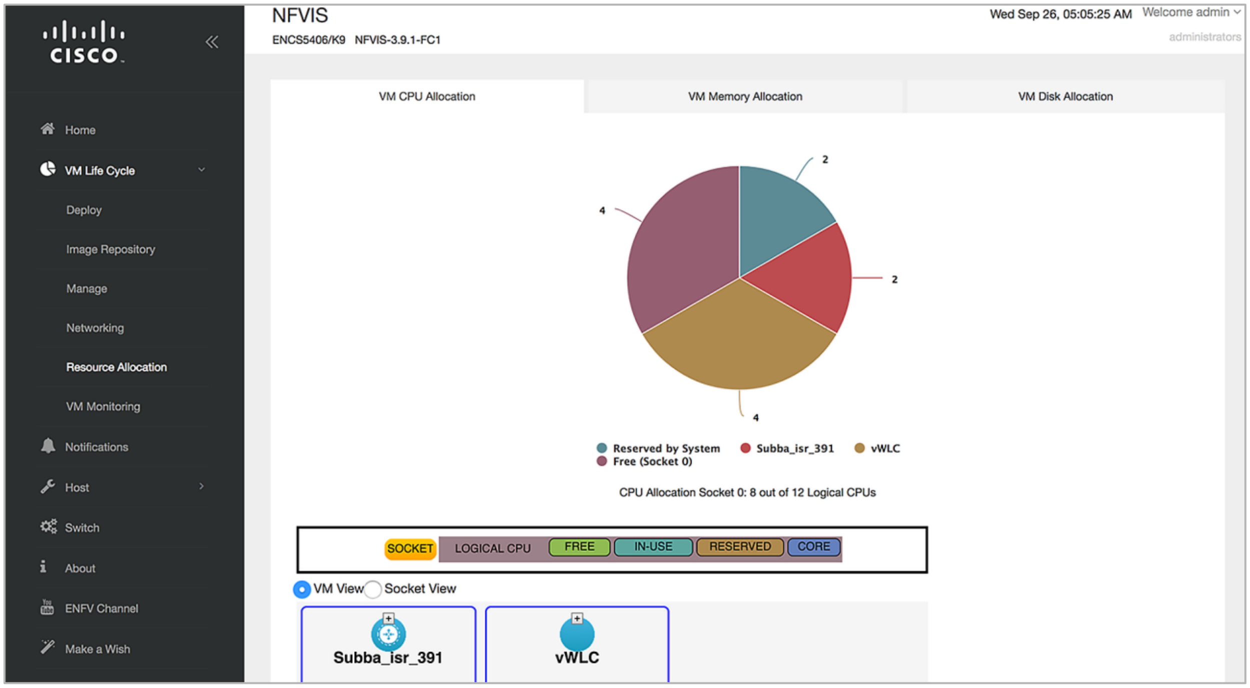
```
nfvis# show system deployments
NAME   ID   STATE
-------------------
  vWLC   2    running

nfvis# vmConsole ?
  Possible completions:
  VM name; "show system deployments" command shows list of VM names.

nfvis# vmConsole <VM name >
```

Viewing VM resource allocation

Follow the procedure below to view the VM resource allocations.

Step 1. From NFVIS, select **VM Life Cycle > Resource Allocation**.

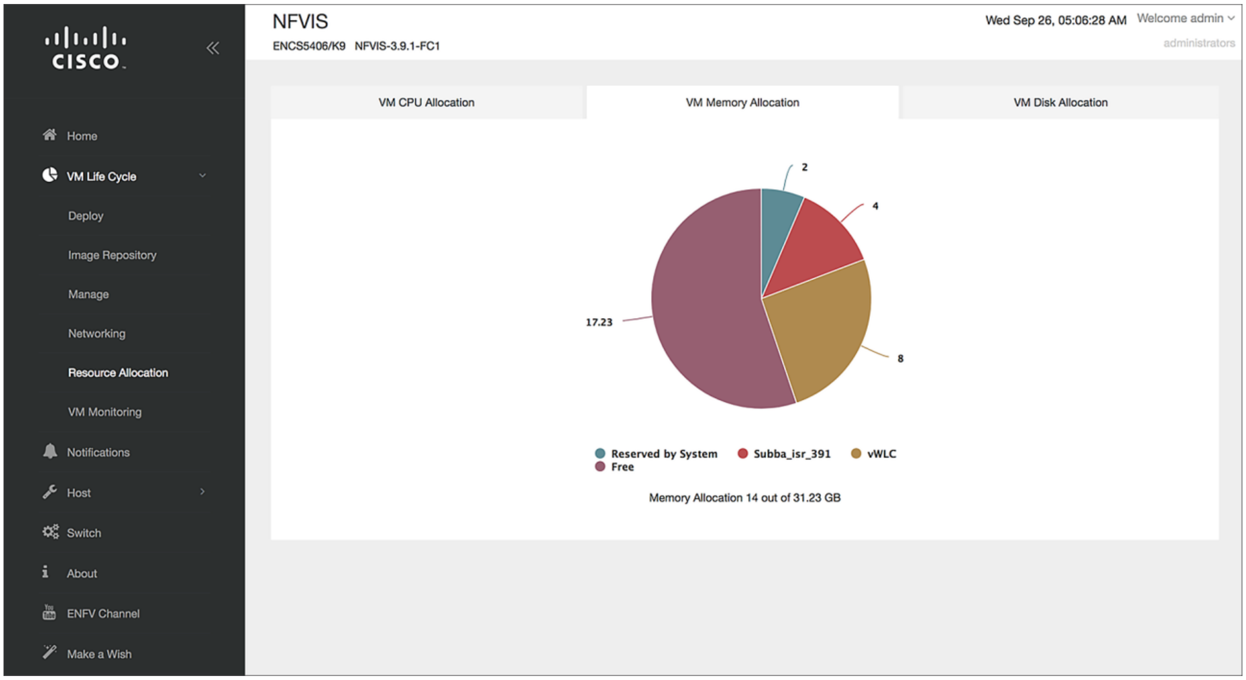
This opens up the VM CPU Allocation tab, which displays the overall CPU allocations.



CPU Allocation Socket 0: 8 out of 12 Logical CPUs

Step 2. Click the **VM Memory Allocation** tab.

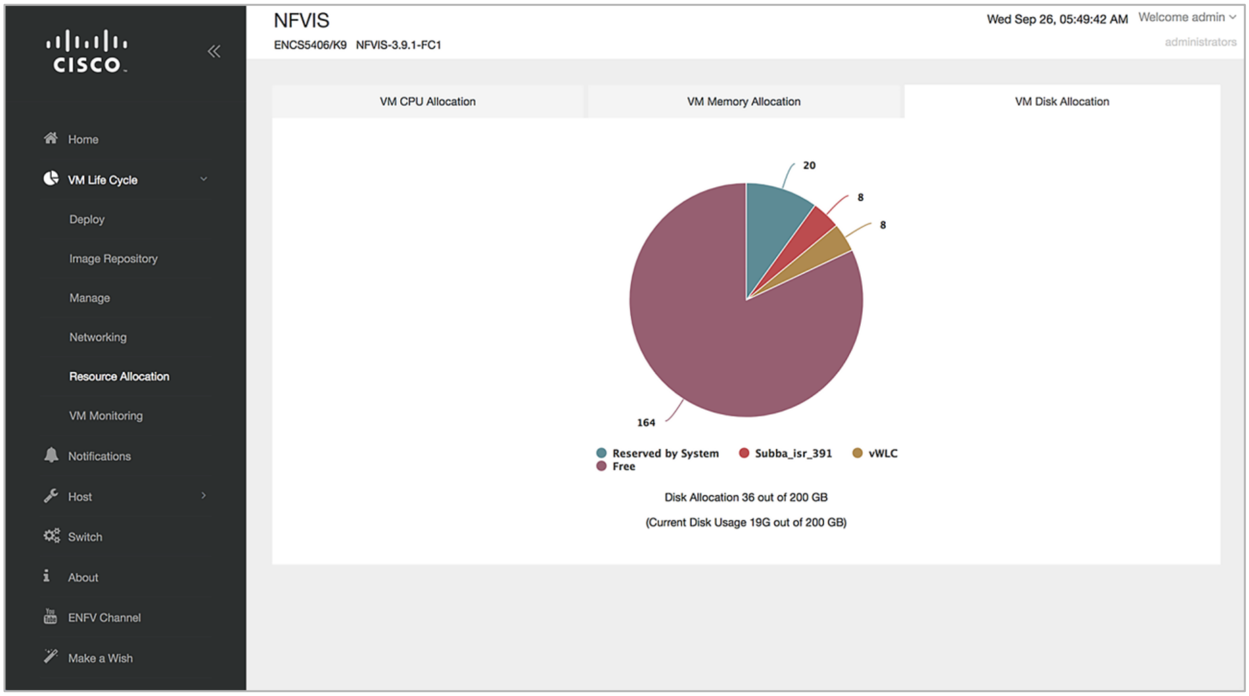
This tab shows the overall memory allocations.



Memory Allocation 14 out of 31.23 GB

Step 3. Click the **VM Disk Allocation** tab.

This tab shows the overall disk allocations.



Disk Allocation 36 out of 200 GB

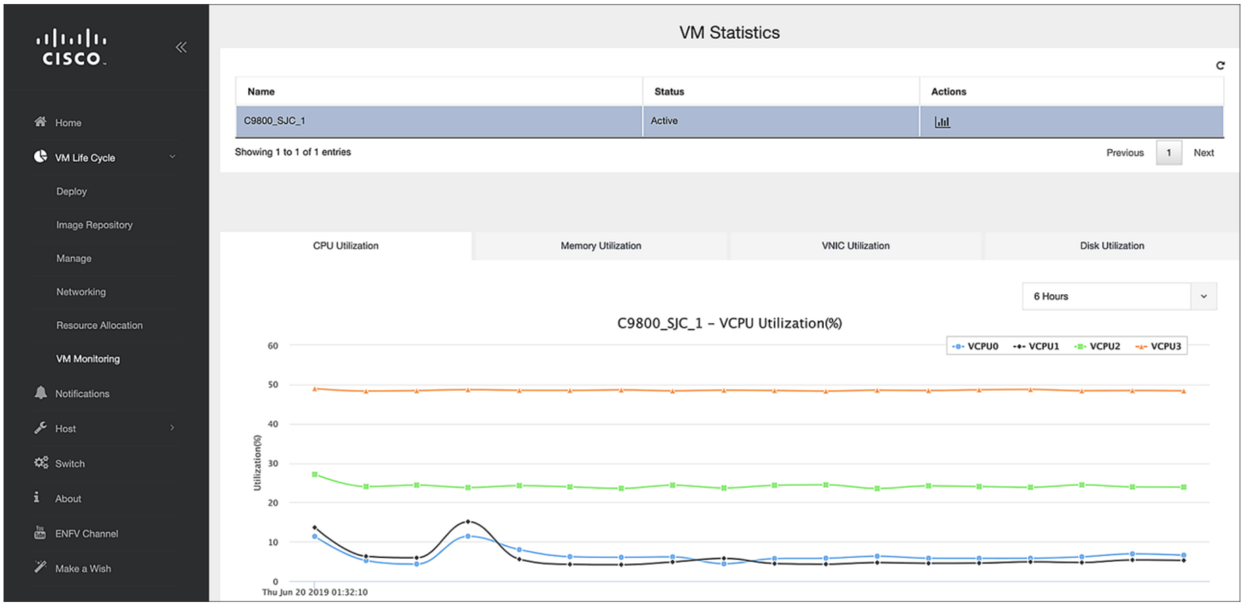
(Current Disk Usage 19G out of 200 GB)

Viewing VM statistics

Follow the procedure below to view the VM resource utilization.

Step 1. From NFVIS, select **VM Life Cycle > VM Monitoring**.

This opens up the VM CPU Utilization tab, which displays the overall CPU utilization per VM. Click the other tabs – Memory Utilization, vNIC Utilization, and Disk Utilization – to view the utilization of the resource.



Name	Status	Actions
C9800_SJC_1	Active	

Showing 1 to 1 of 1 entries

Previous 1 Next

Configuring the 9800-CL

9800-CL DAY 0 CLI configuration setup wizard

For Cisco IOS XE Release 17.4.1 and above, the 9800-CL provides a DAY 0 CLI wizard. To access the CLI, connect to the VGA console. Within the wizard, configurations such as Device Management interface, Wireless Management interface, deployment mode, and self-signed certificate for AP join will be created. After going through the wizard, the controller will generate the new configuration and apply it.

Note: If the DAY 0 WebUI wizard is preferred, please see the **Configure the basic 9800-CL settings** section first.

Example of DAY 0 CLI configuration wizard

```
          --- System Configuration Dialog ---


Would you like to enter the initial configuration dialog? [yes/no]: yes


At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

............................................................
This is a Wireless LAN Controller (WLC) setup wizard.
This wizard gives the option to configure a
device management interface, aka Service Port.
If a separate Service Port is not desired,
the device can also be managed using the same interface
```

```
which is used for wireless management.
For such a case, please select [no] in the prompt below



Setup device management interface (aka Service Port)? [yes]: yes
  Select interface to be used for device management
    1. GigabitEthernet1 [Up]
    2. GigabitEthernet2 [Up]
    3. GigabitEthernet3 [Up]
  Choose the interface to config [1]: 1

... Truncating Output ...

[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.

Enter your selection: 2
Building configuration...
[OK]
Use the enabled mode 'configure' command to modify this configuration.

Building configuration...
[OK]
```

Configure the basic 9800-CL settings

Let’s create the minimal configuration to connect to the WebUI of the 9800-CL and use the DAY 0 guided flow to get the controller fully operational. This will establish basic IP connectivity and user login on the 9800-CL.

Before 17.4.1, DAY 0 assumes that the box has two separate virtual interfaces (one for device management and one for wireless management and client traffic) and that the first login happens on the device management (out-of-band) interface. The wireless management interface is configured via the DAY 0 guided flow. If using a different setup (for example, if you are using only a single interface), see the previous section or go to **Configuring the 9800-CL via the CLI: Skipping the DAY 0 guided flow** section.

Connect to the CLI via the VGA console and follow these steps for the basic configuration:

Step 1. Terminate the configuration wizard (this is the general Cisco IOS CLI wizard, and it’s not specific for wireless).

```
Would you like to enter the initial configuration dialog? [yes/no]: no
Would you like to terminate autoinstall? [yes]: yes
```

Step 2. Optionally, set the hostname:

```
WLC(config)# hostname C9800
```

Step 3. Add login credentials, using the following command:

```
C9800(config)# username <name> privilege 15 password <yourpwd>
```

Step 4. Add an IP address on the device management interface. The example assumes GigabitEthernet1 is mapped to the out-of-band/device management network during VM bootstrap:

```
C9800(config)# interface GigabitEthernet1
C9800(config-if)# no switchport
C9800(config-if)# ip address <Management IP> <Management Subnet>
```

Step 5. Add the route to the remote network from which the 9800-CL will be managed.

```
C9800(config)# ip route <Remote Network Address> <Remote Network Subnet> <Gateway>
```

Note: With an ESXi direct host, no default bootstrap configuration is passed to the instance. If one is desired, you must enter the following configurations manually (these are automatically configured if using vCenter):

```
netconf-yang
ip http server
ip http secure-server
line vty 0 4
 transport input telnet ssh
 login local
```

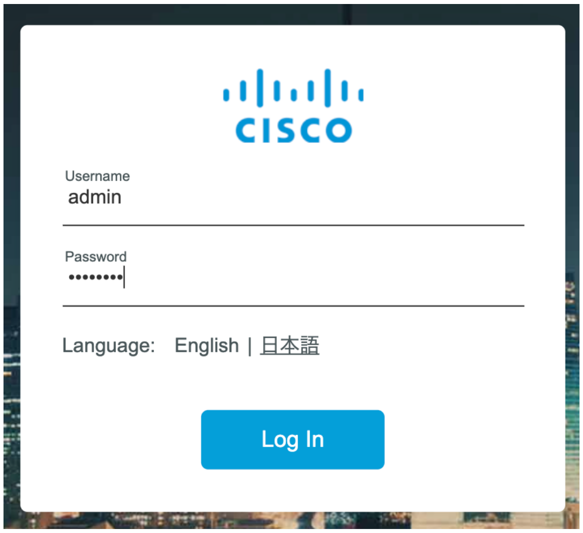
From a computer, verify that the computer can ping the 9800-CL.

9800-CL DAY 0 WebUI configuration setup wizard

Since the box has never been configured, the WebUI will redirect to the DAY 0 page. To skip the DAY 0. WebUI, [lease see the Configuring the 9800-CL via the CLI: Skipping the DAY 0 guided flow section.

To simplify the bootstrap process of the Catalyst 9800-CL wireless controller, the DAY 0 wizard will appear after a virtual instance is deployed, with network connectivity but without any other wireless configuration.

Step 1. Connect to the DAY 0 GUI using `https://< Management IP>`.



Username
admin

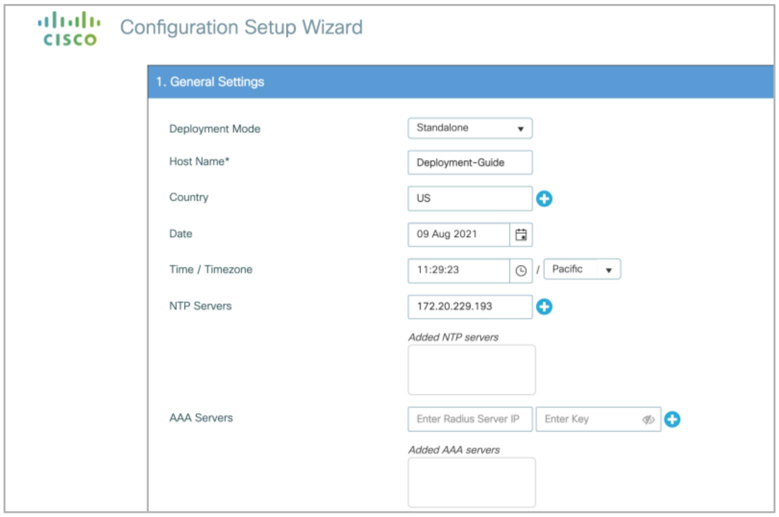
Password
••••••••

Language: English | 日本語

Log In

To log in, use the username and password credentials given during the 9800-CL instance creation described in the previous sections.

Step 2. Once you are logged in, the 9800-CL presents a simplified configuration flow to set the basic parameters and have the controller fully operational. On the first page, enter the required information.



Configuration Setup Wizard

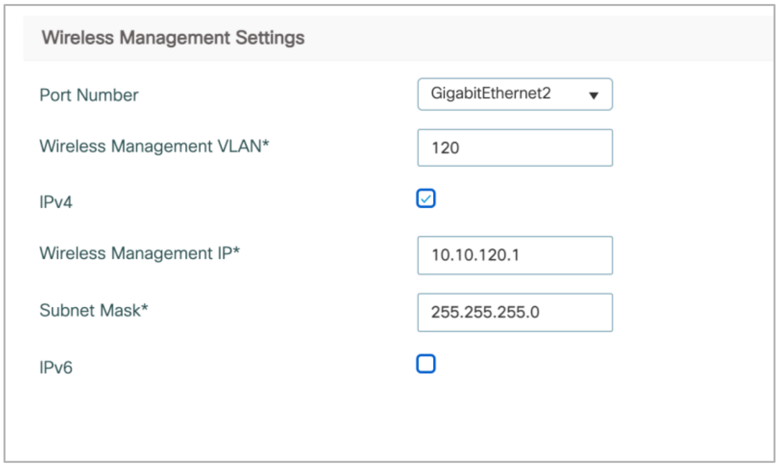
1. General Settings

Deployment Mode	Standalone ▾
Host Name*	Deployment-Guide
Country	US
Date	09 Aug 2021
Time / Timezone	11:29:23 / Pacific ▾
NTP Servers	172.20.229.193
	Added NTP servers
AAA Servers	Enter Radius Server IP, Enter Key
	Added AAA servers

These settings are Deployment Mode, Country, Date, Time, NTP Servers (optional), and AAA Servers (optional).

Note: For Deployment Mode, the available options are Standalone or Active/Standby if configuring HA SSO.

Step 3. Enter the wireless management interface configuration.



Wireless Management Settings

Port Number	GigabitEthernet2 ▾
Wireless Management VLAN*	120
IPv4	☑
Wireless Management IP*	10.10.120.1
Subnet Mask*	255.255.255.0
IPv6	□

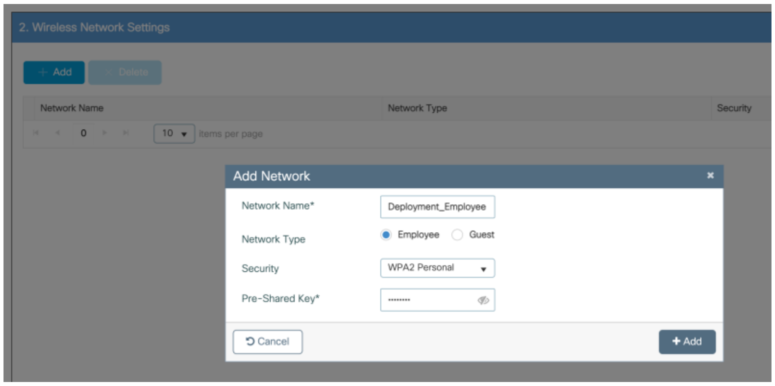
Note: Only an interface that is different from the one used to access the GUI can be selected. In the example above, only GigabitEthernet2 or GigabitEthernet3 can be selected, as GigabitEthernet1 is used to access the GUI.

Step 4. Configure the interface by choosing the VLAN, the IP address, and the default gateway. This will automatically configure the:

- Interface as a trunk port
- Switch Virtual Interface (SVI) for wireless management
- Default gateway.

Click **Next**.

Step 5. On the next page, add a WLAN (optional) so that clients can connect. In this example, the PSK dialog is shown.



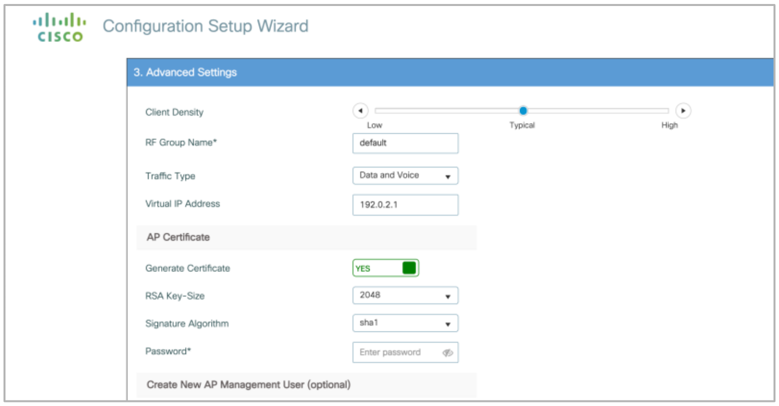
2. Wireless Network Settings

Network Name	Network Type	Security

Add Network

Network Name*	Deployment_Employee
Network Type	● Employee ○ Guest
Security	WPA2 Personal ▾
Pre-Shared Key*	········

Step 6. On the next page, set some basic RF parameters and the AP certificate.



Configuration Setup Wizard

3. Advanced Settings

Client Density: Low — Typical — High

RF Group Name*: default

Traffic Type: Data and Voice

Virtual IP Address: 192.0.2.1

AP Certificate

Generate Certificate: YES

RSA Key-Size: 2048

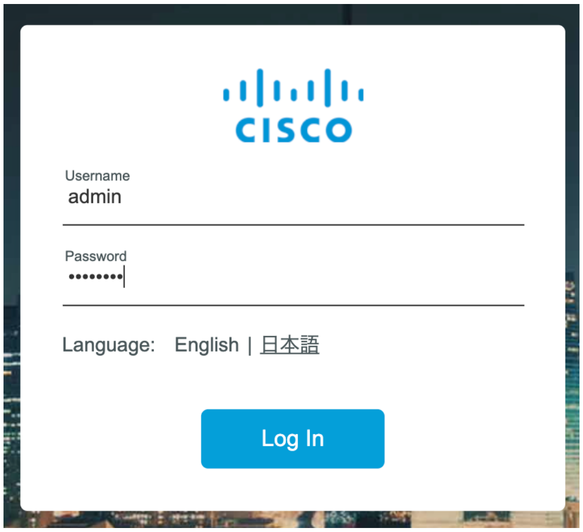
Signature Algorithm: sha1

Password*: Enter password

Create New AP Management User (optional)

A trustpoint is essentially a certificate authority that is trusted implicitly. A trustpoint certificate is a self-signed certificate, hence the name "trustpoint," since it does not rely on the trust of anyone else or another party. A trustpoint is needed for an AP to join the 9800-CL. It can be automatically generated during DAY 0. Otherwise, if the Generate Certificate is toggled to No, a certificate authority will have to be configured at DAY 1 for APs to join.

Click Summary to review the configuration, and then click Finish. The configuration and trustpoint will be pushed to the device and the user will be logged out. The 9800-CL controller will not reboot, but it will take about 60 seconds to prompt you to log in again. Enter the same credentials.



Username: admin

Password: ••••••••

Language: English | 日本語

This time it will skip the DAY 0 page, since the box already has an initial configuration, and redirect to the main dashboard for the DAY 1 configuration.

Configuring the 9800-CL via the CLI: Skipping the DAY 0 guided flow

If two separate virtual interfaces for device management and wireless management are not needed, create the DAY 0 configuration via the CLI and then access the GUI for the DAY 1 configuration. However, if separate interfaces are necessary, please follow the steps in the "**Configure the basic 9800-CL settings**" section first.

Follow the steps below to configure the 9800-CL with a wireless management interface and skip the DAY 0 flow.

This example assumes that GigabitEthernet2 is connected to a trunk interface on the switch and multiple VLANs will be configured with a dedicated one for the Wireless Management Interface (WMI). Also, in this example, VLAN 122 will be used for the WMI.

Step 1. Access the CLI via the VGA/monitor console of ESXi.

Step 2. Terminate the configuration wizard (this wizard is not specific for the wireless controller).

```
Would you like to enter the initial configuration dialog? [yes/no]: no
Would you like to terminate autoinstall? [yes]: yes
```

Step 3. Optionally, set the hostname:

```
WLC(config)# hostname C9800
```

Step 4. Enter the config mode and add login credentials using the following command:

```
C9800(config)# username <name> privilege 15 password <yourpwd>
```

Step 5. Configure the VLAN for the wireless management interface.

```
C9800# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
C9800(config)# vlan 122
C9800(config-vlan)# name wireless_management
```

Step 6. Configure the SVI for the wireless management interface; for example:

```
C9800(config)# interface vlan 122
C9800(config-if)# ip address 172.20.229.21 255.255.255.192
C9800(config-if)# no shutdown
```

Step 7. Configure the interface GigabitEthernet2 as the trunk:

```
C9800(config-if)# interface GigabitEthernet2
C9800(config-if)# switchport mode trunk
C9800(config-if)# switchport trunk allowed vlan 122
C9800(config-if)# shut
C9800(config-if)# no shut
```

Step 8. Configure a default route (or a more specific route) to reach the box:

```
C9800(config-if)# ip route 0.0.0.0 0.0.0.0 172.20.229.1
```

Step 9. Configure the AP country domain. This configuration is what will trigger the GUI to skip the DAY 0 flow, as the 9800-CL needs a country code to be operational:

```
C9800(config)# wireless country ?
  AE  United Arab Emirates
  AL  Albania
  AR  Argentina
  ...
  US  United States
  UY  Uruguay
  VE  Venezuela
  VN  Vietnam
  ZA  South Africa
```

Step 10. A certificate is needed for the AP to join the virtual 9800-CL. This can be created automatically via the DAY 0 flow or manually using the following commands.

a. Specify the interface to be the wireless management interface:

```
C9800(config)# wireless management interface vlan 122
```

b. In exec mode, issue the following command:

```
C9800# wireless config vwlc-ssc key-size 2048 signature-algo sha256 password 0 <pwd>
Configuring vWLC-SSC…
Script is completed
```

Note: Ensure that the gateway for the WMI is reachable from the 9800-CL.

Step 11. Verify certificate installation:

```
C9800# show wireless management trustpoint
Trustpoint Name  : C9800_WLC_TP
Certificate Info : Available
Certificate Type : SSC
Certificate Hash : e55e61b683181ff0999ef317bb5ec7950ab86c9e
Private key Info : Available
```

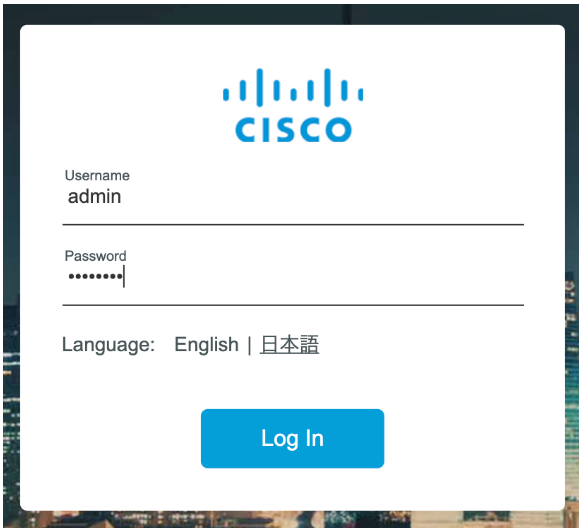
Note: The certificate/trustpoint configuration can be skipped, but APs will not be able to join. This can be configured via the GUI by importing the desired certificate.

Step 12. Verify that the WMI can be pinged, and enter `https://<Management IP>`. Use the credentials entered earlier. Since the box has a country code configured, the GUI will skip the DAY 0 page and go directly to the main dashboard for the DAY 1 configuration.

Accessing the 9800-CL WebUI

Once the 9800-CL can be reached successfully from the network, access the main dashboard to continue the DAY 1 and DAY 2 operations.

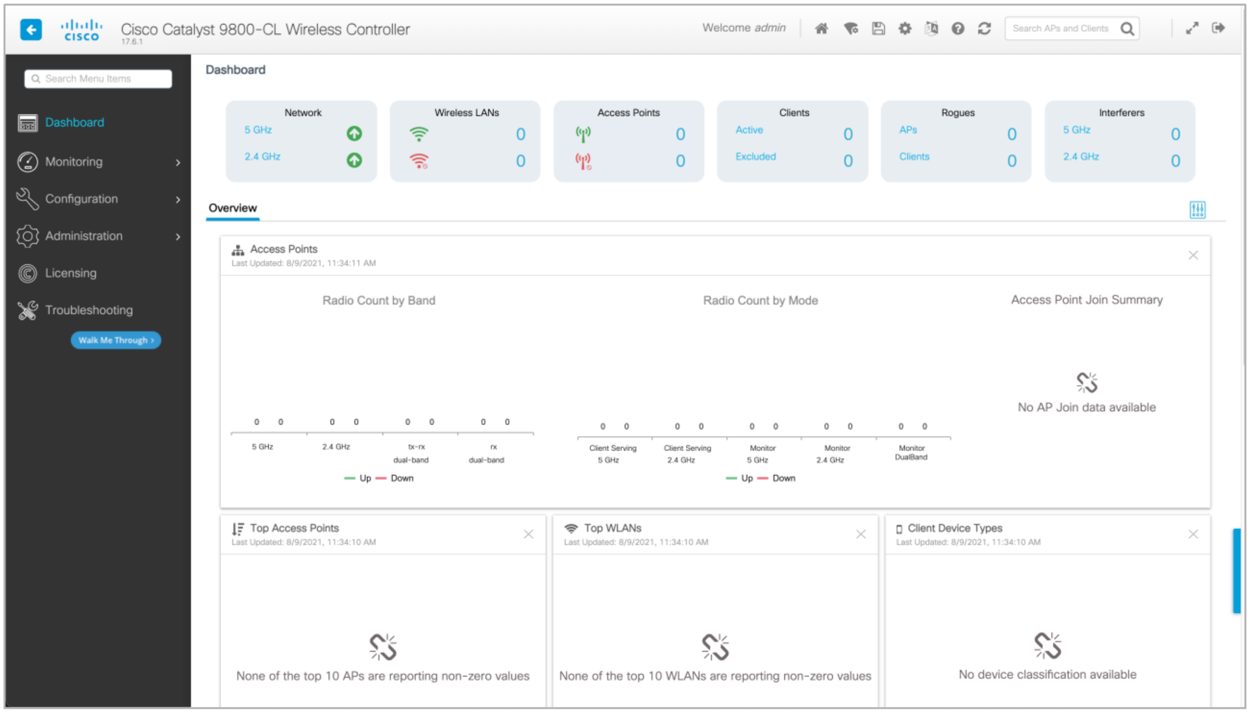
Step 1. Access the 9800-CL WebUI using `https://<Management IP>`. The username and password will be what was provided either during the initial configuration or during the OVA installation with vCenter.



Username
admin

Password
••••••••

Language: English | 日本語



No AP Join data available

None of the top 10 APs are reporting non-zero values

None of the top 10 WLANs are reporting non-zero values

No device classification available

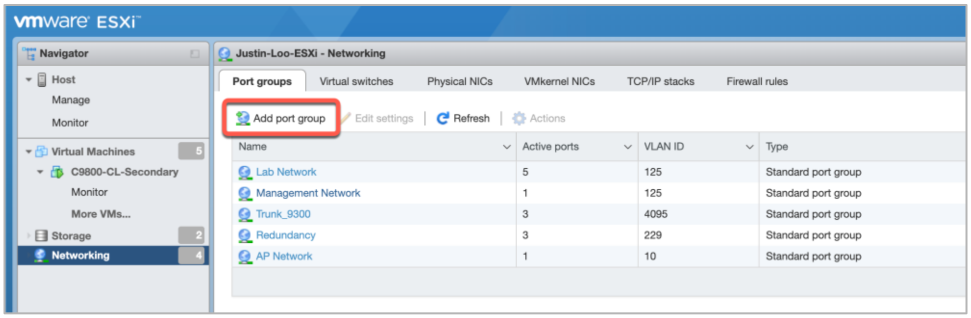
Appendix A: Creating a port group in ESXi

Embedded web GUI

To create a port group, a virtual switch needs to be created. Follow the steps outlined here to create a virtual switch: https://docs.vmware.com/en/VMware-vSphere/6.7/com.vmware.vsphere.html.hostclient.doc/GUID-6BF5281C-F8EF-4F26-8285-52EB5999D687.html

Step 1. Go to the WebUI of the ESXi host.

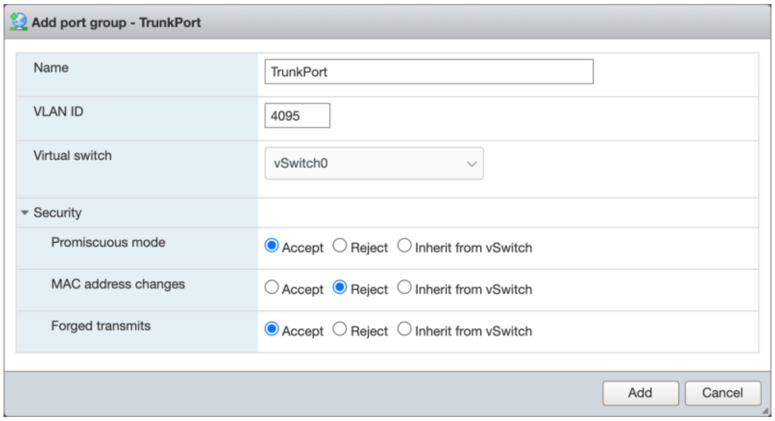
Step 2. Go to **Networking > Port groups** and click **Add port group**.



Name	Active ports	VLAN ID	Type
Lab Network	5	125	Standard port group
Management Network	1	125	Standard port group
Trunk_9300	3	4095	Standard port group
Redundancy	3	229	Standard port group
AP Network	1	10	Standard port group

Step 3. In the Add port group window, set the:

- Name
- VLAN ID
    - The VLAN ID should be the same VLAN ID used for rest of the network. This would be the case for the management and redundancy interfaces, which would be on their own respective VLANs.
    - For the data port, the port group should be set to be a trunk port. To do this, set the VLAN ID to **4095.**
- Virtual switch
- Security
    - Both Promiscuous mode and Forged Transmits need to be set to Accept on the port group where the 9800-CL is connected. This is needed for both trunk and nontrunk connections. These security settings can be restricted to the single port group where the 9800-CL is connected, and as long as the VLANs are available only on this port group, the settings will not affect other VMs connected to other port groups. This is recommended, as setting Promiscuous mode to Accept will result in flooding traffic to all the other VMs on the same VLAN.



Name	TrunkPort
VLAN ID	4095
Virtual switch	vSwitch0
Security	
Promiscuous mode	● Accept ○ Reject ○ Inherit from vSwitch
MAC address changes	○ Accept ● Reject ○ Inherit from vSwitch
Forged transmits	● Accept ○ Reject ○ Inherit from vSwitch

Step 4. Click **Add** to save the settings.

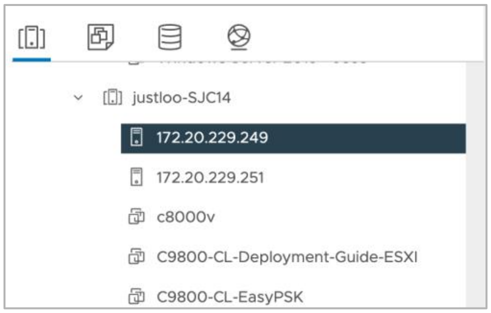
Step 5. Repeat for all required port groups.

vCenter

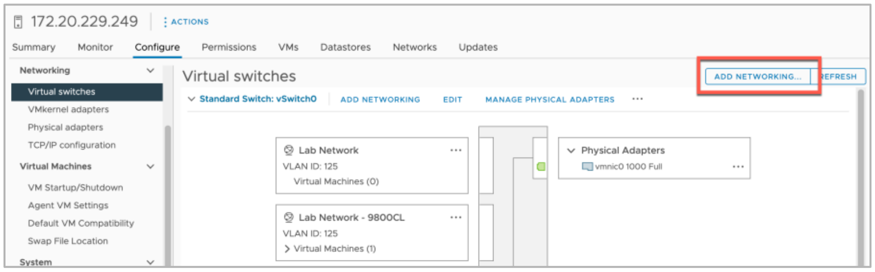
To create a port group, a virtual switch needs to be created. Follow the steps outlined here to create a virtual switch: https://docs.vmware.com/en/VMware-vSphere/6.7/com.vmware.vsphere.networking.doc/GUID-DAF824CD-104D-4ED7-8BA3-D769DF688CEB.html

Step 1. Go to the vSphere Web Client.

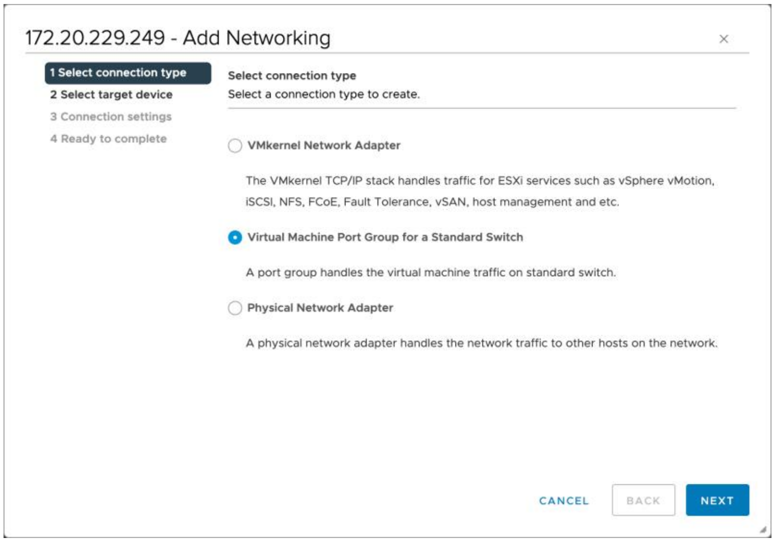
Step 2. Select the required ESXi host.



Step 3. Go to the Configure tab and select **Networking > Virtual switches**. Click **ADD NETWORKING.**



Step 4. In the Add Networking window, set the connection type as **Virtual Machine Port Group for a Standard Switch**. Click **Next**.



172.20.229.249 - Add Networking

Select connection type

Select a connection type to create.

○ VMkernel Network Adapter

The VMkernel TCP/IP stack handles traffic for ESXi services such as vSphere vMotion, iSCSI, NFS, FCoE, Fault Tolerance, vSAN, host management and etc.

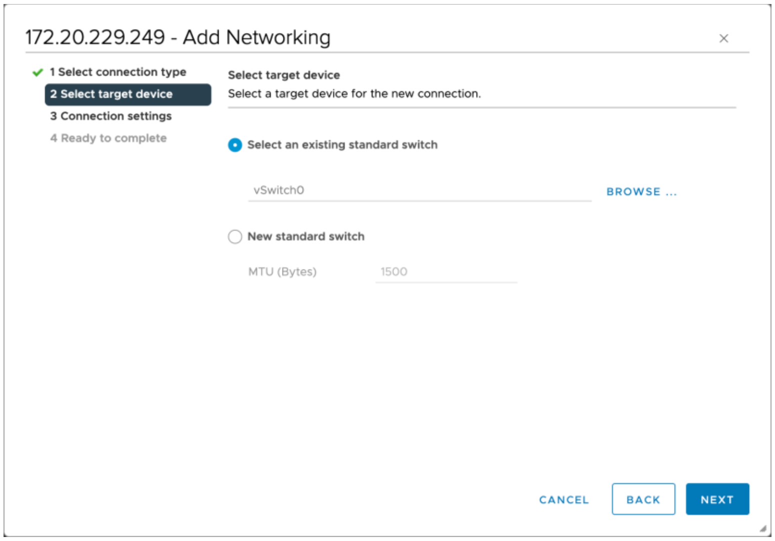
● Virtual Machine Port Group for a Standard Switch

A port group handles the virtual machine traffic on standard switch.

○ Physical Network Adapter

A physical network adapter handles the network traffic to other hosts on the network.

Step 5. Select the required vSwitch for the port group. Click **Next**.



172.20.229.249 - Add Networking

Select target device

Select a target device for the new connection.

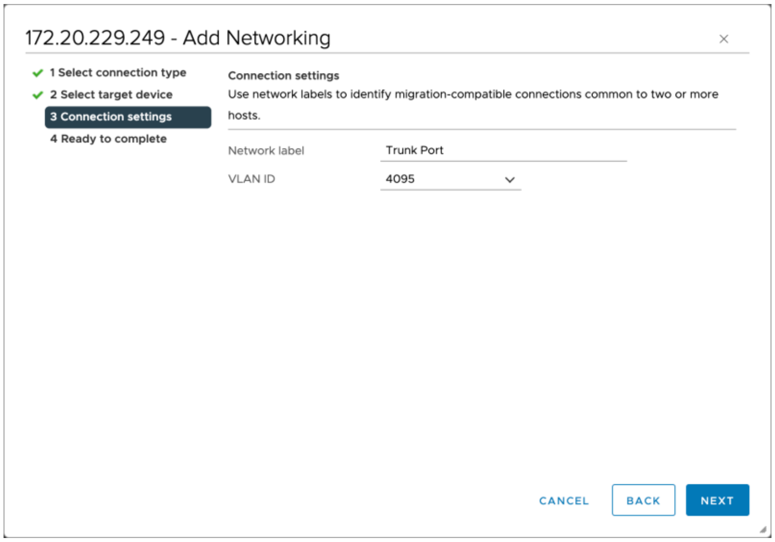
● Select an existing standard switch

vSwitch0

○ New standard switch

MTU (Bytes) 1500

Step 6. Set the **Network label** and **VLAN ID** for the port group. Click **Next**.



Connection settings

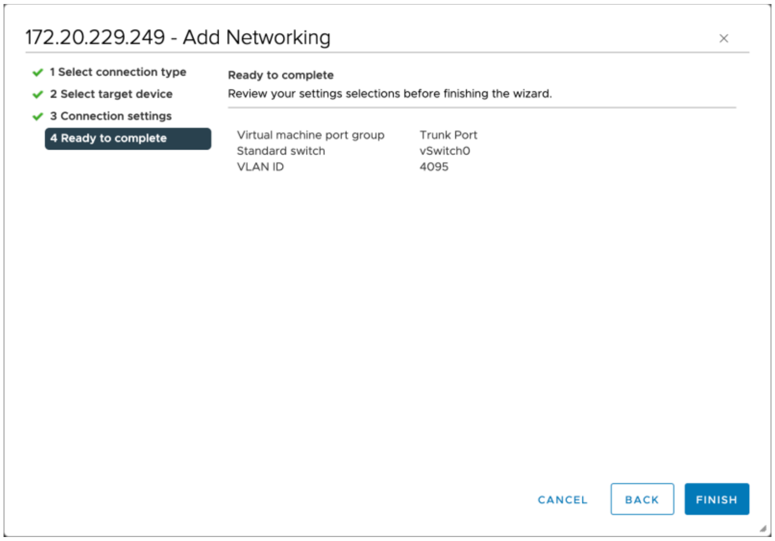
Use network labels to identify migration-compatible connections common to two or more hosts.

Network label: Trunk Port

VLAN ID: 4095

Note: The VLAN ID should be the same VLAN ID used for rest of the network. This would be the case for the management and redundancy interfaces, which would be on their own respective VLANs. For the data port, the port group should be set to be a trunk port. To do this, set the VLAN ID to **4095**.

Step 7. Review the settings and click **Finish**.



Ready to complete

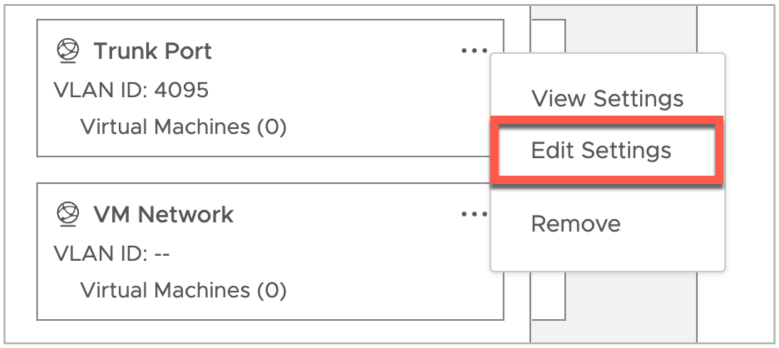
Review your settings selections before finishing the wizard.

Virtual machine port group: Trunk Port

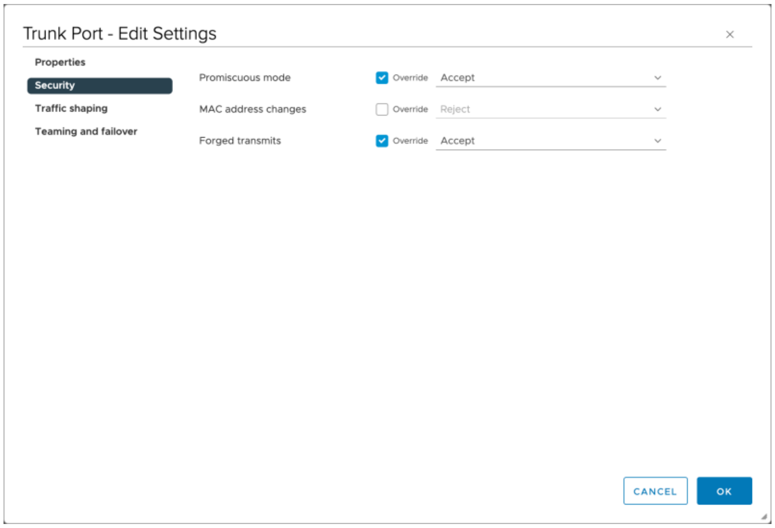
Standard switch: vSwitch0

VLAN ID: 4095

Step 8. To change the security settings of the port group, click the **...** icon for the newly created port group. Choose **Edit Settings**.



Step 9. In the Security section, check the override boxes for **Promiscuous mode** and **Forged transmits**. Set both values to **Accept**. Click **OK**.



Trunk Port - Edit Settings

Promiscuous mode	☑ Override	Accept
MAC address changes	□ Override	Reject
Forged transmits	☑ Override	Accept

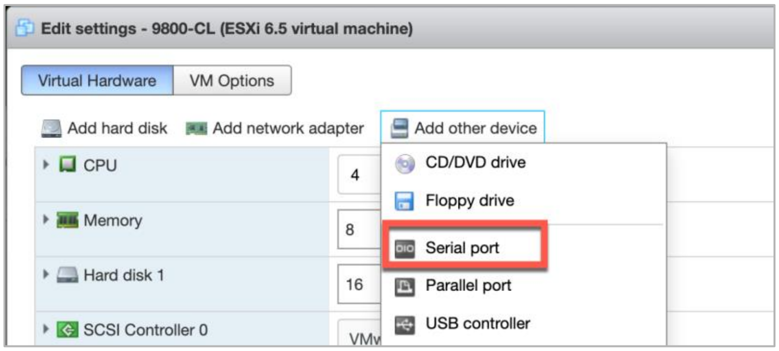
Note: Both Promiscuous mode and Forged Transmits need to be set to Accept on the port group where the 9800-CL is connected. This is needed both for trunk and nontrunk connections. These security settings can be restricted to the single port group where the 9800-CL is connected, and as long as the VLANs are available only on this port group, the settings will not affect other VMs connected to other port groups. This is recommended, as setting Promiscuous mode to Accept will result in flooding traffic to all the other VMs on the same VLAN.

Step 10. Repeat for all required port groups.

Appendix B: Adding a virtual serial port in ESXi

Adding a virtual serial port allows an administrator to connect to the virtual wireless controller like accessing a physical appliance’s serial console.

Step 1. In the **Edit settings** window for 9800-CL, click **Add other device**. Select **Serial port**.



Edit settings - 9800-CL (ESXi 6.5 virtual machine)

CPU	4
Memory	8
Hard disk 1	16
SCSI Controller 0	VMw

Step 2. In the New Serial Port settings:

a. Select **Use network**, as Telnet will be used to connect to the ESXi network address and custom port assignment.

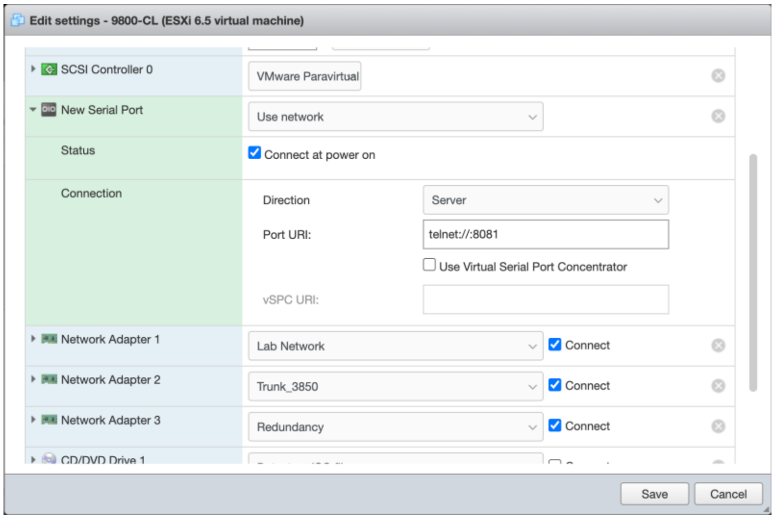
b. For Direction, select **Server**.

c. Enter the port URI to connect to.

d. Click **Save**.

```
telnet://<ESXi IP address>:<port>
```

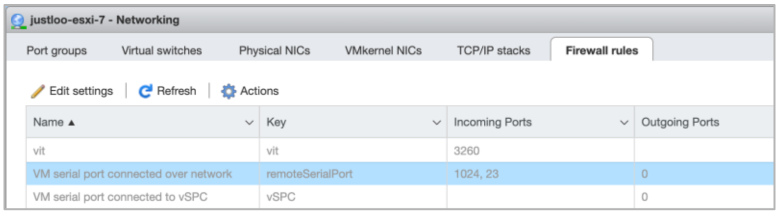
Note: The ESXi IP address can be omitted (for example, `telnet://:<port>`). In this case, the IP address of the ESXi host the device is hosted on will used.



Edit settings - 9800-CL (ESXi 6.5 virtual machine)

SCSI Controller 0	VMware Paravirtual	
New Serial Port	Use network	
Status	☑ Connect at power on	
Connection	Direction	Server
	Port URI:	telnet://:8081
		□ Use Virtual Serial Port Concentrator
	vSPC URI:	
Network Adapter 1	Lab Network	☑ Connect
Network Adapter 2	Trunk_3850	☑ Connect
Network Adapter 3	Redundancy	☑ Connect
CD/DVD Drive 1		

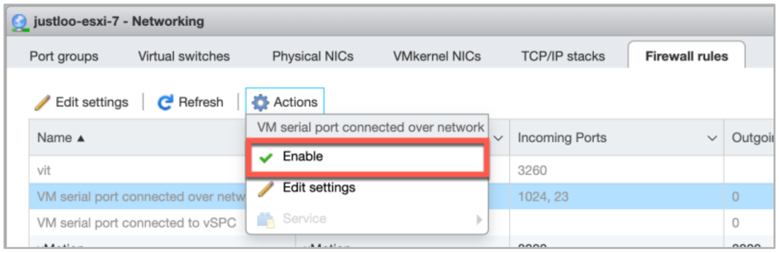
Step 3. To allow for computers to access the serial port of the VM, go to **Networking > Firewall rules**. Select **VM serial port connected over network**.



justloo-esxi-7 - Networking

Name ▲	Key	Incoming Ports	Outgoing Ports
vit	vit	3260	
VM serial port connected over network	remoteSerialPort	1024, 23	0
VM serial port connected to vSPC	vSPC		0

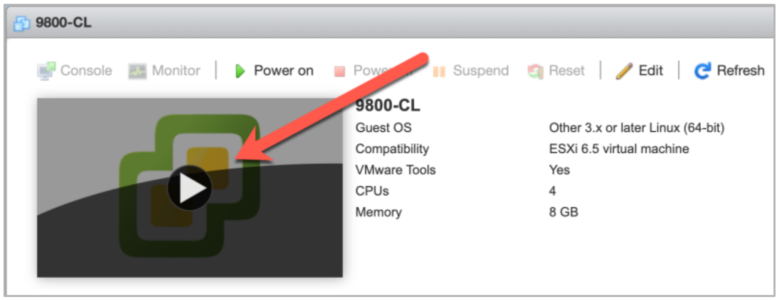
Step 4. Click **Actions** and then click **Enable.**



justloo-esxi-7 - Networking

Name ▲	Incoming Ports	Outgoi
vit	3260	
VM serial port connected over netw	1024, 23	0
VM serial port connected to vSPC		0

Step 5. Click the **Play icon** to power on the VM and bring up the VGA console simultaneously.



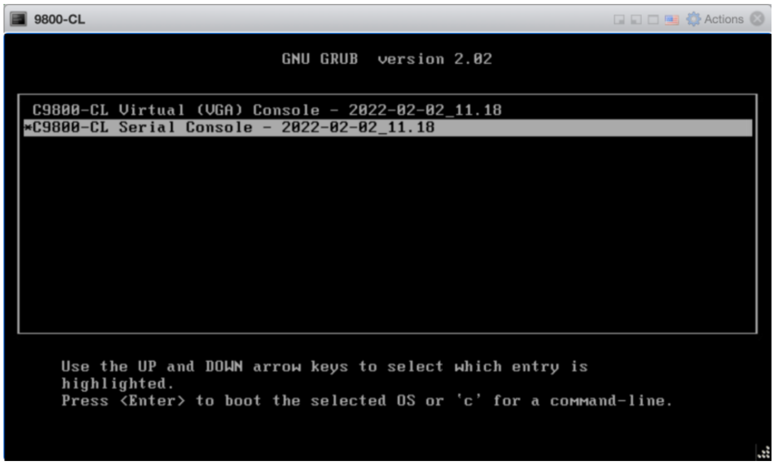
9800-CL

9800-CL

Guest OS	Other 3.x or later Linux (64-bit)
Compatibility	ESXi 6.5 virtual machine
VMware Tools	Yes
CPUs	4
Memory	8 GB

Step 6. If this is the first boot after creating the VM, select the Serial Console boot option to change the default console output to the serial port. This will be a one-time action. Proceed to **step 7**.

Note: If this step is missed, the console output can be changed to the serial port via the 9800-CL CLI. Please see **step 6**.



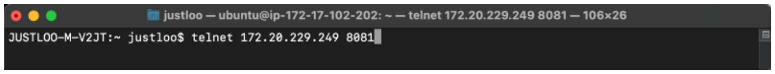
```
                         GNU GRUB  version 2.02

 C9800-CL Virtual (VGA) Console - 2022-02-02_11.18
*C9800-CL Serial Console - 2022-02-02_11.18

      Use the UP and DOWN arrow keys to select which entry is
      highlighted.
      Press <Enter> to boot the selected OS or 'c' for a command-line.
```

Step 7. If vWLC Virtual (VGA) Console was selected, enter the followings commands in the 9800-CL CLI.

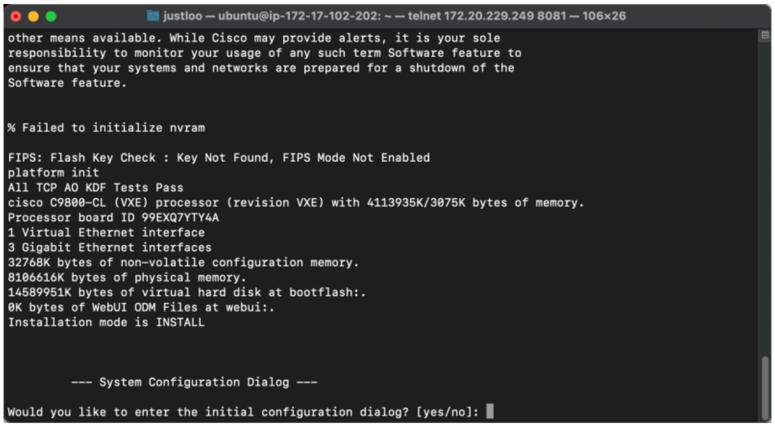
```
C9800> enable
C9800# configure terminal
C9800(config)# platform console serial
```

The mode will be available on the next reload.

Step 8. Once the 9800-CL has booted with the serial console option selected (or platform serial mode enabled), connect to the console of the 9800-CL by using Telnet to the ESXi and assigned port.


justloo — ubuntu@ip-172-17-102-202: ~ — telnet 172.20.229.249 8081 — 106×26

```
JUSTLOO-M-V2JT:~ justloo$ telnet 172.20.229.249 8081
```


justloo — ubuntu@ip-172-17-102-202: ~ — telnet 172.20.229.249 8081 — 106×26

```
other means available. While Cisco may provide alerts, it is your sole
responsibility to monitor your usage of any such term Software feature to
ensure that your systems and networks are prepared for a shutdown of the
Software feature.


% Failed to initialize nvram

FIPS: Flash Key Check : Key Not Found, FIPS Mode Not Enabled
platform init
All TCP AO KDF Tests Pass
cisco C9800-CL (VXE) processor (revision VXE) with 4113935K/3075K bytes of memory.
Processor board ID 99EXQ7YTY4A
1 Virtual Ethernet interface
3 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
8106616K bytes of physical memory.
14589951K bytes of virtual hard disk at bootflash:.
0K bytes of WebUI ODM Files at webui:.
Installation mode is INSTALL



         --- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
```

Step 9. To revert back to using the VGA console, enter the following commands and reload the 9800-CL.

```
C9800> enable
C9800# configure terminal
C9800(config)# no platform console serial
C9800(config)# platform console virtual
```

The mode will be available on the next reload.

Appendix C: Enabling and using the SR-IOV NIC in ESXi

SR-IOV (single-root I/O virtualization) introduction

SR-IOV provides the ability to partition a single physical PCI resource into virtual PCI functions which can then be injected into a VM. These network Virtual Functions (VFs) of SR-IOV improve north-south network performance by allowing traffic to bypass the host machine's network stack.

- Each virtual machine is directly assigned and given access to the physical resources (VFs) by the hypervisor (VMM).
- VMs load up specific drivers to support SR-IOV.
- The VM boots up and probes its PCIe config space to see what devices it has.
- VMM tells that it has a VF attached and indicates the HW registers for VFs to the NIC driver in the VM.

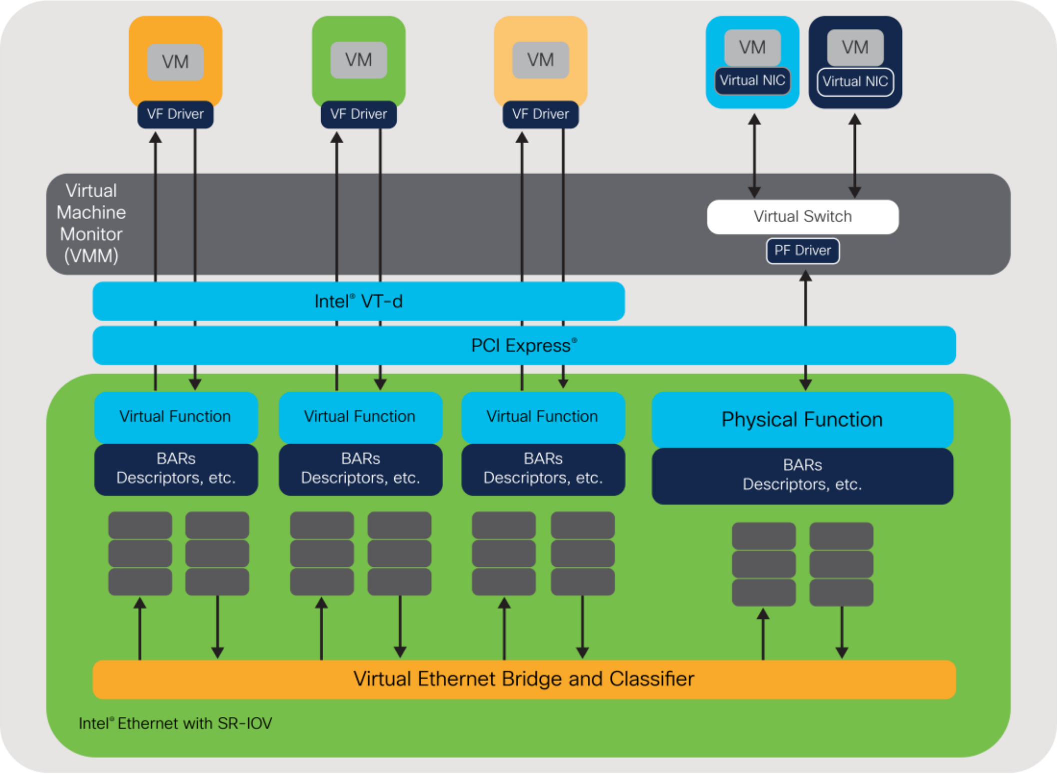
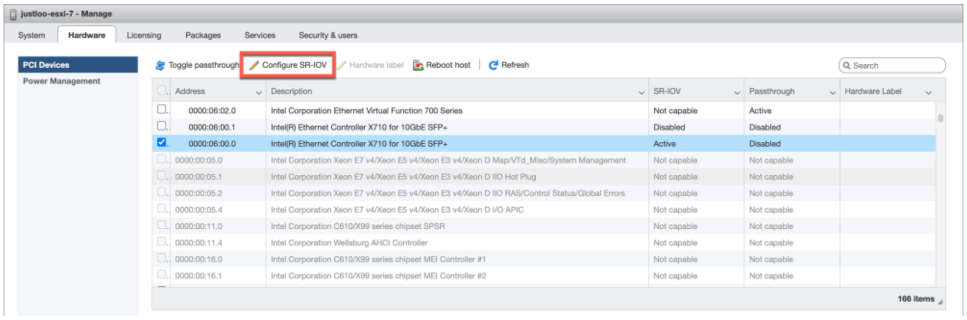


Figure 3.
Reference: Intel SR-IOV architecture

Enabling SR-IOV on the C9800-CL on ESXi

Step 1. Enable SR-IOV on the network adapter.



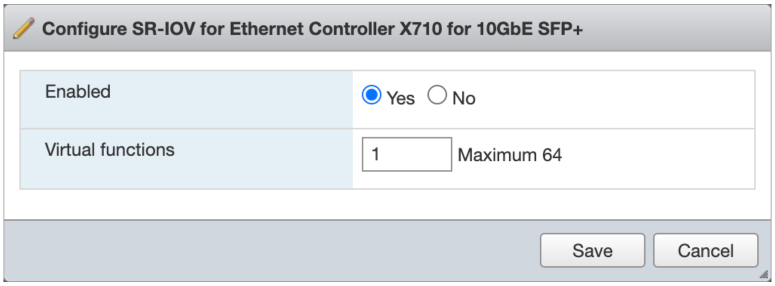
justloo-esxi-7 - Manage

	Address	Description	SR-IOV	Passthrough	Hardware Label
□	0000:06:02.0	Intel Corporation Ethernet Virtual Function 700 Series	Not capable	Active	
□	0000:06:00.1	Intel(R) Ethernet Controller X710 for 10GbE SFP+	Disabled	Disabled	
☑	0000:06:00.0	Intel(R) Ethernet Controller X710 for 10GbE SFP+	Active	Disabled	
□	0000:00:05.0	Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D Map/VTd_Misc/System Management	Not capable	Not capable	
□	0000:00:05.1	Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D IIO Hot Plug	Not capable	Not capable	
□	0000:00:05.2	Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D IIO RAS/Control Status/Global Errors	Not capable	Not capable	
□	0000:00:05.4	Intel Corporation Xeon E7 v4/Xeon E5 v4/Xeon E3 v4/Xeon D I/O APIC	Not capable	Not capable	
□	0000:00:11.0	Intel Corporation C610/X99 series chipset SPSR	Not capable	Not capable	
□	0000:00:11.4	Intel Corporation Wellsburg AHCI Controller	Not capable	Not capable	
□	0000:00:16.0	Intel Corporation C610/X99 series chipset MEI Controller #1	Not capable	Not capable	
□	0000:00:16.1	Intel Corporation C610/X99 series chipset MEI Controller #2	Not capable	Not capable	

166 items

Step 2. Enable and configure the virtual functions on the adapter.

Note: Ethernet Server Adapter X710 supports up to 32 VFs per port. Creating one VF per port gives the maximum performance. Each VF would represent a NIC.

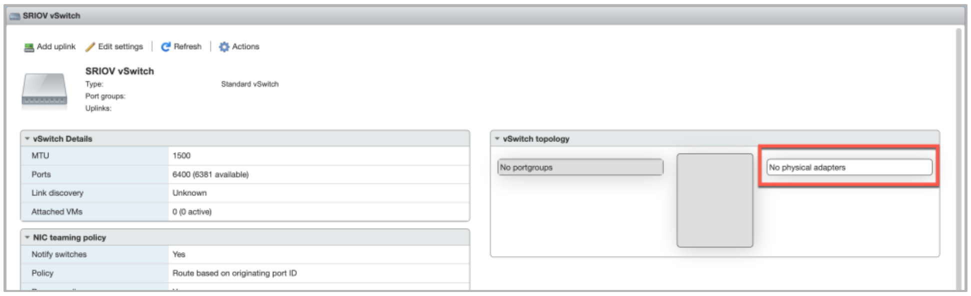


Configure SR-IOV for Ethernet Controller X710 for 10GbE SFP+

Enabled	● Yes ○ No
Virtual functions	1 Maximum 64

Step 3. Reboot the ESXi host and the SR-IOV configurations will take effect.

Step 4. Create a new virtual switch without any physical NICs attached to it.



SRIOV vSwitch

SRIOV vSwitch
Type: Standard vSwitch
Port groups:
Uplinks:

vSwitch Details

MTU	1500
Ports	6400 (6381 available)
Link discovery	Unknown
Attached VMs	0 (0 active)

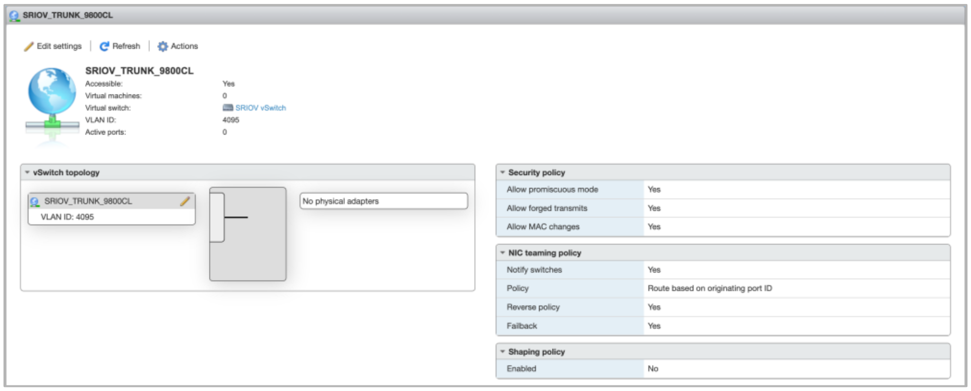
NIC teaming policy

Notify switches	Yes
Policy	Route based on originating port ID

vSwitch topology

Step 5. Create a new port group with the settings below and attach it to the newly created vSwitch. The settings below are for the WMI, which will act as a trunk port.

- VLAN ID: **4095**
- Promiscuous Mode: **Accept**
- MAC Address Changes: **Accept**
- Forged Transmits: **Accept**



SRIOV_TRUNK_9800CL

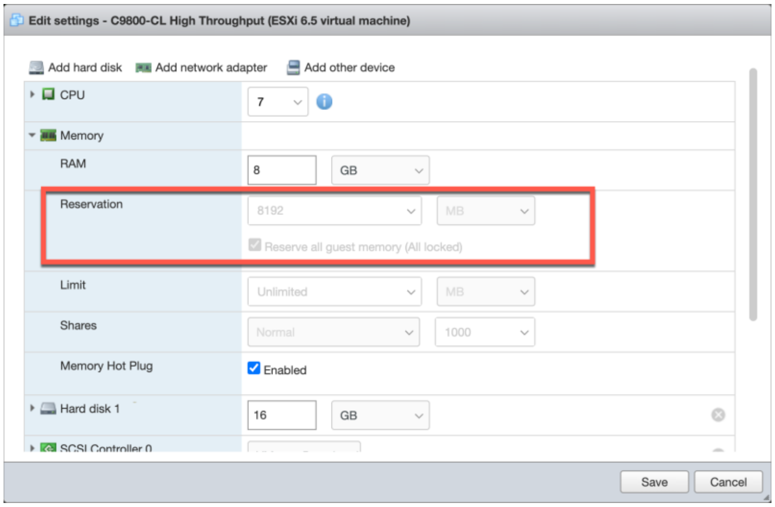
Accessible:	Yes
Virtual machines:	0
Virtual switch:	SRIOV vSwitch
VLAN ID:	4095
Active ports:	0

Security policy	
Allow promiscuous mode	Yes
Allow forged transmits	Yes
Allow MAC changes	Yes

NIC teaming policy	
Notify switches	Yes
Policy	Route based on originating port ID
Reverse policy	Yes
Failback	Yes

Shaping policy	
Enabled	No

Step 6. Edit the VM and reserve all the guest memory for the VM, which is necessary for SR-IOV. For the 9800-CL, this will be 8192 MB.

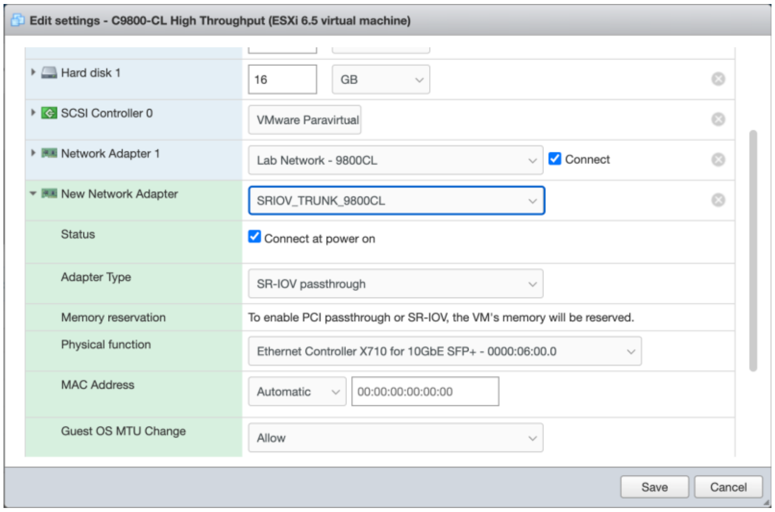


Edit settings - C9800-CL High Throughput (ESXi 6.5 virtual machine)

CPU	7	
Memory		
RAM	8	GB
Reservation	8192 ☑ Reserve all guest memory (All locked)	MB
Limit	Unlimited	MB
Shares	Normal	1000
Memory Hot Plug	☑ Enabled	
Hard disk 1	16	GB
SCSI Controller 0		

Step 7. Edit the VM, remove the network port already attached, and add a new network adapter with the following settings:

- Port group: **Set to the newly created port group**
- Adapter Type: **SR-IOV passthrough**
- Physical function: **Required Physical NIC with SR-IOV enabled**
- Guest OS MTU Change: **Allow**



Edit settings - C9800-CL High Throughput (ESXi 6.5 virtual machine)

Hard disk 1	16 GB
SCSI Controller 0	VMware Paravirtual
Network Adapter 1	Lab Network - 9800CL ☑ Connect
New Network Adapter	SRIOV_TRUNK_9800CL
Status	☑ Connect at power on
Adapter Type	SR-IOV passthrough
Memory reservation	To enable PCI passthrough or SR-IOV, the VM's memory will be reserved.
Physical function	Ethernet Controller X710 for 10GbE SFP+ - 0000:06:00.0
MAC Address	Automatic 00:00:00:00:00:00
Guest OS MTU Change	Allow

Step 8. Save the configuration and reboot the VM.

Step 9. In the Security settings, verify that the trust settings are updated correctly on the NIC.

https://kb.vmware.com/s/varticle/74909

vSwitch security policy is not persistent when SR-IOV is enabled. To work around this, SSH to ESXi.

Step 10. Use the following command to verify that the NIC is trusted and spoof check is disabled.

```
esxcli intnet sriovnic vf get -n <nic>
```

Example:

```
esxcli intnet sriovnic vf get -n vmnic2
VF ID           Trusted         Spoof Check
-----           -------         -----------
0               true            false
```

If the trust parameters are not set correctly

Step 1. Stop the C9800-CL VM at the boot prompt.

```
GNU GRUB version 0.97 (638K lower / 3143552K upper memory
+-------------------------------------------------------------------+
|   vWLC - packages.conf
|   vWLC - GOLDEN IMAGE
```

Step 2. Use the CLI to set the trust parameters using the following command:

```
esxcli intnet sriovnic vf set -t on -s off -v <vf num> -n <nic>
```

- -t sets the trust mode
- -s sets the spoof check

For firmware and driver versions prior to and including firmware version 7.0 and driver version 1.8.6, the above two steps are always needed on VM reboot.

Verified and recommended software versions

Guest OS	NIC	Driver version	Firmware	Notes
VMware Version 6.5	Intel x710	I40en 1.10.6 Plugin version 1.4.1	7.10	
VMware Version 6.5	Ciscoized x710	I40en 1.8.6 Plugin version 1.4.1	7.0	7.0 firmware and 1.8.6 driver have a trust mode persistence issue across VM reload. Issue will be fixed in subsequent firmware and driver versions.

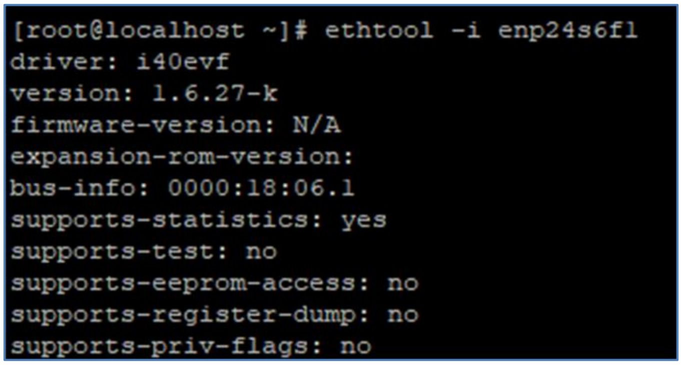
Appendix D: Enabling and using the SR-IOV NIC in KVM

Step 1. Install the latest drivers for the NIC.

The Ethernet and driver versions can be verified using the following command:

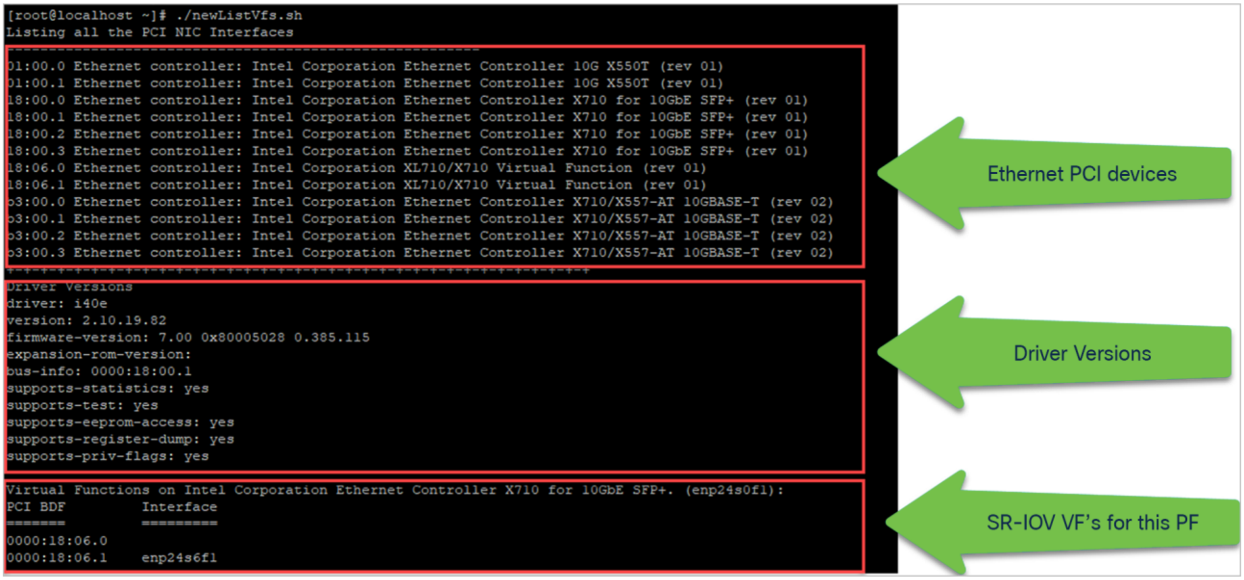
```
# ethtool -i <interface name>
```

Example output:



```
[root@localhost ~]# ethtool -i enp24s6f1
driver: i40evf
version: 1.6.27-k
firmware-version: N/A
expansion-rom-version:
bus-info: 0000:18:06.1
supports-statistics: yes
supports-test: no
supports-eeprom-access: no
supports-register-dump: no
supports-priv-flags: no
```

The script below can print all the Ethernet information followed by the driver versions and the SR-IOV VF names.



```
[root@localhost ~]# ./newListVfs.sh
Listing all the PCI NIC Interfaces
------------------------------------------------------
01:00.0 Ethernet controller: Intel Corporation Ethernet Controller 10G X550T (rev 01)
01:00.1 Ethernet controller: Intel Corporation Ethernet Controller 10G X550T (rev 01)
18:00.0 Ethernet controller: Intel Corporation Ethernet Controller X710 for 10GbE SFP+ (rev 01)
18:00.1 Ethernet controller: Intel Corporation Ethernet Controller X710 for 10GbE SFP+ (rev 01)
18:00.2 Ethernet controller: Intel Corporation Ethernet Controller X710 for 10GbE SFP+ (rev 01)
18:00.3 Ethernet controller: Intel Corporation Ethernet Controller X710 for 10GbE SFP+ (rev 01)
18:06.0 Ethernet controller: Intel Corporation XL710/X710 Virtual Function (rev 01)
18:06.1 Ethernet controller: Intel Corporation XL710/X710 Virtual Function (rev 01)
b3:00.0 Ethernet controller: Intel Corporation Ethernet Controller X710/X557-AT 10GBASE-T (rev 02)
b3:00.1 Ethernet controller: Intel Corporation Ethernet Controller X710/X557-AT 10GBASE-T (rev 02)
b3:00.2 Ethernet controller: Intel Corporation Ethernet Controller X710/X557-AT 10GBASE-T (rev 02)
b3:00.3 Ethernet controller: Intel Corporation Ethernet Controller X710/X557-AT 10GBASE-T (rev 02)
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
Driver Versions
driver: i40e
version: 2.10.19.82
firmware-version: 7.00 0x80005028 0.385.115
expansion-rom-version:
bus-info: 0000:18:00.1
supports-statistics: yes
supports-test: yes
supports-eeprom-access: yes
supports-register-dump: yes
supports-priv-flags: yes

Virtual Functions on Intel Corporation Ethernet Controller X710 for 10GbE SFP+. (enp24s0f1):
PCI BDF         Interface
=======         =========
0000:18:06.0
0000:18:06.1    enp24s6f1
```

Example output from script below:

```
#!/bin/bash
# Copy this script to a .sh file and execute
echo "Listing all the PCI NIC Interfaces "
echo --------------------------------------------------------
lspci | grep -i eth

NIC_DIR="/sys/class/net"
for i in $( ls $NIC_DIR) ;
do
        if [ -d "${NIC_DIR}/$i/device" -a ! -L "${NIC_DIR}/$i/device/physfn" ]; then
                declare -a VF_PCI_BDF
                declare -a VF_INTERFACE
                k=0
                for j in $( ls "${NIC_DIR}/$i/device" ) ;
                do
                        if [[ "$j" == "virtfn"* ]]; then
                                VF_PCI=$( readlink "${NIC_DIR}/$i/device/$j" | cut -d '/' -f2 )
                                VF_PCI_BDF[$k]=$VF_PCI
                                #get the interface name for the VF at this PCI Address
                                for iface in $( ls $NIC_DIR );
                                do
                                        link_dir=$( readlink ${NIC_DIR}/$iface )
                                        if [[ "$link_dir" == *"$VF_PCI"* ]]; then
                                                VF_INTERFACE[$k]=$iface
                                        fi
                                done
                                ((k++))
                        fi
                done
                NUM_VFs=${#VF_PCI_BDF[@]}
                if [[ $NUM_VFs -gt 0 ]]; then
                    echo +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                    echo "Driver Versions"
                        ethtool -i $i
                    echo --------------------------------------------------------------------
                        #get the PF Device Description
                        PF_PCI=$( readlink "${NIC_DIR}/$i/device" | cut -d '/' -f4 )
                        PF_VENDOR=$( lspci -vmmks $PF_PCI | grep ^Vendor | cut -f2)
                        PF_NAME=$( lspci -vmmks $PF_PCI | grep ^Device | cut -f2).
                        echo "Virtual Functions on $PF_VENDOR $PF_NAME ($i):"
                        echo -e "PCI BDF\t\tInterface"
                        echo -e "=======\t\t========="
                        for (( l = 0; l < $NUM_VFs; l++ )) ;
                        do
                                echo -e "${VF_PCI_BDF[$l]}\t${VF_INTERFACE[$l]}"
                        done
                        unset VF_PCI_BDF
                        unset VF_INTERFACE
                        echo " "
                fi
        fi
done
```

References for the firmware downloads can be found in the links below.

Firmware for Intel NIC

https://downloadcenter.intel.com/product/82947/Intel-Ethernet-Controller-X710-Series

Driver for Intel and Cisco NIC

https://downloadcenter.intel.com/download/24411/Intel-Network-Adapter-Driver-for-PCIe-40-Gigabit-Ethernet-Network-Connections-Under-Linux-?product=82947

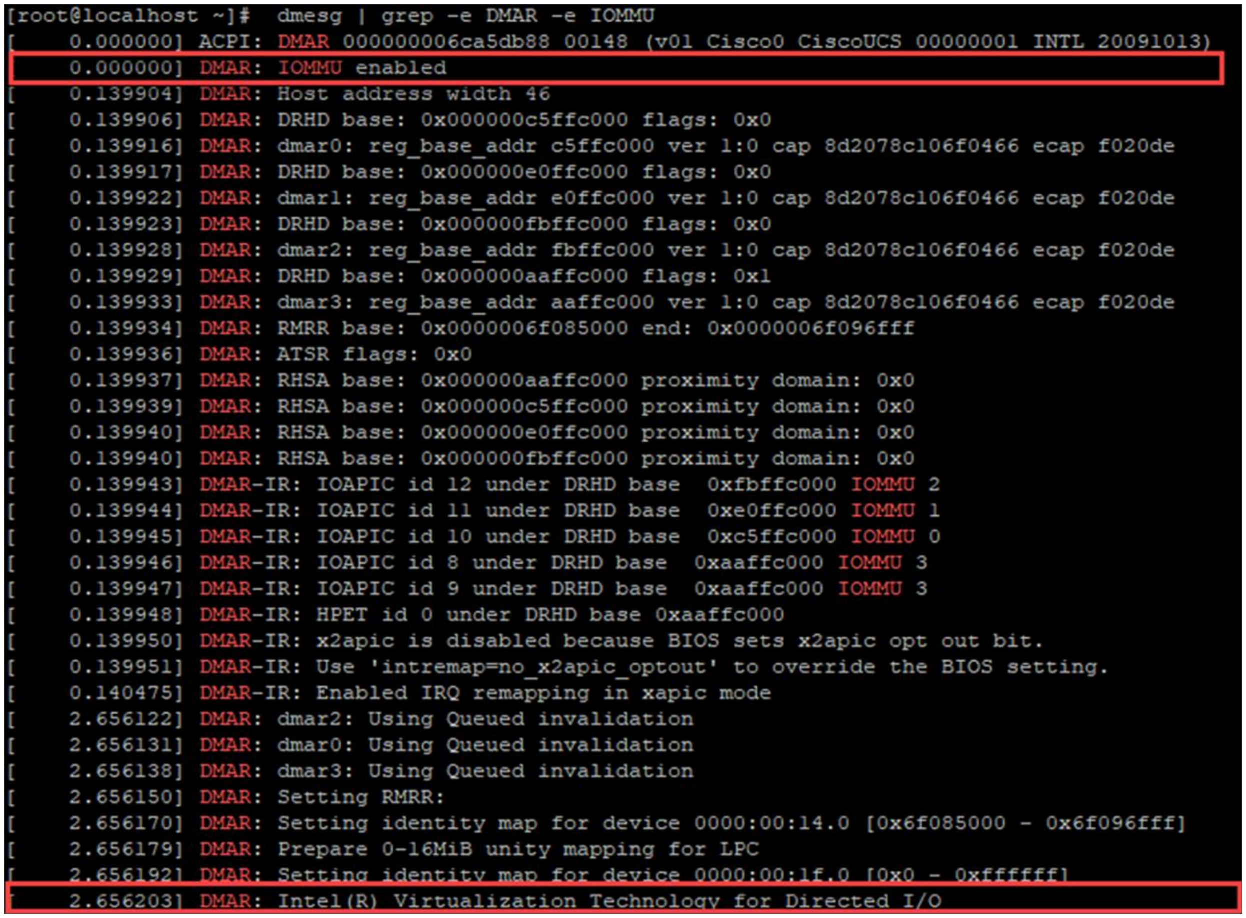
Firmware for Cisco NIC

https://www.cisco.com/c/en/us/td/docs/unified_computing/ucs/c/sw/fwp/user/guide/Firmware_Upgrade_Utility/Using.html

Step 2. Verify that the Intel VT-D support is enabled on the Linux Kernel.

Do this by running the command `dmesg | grep -e DMAR -e IOMMU`

The output should show that the IOMMU is enabled, as shown in the example below



```
[root@localhost ~]#  dmesg | grep -e DMAR -e IOMMU
[    0.000000] ACPI: DMAR 000000006ca5db88 00148 (v01 Cisco0 CiscoUCS 00000001 INTL 20091013)
[    0.000000] DMAR: IOMMU enabled
[    0.139904] DMAR: Host address width 46
[    0.139906] DMAR: DRHD base: 0x000000c5ffc000 flags: 0x0
[    0.139916] DMAR: dmar0: reg_base_addr c5ffc000 ver 1:0 cap 8d2078c106f0466 ecap f020de
[    0.139917] DMAR: DRHD base: 0x000000e0ffc000 flags: 0x0
[    0.139922] DMAR: dmar1: reg_base_addr e0ffc000 ver 1:0 cap 8d2078c106f0466 ecap f020de
[    0.139923] DMAR: DRHD base: 0x000000fbffc000 flags: 0x0
[    0.139928] DMAR: dmar2: reg_base_addr fbffc000 ver 1:0 cap 8d2078c106f0466 ecap f020de
[    0.139929] DMAR: DRHD base: 0x000000aaffc000 flags: 0x1
[    0.139933] DMAR: dmar3: reg_base_addr aaffc000 ver 1:0 cap 8d2078c106f0466 ecap f020de
[    0.139934] DMAR: RMRR base: 0x0000006f085000 end: 0x0000006f096fff
[    0.139936] DMAR: ATSR flags: 0x0
[    0.139937] DMAR: RHSA base: 0x000000aaffc000 proximity domain: 0x0
[    0.139939] DMAR: RHSA base: 0x000000c5ffc000 proximity domain: 0x0
[    0.139940] DMAR: RHSA base: 0x000000e0ffc000 proximity domain: 0x0
[    0.139940] DMAR: RHSA base: 0x000000fbffc000 proximity domain: 0x0
[    0.139943] DMAR-IR: IOAPIC id 12 under DRHD base  0xfbffc000 IOMMU 2
[    0.139944] DMAR-IR: IOAPIC id 11 under DRHD base  0xe0ffc000 IOMMU 1
[    0.139945] DMAR-IR: IOAPIC id 10 under DRHD base  0xc5ffc000 IOMMU 0
[    0.139946] DMAR-IR: IOAPIC id 8 under DRHD base  0xaaffc000 IOMMU 3
[    0.139947] DMAR-IR: IOAPIC id 9 under DRHD base  0xaaffc000 IOMMU 3
[    0.139948] DMAR-IR: HPET id 0 under DRHD base 0xaaffc000
[    0.139950] DMAR-IR: x2apic is disabled because BIOS sets x2apic opt out bit.
[    0.139951] DMAR-IR: Use 'intremap=no_x2apic_optout' to override the BIOS setting.
[    0.140475] DMAR-IR: Enabled IRQ remapping in xapic mode
[    2.656122] DMAR: dmar2: Using Queued invalidation
[    2.656131] DMAR: dmar0: Using Queued invalidation
[    2.656138] DMAR: dmar3: Using Queued invalidation
[    2.656150] DMAR: Setting RMRR:
[    2.656170] DMAR: Setting identity map for device 0000:00:14.0 [0x6f085000 - 0x6f096fff]
[    2.656179] DMAR: Prepare 0-16MiB unity mapping for LPC
[    2.656192] DMAR: Setting identity map for device 0000:00:1f.0 [0x0 - 0xffffff]
[    2.656203] DMAR: Intel(R) Virtualization Technology for Directed I/O
```

If the VT-D support is not enabled:

1. Activate Intel VT-d in the kernel by adding the `intel_iommu=on` and `iommu=pt` parameters to the end of the `GRUB_CMDLINX_LINUX` line, within the quotes, in the /etc/sysconfig/grub file.
2. Regenerate /etc/grub2.cfg by running:

```
grub2-mkconfig -o /etc/grub2.cfg
```

3. **Reboot** the system to enable the changes. The system is now capable of PCI device assignment.

Step 3. Configure SR-IOV VFs on the NIC.

In step 1, if the VF is not seen in the output of the script, enable it using the following commands:

Configure VF on the NIC:

```
# echo 1 > /sys/class/net/enp129s0f0/device/sriov_numvfs
```

Create one VF per port for maximum performance.

Configure spoofcheck, trust mode, and MAC using the commands below:

```
# ip link set dev enp129s0f0 vf 0 trust on
# ip link set enp129s0f0 vf 0 spoofchk off
# ip link set enp129s0f0 vf 0 mac 3c:fd:fe:de:cc:bc
```

Verify the settings using the command below:

```
# ip link show <nic name>
```

Example:

```
[root@localhost ~]# ip link show enp129s0f0
6: enp129s0f0: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT group
default qlen 1000
    link/ether 3c:fd:fe:de:01:bc brd ff:ff:ff:ff:ff:ff
    vf 0 MAC 3c:fd:fe:de:cc:bc, spoof checking off, link-state auto, trust on
```

Step 4. SR-IOV setting persistence:

SR-IOV configurations configured in the above way are not persistent across the reboots. To fix this, the above configuration can be run as a service that is auto enabled on host reboots.

1. Create a bash script with the commands to be persisted, for example, in **`/usr/bin/sriov-config`**. Write the script in /usr/bin/sriov-config :

```
#!/bin/sh
echo 1 > /sys/class/net/enp129s0f0/device/sriov_numvfs
ip link set dev enp129s0f0 vf 0 trust on
ip link set enp129s0f0 vf 0 spoofchk off
ip link set enp129s0f0 vf 0 mac 3c:fd:fe:de:cc:bc
```

2. Repeat the above for all VFs.
3. Provide execute permission for the script:

```
# chmod 777 /usr/bin/sriov-config
```

4. Create the system service: Define a new systemd service to be executed at the end of boot. This service executes the bash script which has the required SR-IOV commands, as shown in step 1.

Note: "**`ExecStart=/usr/bin/sriov-config`**" given below executes the script.

To create the system service, make a new file "**`sriov.service`**" in **`/usr/lib/systemd/system`** with the following content:

```
[Unit]
Description=SR-IOV configuration
After=rc-local.service
Before=getty.target
[Service]
Type=oneshot
ExecStart=/usr/bin/sriov-config
[Install]
WantedBy=multi-user.target
```

Step 5. Enable and start the service using:

```
# systemctl --now enable sriov.service
```

This command will start the service immediately and also ensures that the service runs every time the host reboots.

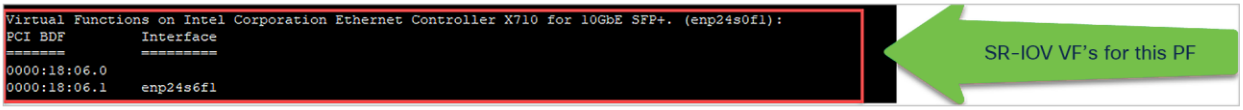
Reference: The SR-IOV configuration for KVM is explained at:

https://www.intel.com/content/www/us/en/embedded/products/networking/xl710-sr-iov-config-guide-gbe-linux-brief.html

Step 6. Attach the SR-IOV to the C9800-CL:

Attaching to a new VM using the command line

Add the PCI VF devices using the host device command. Using the script from step 1, note the PCI BDF number and use that to attach the devices.



```
Virtual Functions on Intel Corporation Ethernet Controller X710 for 10GbE SFP+. (enp24s0f1):
PCI BDF         Interface
=======         =========
0000:18:06.0
0000:18:06.1    enp24s6f1
```

Appendix E: Resetting the 9800-CL to the factory default

All 9800-CL deployments except those using the OVA file with vCenter

Step 1. To reset the 9800-CL instance to the factory default, use the following commands:

```
C9800-CL# wr erase
Erasing the nvram filesystem will remove all configuration files! Continue? [confirm]
[OK]
Erase of nvram: complete
```

Step 2. Reload the box and enter **no** at the **Save configuration** prompt.

```
C9800-CL# reload
System configuration has been modified. Save? [yes/no]: no
Reload command is being issued on Active unit, this will reload the whole stack
Proceed with reload? [confirm]
```

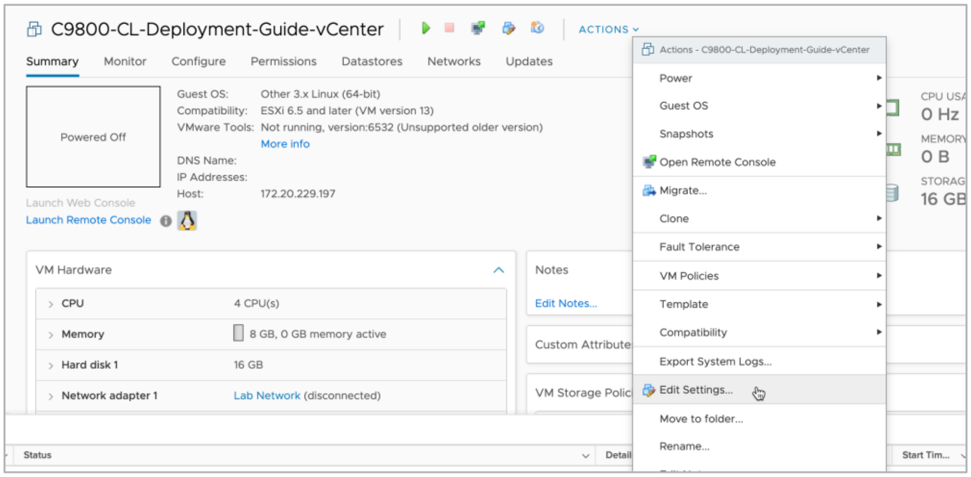
Step 3. Then press Enter at the second prompt. The box will reload and come up with the default configuration.

9800-CL deployments using the OVA file with vCenter

If the 9800-CL was deployed using the OVA file via ESXi vCenter, there is a configuration bootstrap that will always get applied, so “wr erase” and “reload” will not bring the box to the default configuration.

Step 1. Power off the 9800-CL VM.

Step 2. Go to **Edit Settings**.



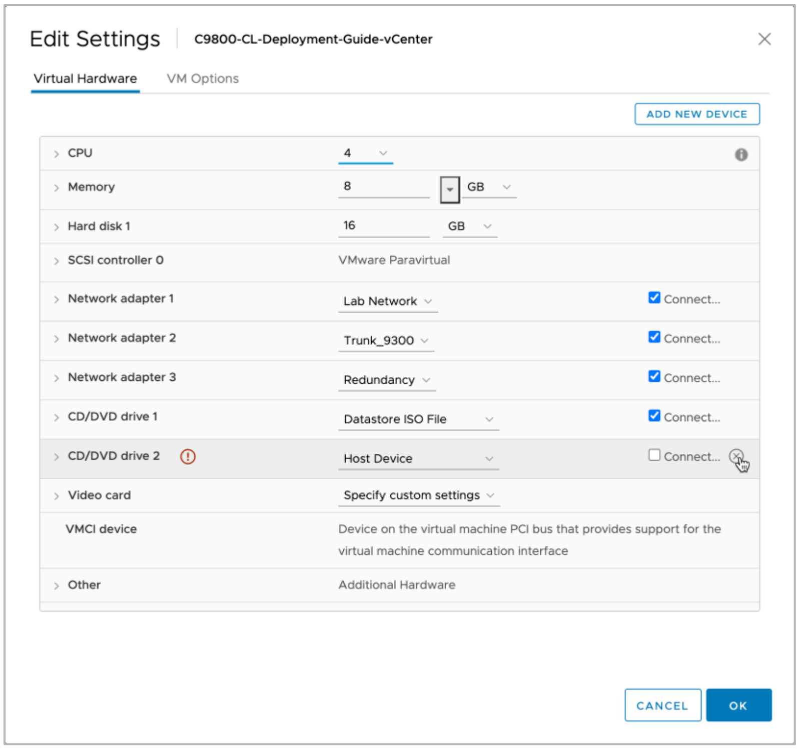
Guest OS: Other 3.x Linux (64-bit)
Compatibility: ESXi 6.5 and later (VM version 13)
VMware Tools: Not running, version:6532 (Unsupported older version)
More info
DNS Name:
IP Addresses:
Host: 172.20.229.197

CPU USA 0 Hz
MEMORY 0 B
STORAG 16 GB

VM Hardware

CPU	4 CPU(s)
Memory	8 GB, 0 GB memory active
Hard disk 1	16 GB
Network adapter 1	Lab Network (disconnected)

Step 3. Under **CD/DVD drive 2**, click the X icon to delete. This stores the bootstrap configuration configured during deployment. Deleting it enables the 9800-CL to reset to the factory defaults.



CPU	4	
Memory	8 GB	
Hard disk 1	16 GB	
SCSI controller 0	VMware Paravirtual	
Network adapter 1	Lab Network	☑ Connect...
Network adapter 2	Trunk_9300	☑ Connect...
Network adapter 3	Redundancy	☑ Connect...
CD/DVD drive 1	Datastore ISO File	☑ Connect...
CD/DVD drive 2	Host Device	□ Connect...
Video card	Specify custom settings	
VMCI device	Device on the virtual machine PCI bus that provides support for the virtual machine communication interface	
Other	Additional Hardware	

Step 4. Click **OK** to save the changes.

Step 5. Follow the steps outlined at the beginning of this appendix to reset the 9800-CL to factory defaults.

Appendix F: 9800-CL CLI reference

```
C9800-CL# show platform software vnic-if interface-mapping
-------------------------------------------------------------
 Interface Name        Driver Name         Mac Addr
-------------------------------------------------------------
 GigabitEthernet1       net_vmxnet3        0050.5693.1d6e
```

```
C9800-CL# show int gig 1
GigabitEthernet1 is up, line protocol is up
 Hardware is CSR vNIC, address is 0050.5693.1d6e (bia 0050.5693.1d6e)
```

```
C9800-CL# show ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet1       unassigned      YES unset  up                    up
Capwap1                unassigned      YES unset  up                    up
Capwap2                unassigned      YES unset  up                    up
Capwap3                unassigned      YES unset  up                    up
Vlan1                  unassigned      YES NVRAM  administratively down down
Vlan10                 10.10.1.2       YES NVRAM  up                    up
Vlan118                172.20.228.41   YES NVRAM  up                    up
```

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