Virtual Wireless LAN Controller Deployment Guide 8.2

Revised: January 11, 2018,

Introduction

Prior to release 7.4, WirelessLAN (WLAN) controller software ran on dedicated hardware you were expected to purchase. The Virtual WirelessLAN Controller (vWLC)runs on general hardware under an industry standard virtualization infrastructure. The vWLC is ideal for small and mid-size deployments with a virtual infrastructure and require an on-premises controller. Distributed branch environments can also benefit with a centralized virtual controller with fewer branches required (up to 200).

vWLCs are not a replacement of shipping hardware controllers. The function and features of the vWLC offer deployment advantages and benefits of controller services where data centers with virtualization infrastructure exist or are considered.

Advantages of the vWLC

- Flexibility in hardware selection based on your requirements.
- Reduced cost, space requirements, and other overheads since multiple boxes can be replaced with single hardware running multiple instances of virtual appliances.

New Features in 8.2

The new features in 8.2 are:

1. Increased scale support for Small and Large vWLC Deployment in the private cloud for simplified operations, flexible deployments and pay as you grow model
    1. Small vWLC supports 200 access points
    2. Large vWLC supports 3000 access points
2. Support for Smart Licensing for vWLC - Provide cloud based license visibility on what the customer owns and what the customer is using, this improves visibility, reduced activation complexity, and optimal utilization.

Features Not Supported on Cisco Virtual WLCs (as of 8.2.100.0 and below)

- Internal DHCP server
- TrustSec SXP
- Access points in local mode
- Mobility/Guest Anchor
- Multicast
- Cisco WLC integration with Lync SDN
- FlexConnect Central Switching

Note FlexConnect Local Switching is supported.

Note FlexConnect local-switched multicast traffic is bridged transparently for both wired and wireless on the same VLAN. FlexConnect access points do not limit traffic based on IGMP or MLD snooping.

High Availability Features not Supported

- AP SSO HA
- N+1 HA (CSCuf38985)

Note When an AP moves from one vWLC to another, it may refuse to join the second vWLC. It occurs when the server hardware fails, or a new instance of vWLCs are created. It is recommended to implement server mirroring scheme at the VMware level such as vMotion or some orchestrator. It is highly recommended to retain a snapshot of the VM instance, one from the mobility domain to which access points have joined previously. Then use the snapshot to start the vWLC instance. Access points then join the vWLC. This method can be also be used for priming access points instead of a physical controller.

- PMIPv6
- Workgroup Bridges
- Client downstream rate limiting for central switching
- SHA2 certificates

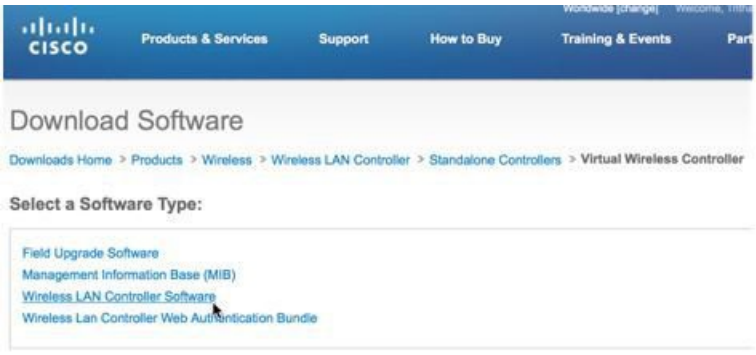
Hardware Requirement for Virtual Wireless LAN Controller Version 8.2

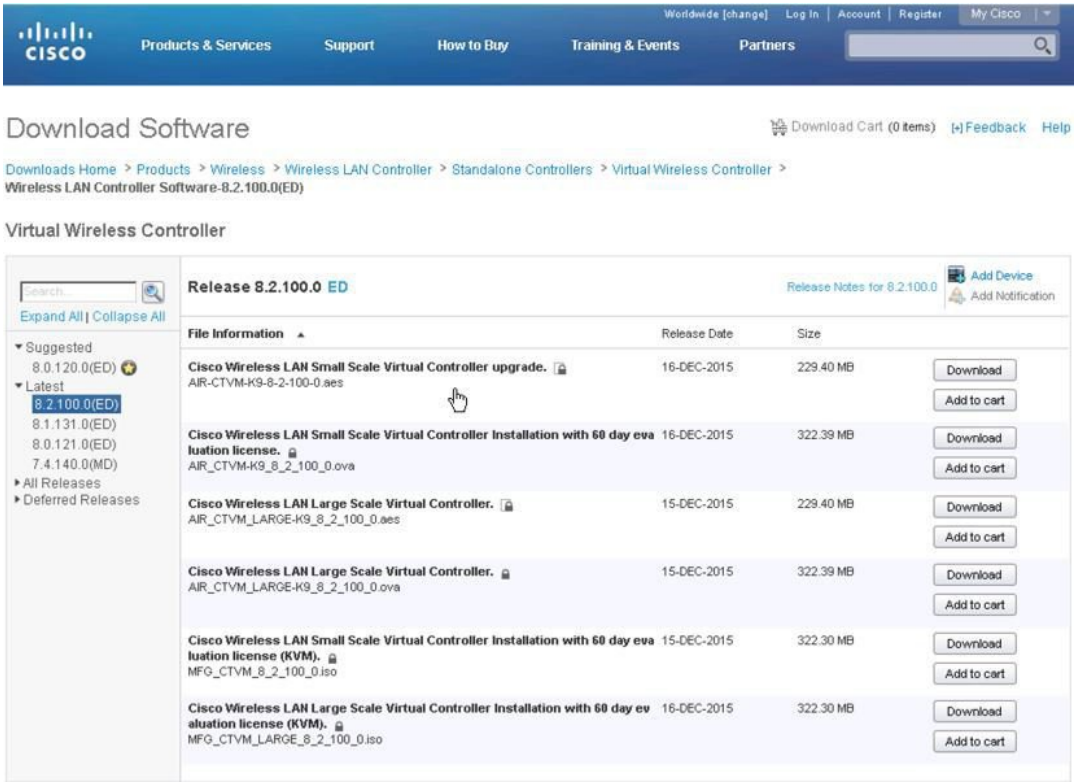
Settings	Small	Large
Minimum Number of vCPUs	1	2
Minimum Memory	2 GB	8 GB
Required Storage	8 GB	8 GB
Minimum Number of VMNICs	2	2
Maximum Access Points	200	3000
Maximum Clients Support	6000	32000
Upgrade to Small*	Yes	No
Upgrade to Large*	No	Yes

* Upgrades are supported on the same platform.

Download Cisco Virtual Wireless LAN Controller

Download the latest 8.x software from: https://software.cisco.com/download/type.html?mdfid=284464214&i=rm





For software release 8.2, virtual wireless controllers will be offered in 2 types of deployment, SMALL or LARGE, in *aes (software upgrade) or *.ova (VMware) or *.iso (KVM) format. Refer to the HW requirement needed to support the target deployment.

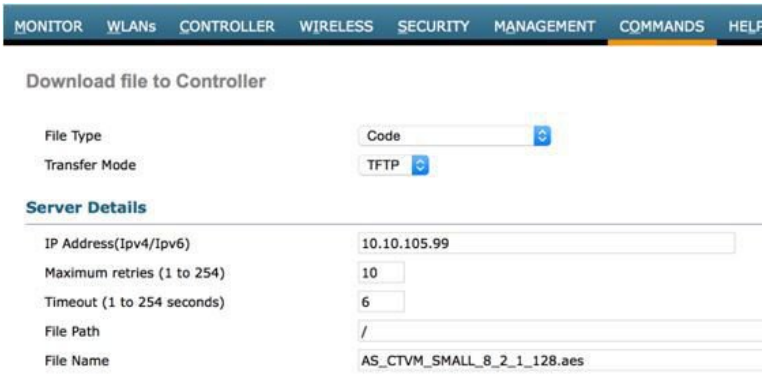
Software upgrade is *.aes format.

Cisco Wireless LAN Small Scale Virtual Controller upgrade
AIR-CTVM-K9-8-2-100-0.aes

Cisco Wireless LAN Large Scale Virtual Controller
AIR_CTVM_LARGE-K9_8_2_100_0.aes

To upgrade existing vWLC, use the *.aes software and go through the normal upgrade process of WLCs.

Note vWLC upgrade supports only of the same type (e.g. Small to Small, Large to Large). Mixed is not supported (e.g. Small to Large, or Large to Small).



For installing NEW virtual wireless controllers on VMware, use *.ova.

Cisco Wireless LAN Small Scale Virtual Controller Installation with 60 day evaluation license
AIR_CTVM-K9_8_2_100_0.ova
Cisco Wireless LAN Large Scale Virtual Controller
AIR_CTVM_LARGE-K9_8_2_100_0.ova

For installing NEW virtual wireless controllers on KVM, use *.iso.

Cisco Wireless LAN Small Scale Virtual Controller Installation with 60 day evaluation license (KVM)
MFG_CTVM_8_2_100_0.iso
Cisco Wireless LAN Large Scale Virtual Controller Installation with 60 day evaluation license (KVM)
MFG_CTVM_LARGE_8_2_100_0.iso

VMware Virtual Machine

This document is an update for vWLC based on the CUWN 8.2 software release and the support for VMware ESX. VMware is supported in Cisco Wireless Release 7.4 and later releases.

VMware Prerequisite for Hosting Virtual WLC (vWLC)

Following are the VMware prerequisites for hosting vWLC:

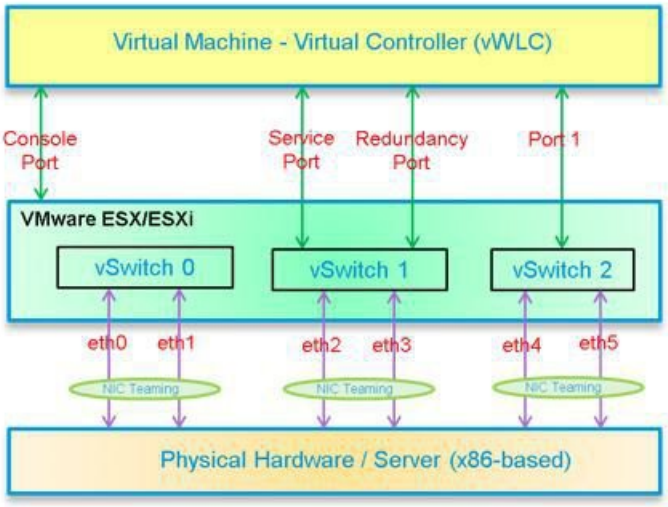
- Minimum of 2 G (small) or 8 G (large) memory
- Minimum of 1 vCPU (small) or 2 vCPU (large)
- Minimum of 2 network interfaces
- Required storage of 8 G

In ESXi, configure the appropriate networking needed to support vWLC. The recommendation is to use a trunk for Dataport, and an optional access port for the Service Port*, such as the example below:

Note * vWLC service port can be used to enable the feature of Simplified initial (or day 0 Controller Provisioning setup) for Cisco WLCs. This provides an alternate setup using a client browser and following a minimal set of steps. By using the simplified setup, best practices defaults including RF parameter optimization and network profiles are enabled.

Virtual Controller Virtual Interfaces

- Management Interface
- Virtual Interface
- Dynamic Interface
- AP Manager Interface



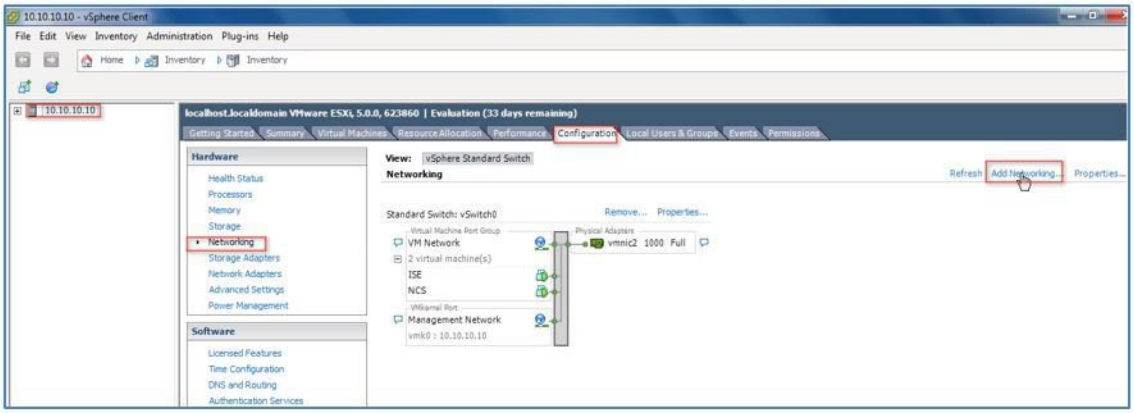
Switch Interface Configuration Connected to UCS Server

A sample configuration of the Cisco Catalyst interface connection to the ESXi server for the virtual switch as trunk interface. Management interface can be connected to an access port on the switch.

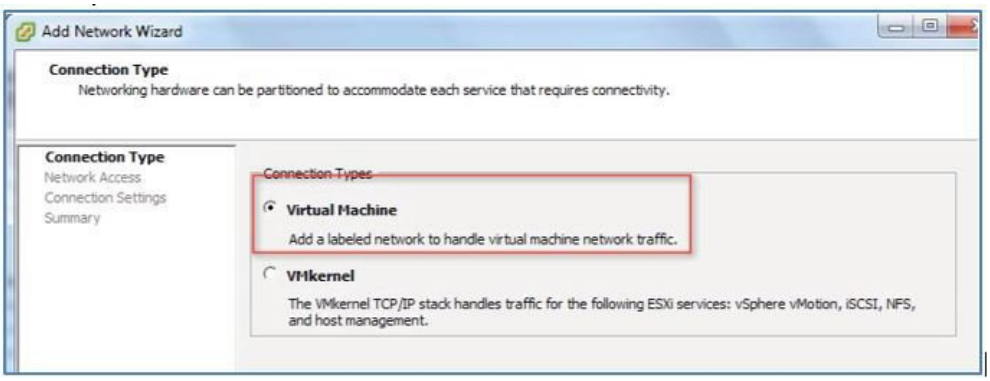
```
interface GigabitEthernet1/1/2
description ESXi Management
 switchport access vlan 10
 switchport mode access
!
interface GigabitEthernet1/1/3
 description ESXi Trunk
 switchport trunk encapsulation dot1q
 switchport mode trunk
end
```

Procedure

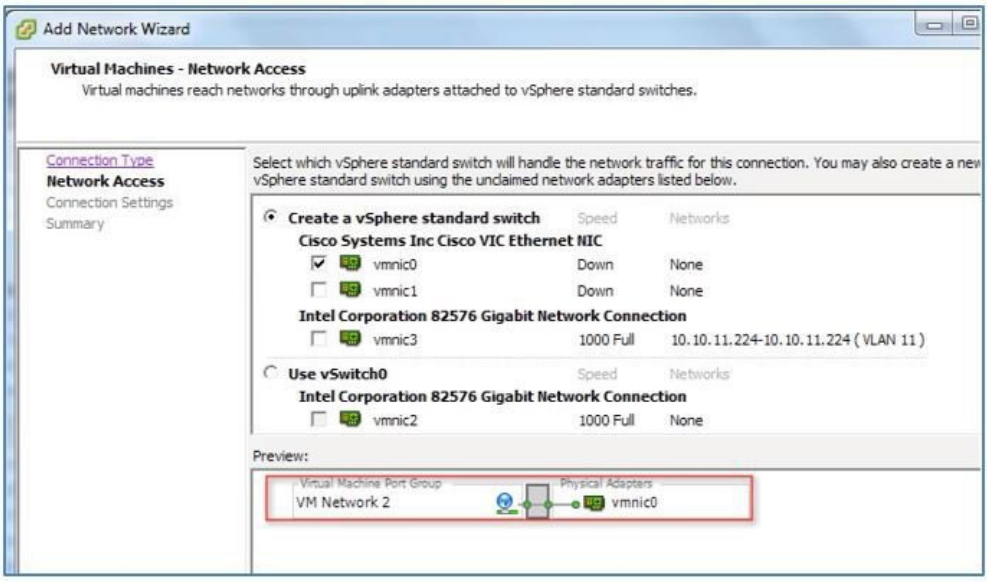
Step 1 Create two separate virtual switches to map to the virtual controller Service and Data Port. Navigate to **ESX > Configuration > Networking** and click **Add Networking**.



Step 2 Select **Virtual Machine** and click **Next**.



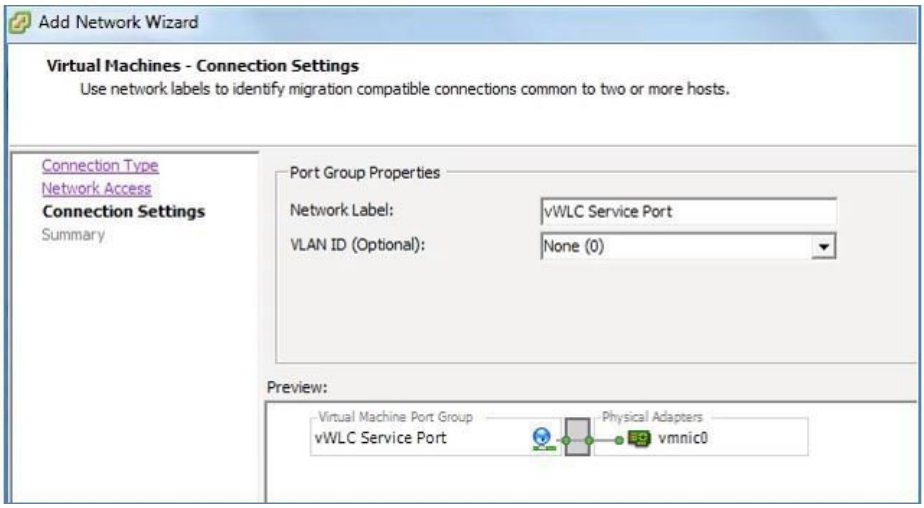
Step 3 Create a vswitch, and assign a physical NIC to connect vWLC service port. The service port does not have to be connected to any part of the network (typically disconnected/unused), therefore any NIC (even disconnected), can be used for this vswitch.



Step 4 Click **Next** to continue.

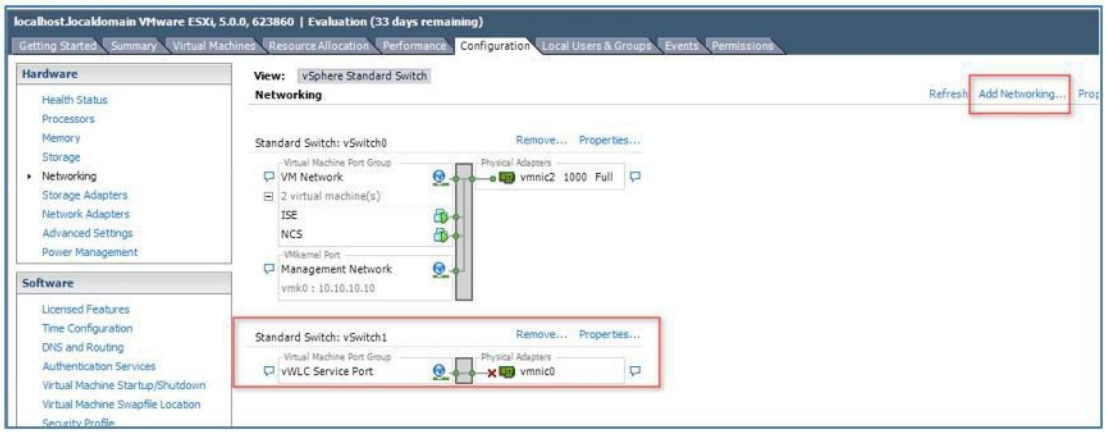
Step 5 Provide a Label, such as the example below,
E.g. 'vWLC Service Port'.

Step 6 Select VLAN ID to be 'None (0)', as typically service port is an access port.



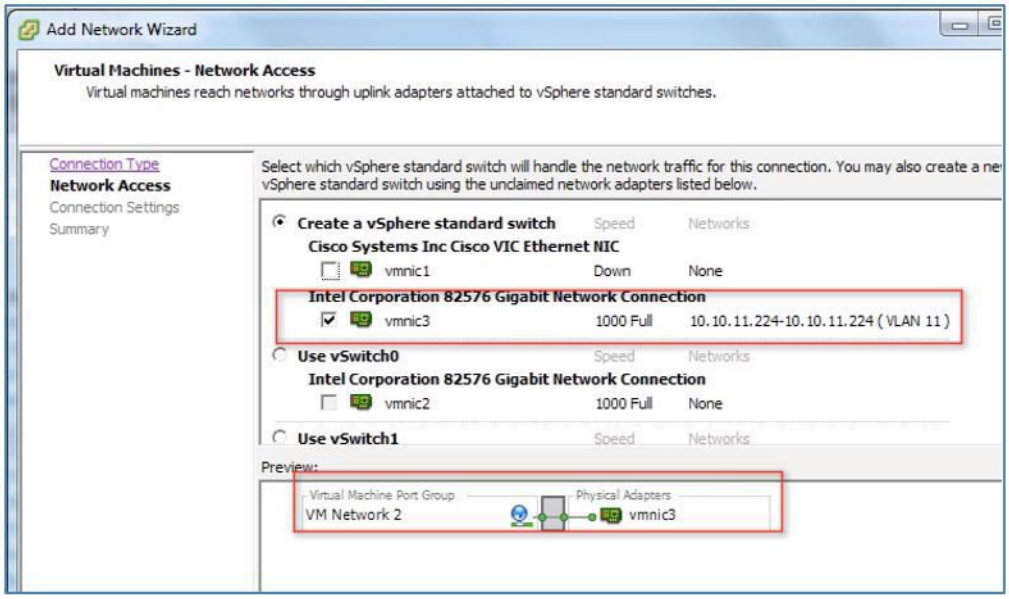
Step 7 Click **Next** to continue.

Step 8 In the below screenshot, we see vSwitch1 created for 'vWLC Service Port'. Click on 'Add Networking' to repeat for the Data Port.



For the new vSwitch, select the physical NIC(s) connected on a trunk port if there are multiple NICs / portgroup assigned to an etherchannel on the switch.

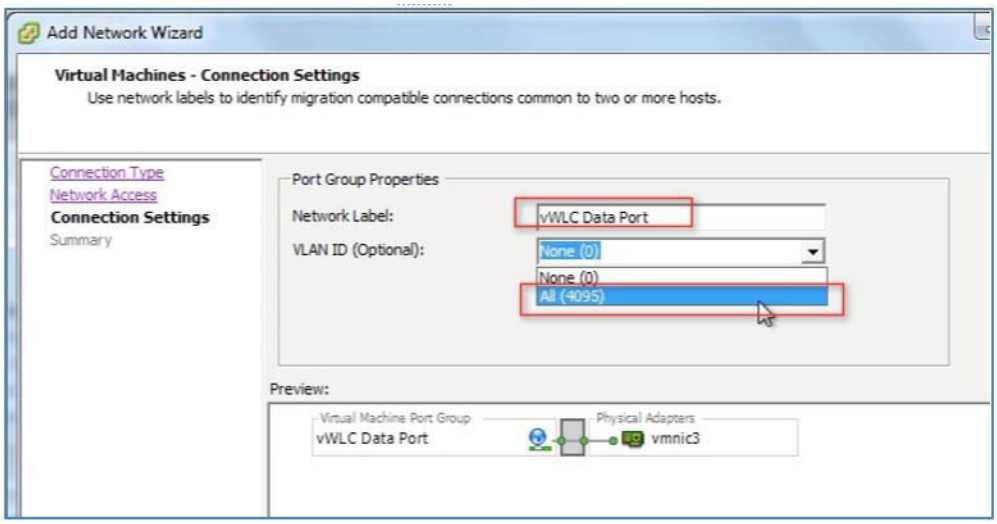
Step 9 Add the NIC.



Step 10 Click **Next** to continue.

Step 11 Provide a label, e.g. 'vWLC Data Port'.

Step 12 For VLAN ID, select **ALL(4095)** since this is connected to a switch trunk port.



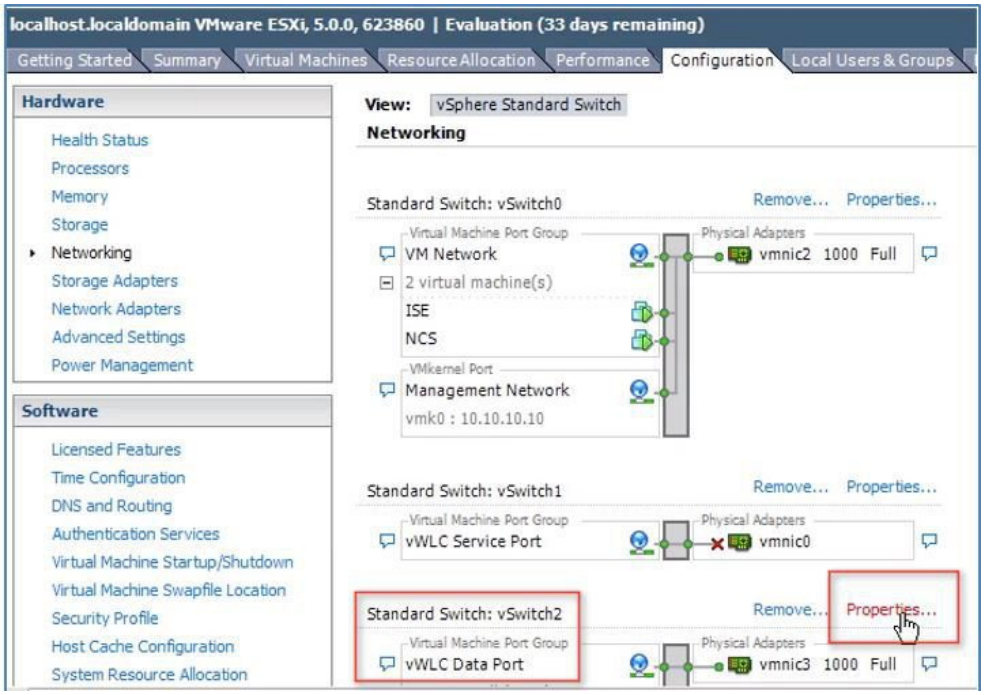
Step 13 Click Next until completing the steps to add the vswitch.

VMware Promiscuous Mode Definition— Promiscuous mode is a security policy which can be defined at the virtual switch or portgroup level in vSphere ESX/ESXi. A virtual machine, Service Console or VMkernel network interface in a portgroup which allows use of promiscuous mode can see all network traffic traversing the virtual switch.

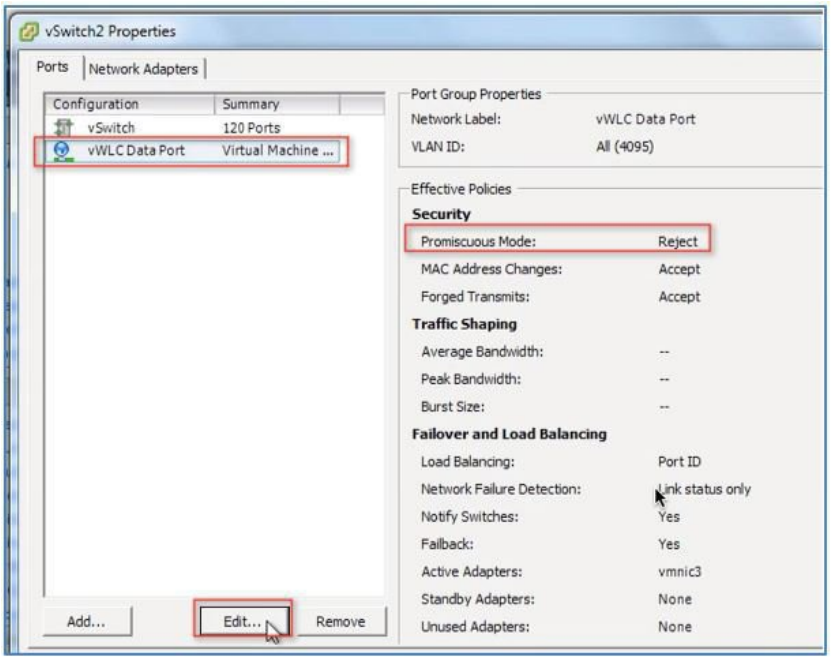
By default, a guest operating system's virtual network adapter only receives frames that are meant for it. Placing the guest's network adapter in promiscuous mode causes it to receive all frames passed on the virtual switch that are allowed under the VLAN policy for the associated portgroup. This can be useful for intrusion detection monitoring or if a sniffer needs to to analyze all traffic on the network segment.

The vWLC Data Port requires the assigned vSwitch to accept Promiscuous mode for proper operations.

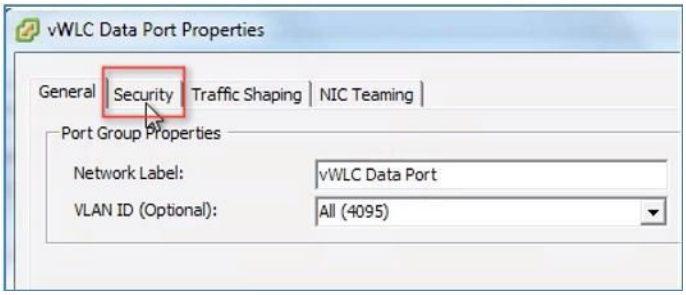
Step 14 Locate vSwitch2 (assigned for vWLC Data Port), and click **Properties**.



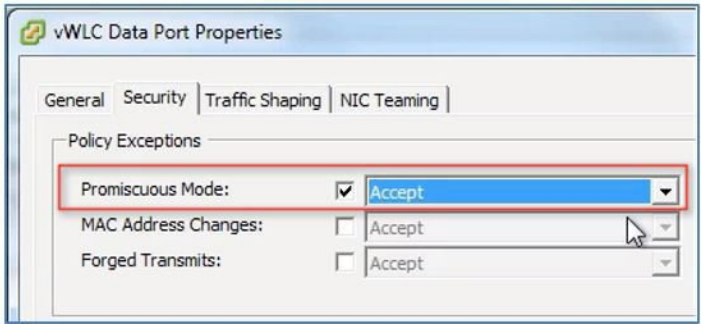
Step 15 Select the VMNet assigned to the vWLC Data Port, note the default Security Promiscuous Mode is set to Reject and click **Edit**.



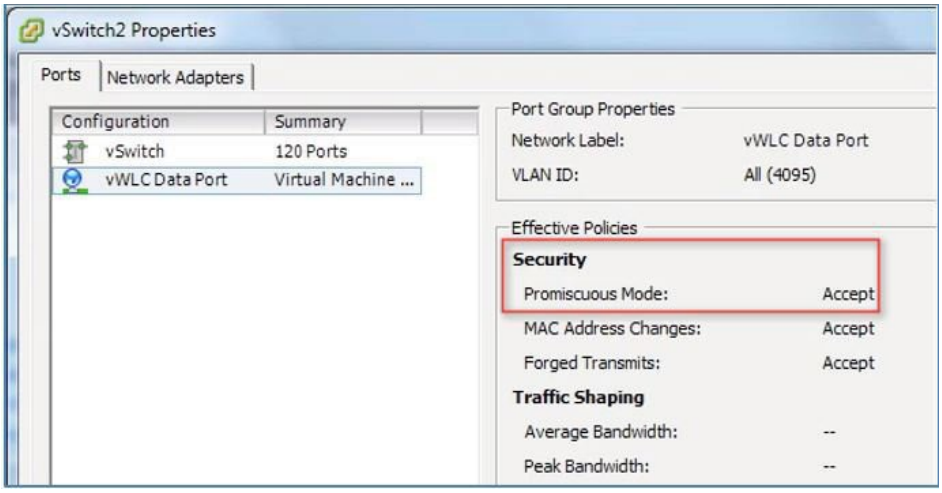
Step 16 In properties, select Security tab.



Step 17 Check the box for Promiscuous Mode and select **Accept**. Click OK.



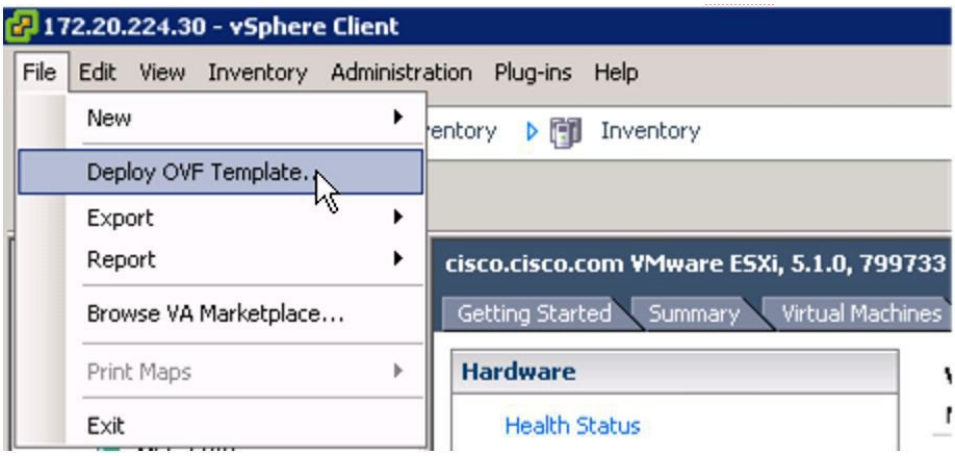
Step 18 Confirm the change and click Close to continue.



The virtual controller software will be posted as .ova package in the Cisco software center. Customers can download the .ova package and install similar to any other virtual application. Software comes with a free-60 day evaluation license. After the VM is started, the evaluation license can be activated and later a purchased license can be automatically installed and activated.

Step 19 Download the virtual controller OVA image to the local disk.

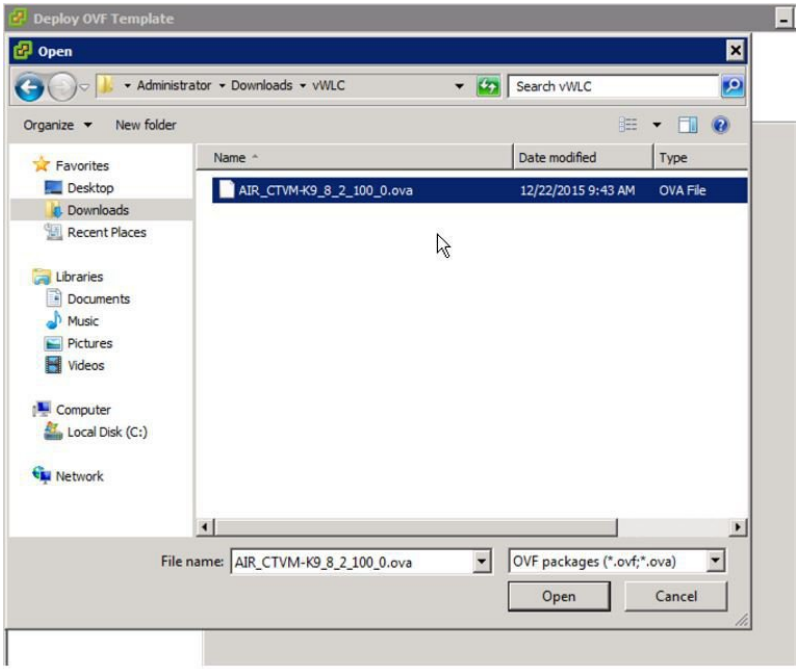
Step 20 Use **vSphere client > Deploy OVF Template** to deploy vWLC.



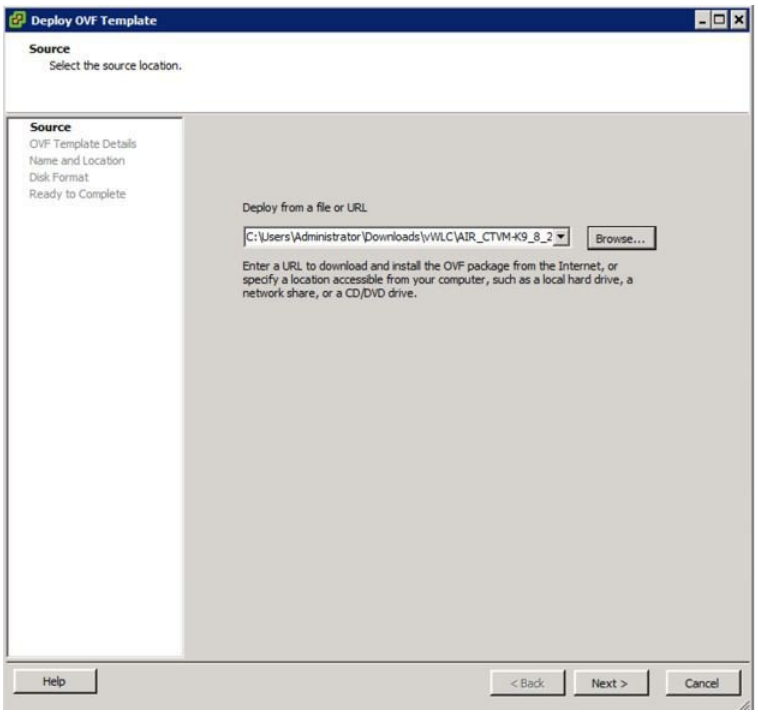
Deploying vWLC OVA

Procedure

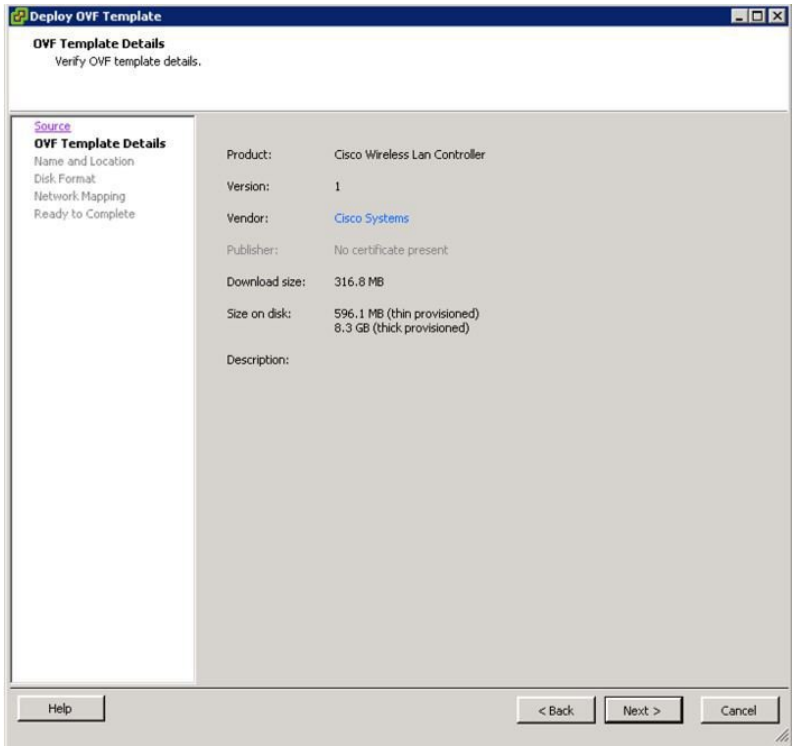
Step 1 Use either SMALL or LARGE *.ova that was downloaded and extracted to local storage.



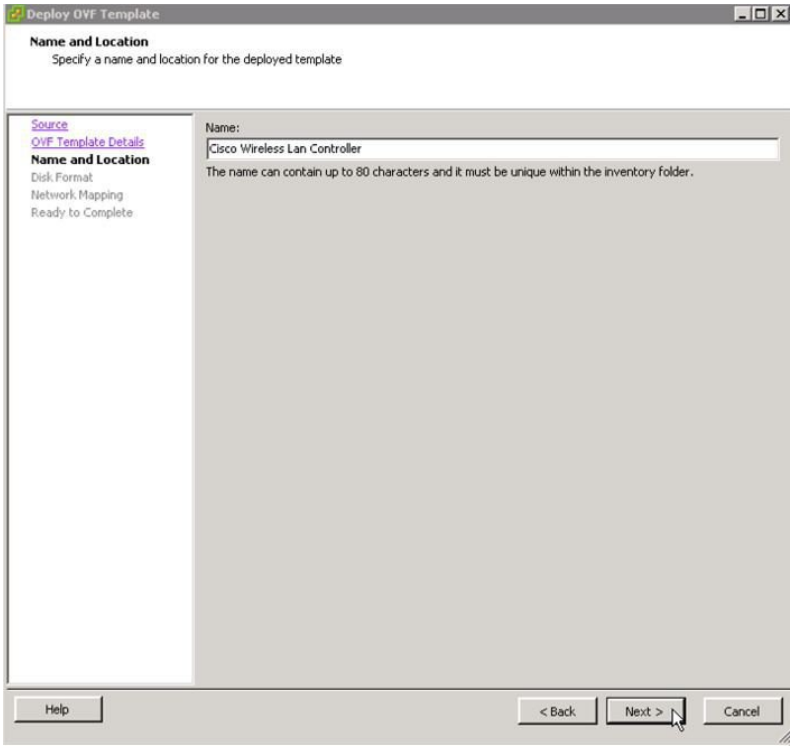
Step 2 Specify the target OVF file, and click **Next**.



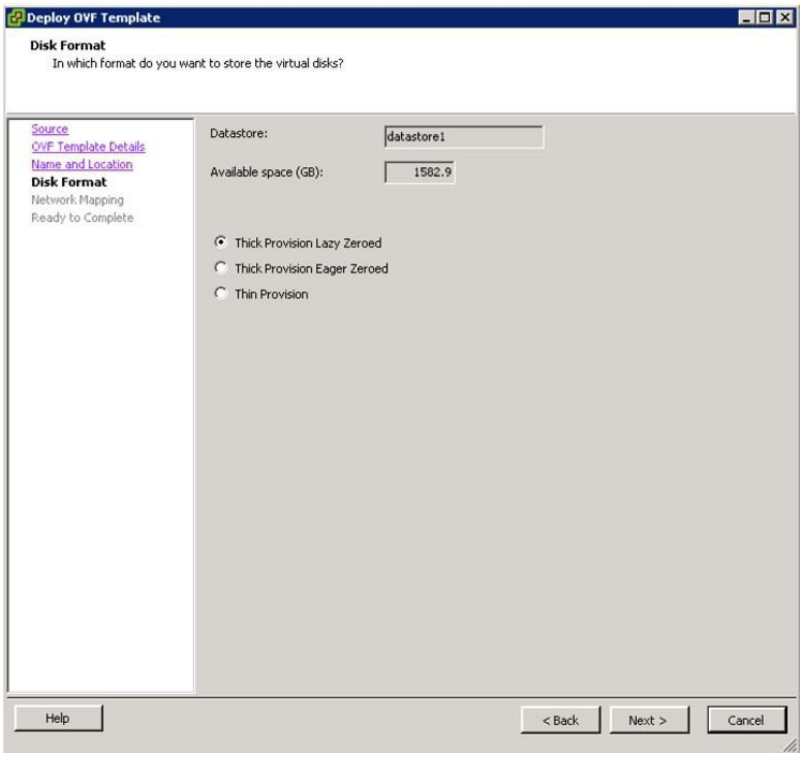
Step 3 The target OVF will display the detail of vWLC being configured, no changes are required, and click Next.



Step 4 Provide a name for the vWLC instance that will be created, and click Next.

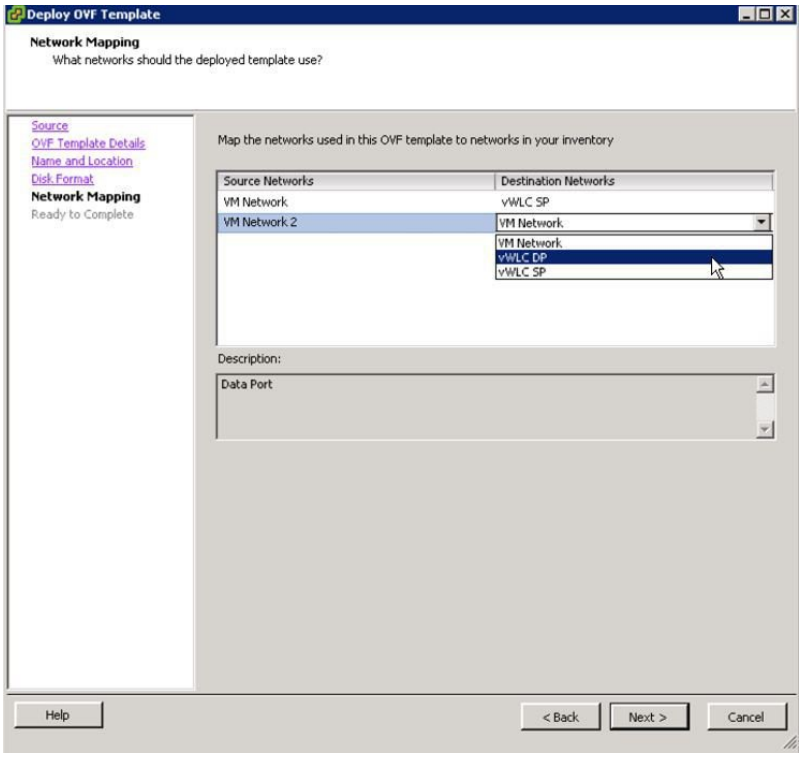


Step 5 Leave default in the Disk Format, which is Thick Provision Lazy Zeroed, and click Next.

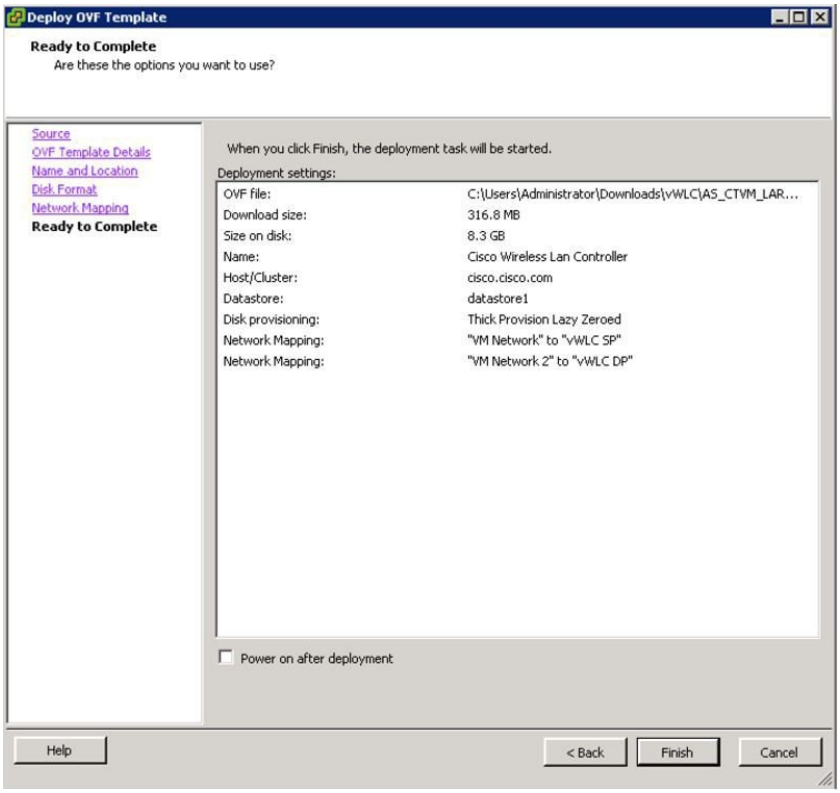


Step 6 In the Network Mapping, note that there are 2 source Networks, predefined as Service Port and Data Port (also labeled in the description). Map these interfaces as required in the Destination Networks, and click Next.

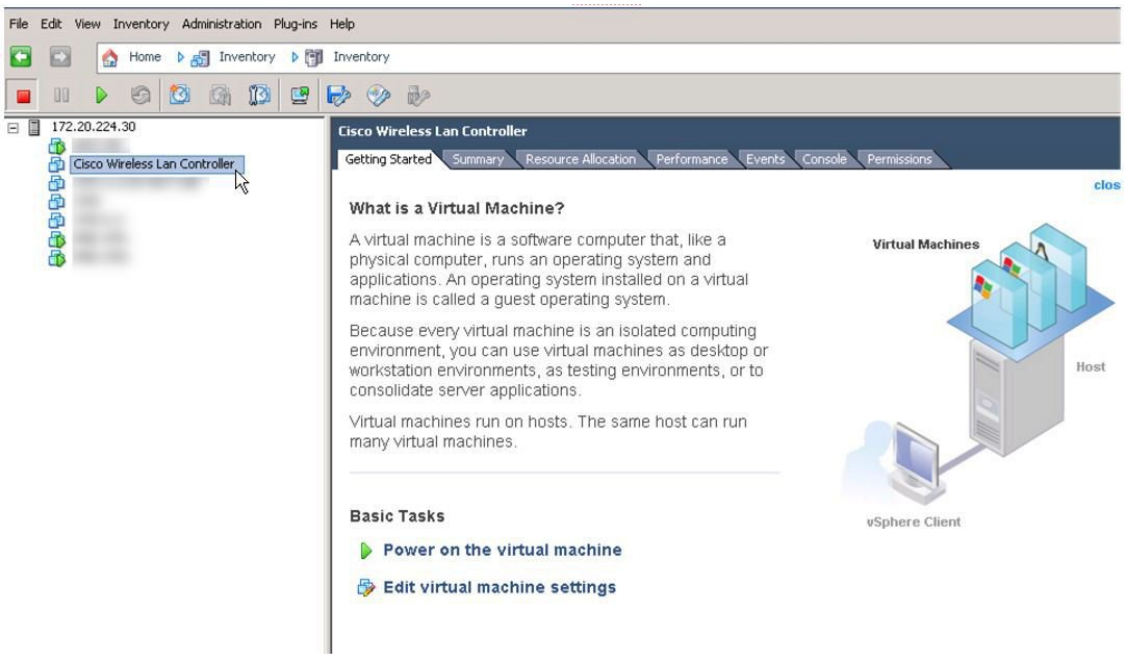
Note A reminder that the Simplified Controller Provisioning is enabled for new vWLC, using a web browser. A client PC wired connected to the Service Port segment will be able to access this feature upon installing vWLC.



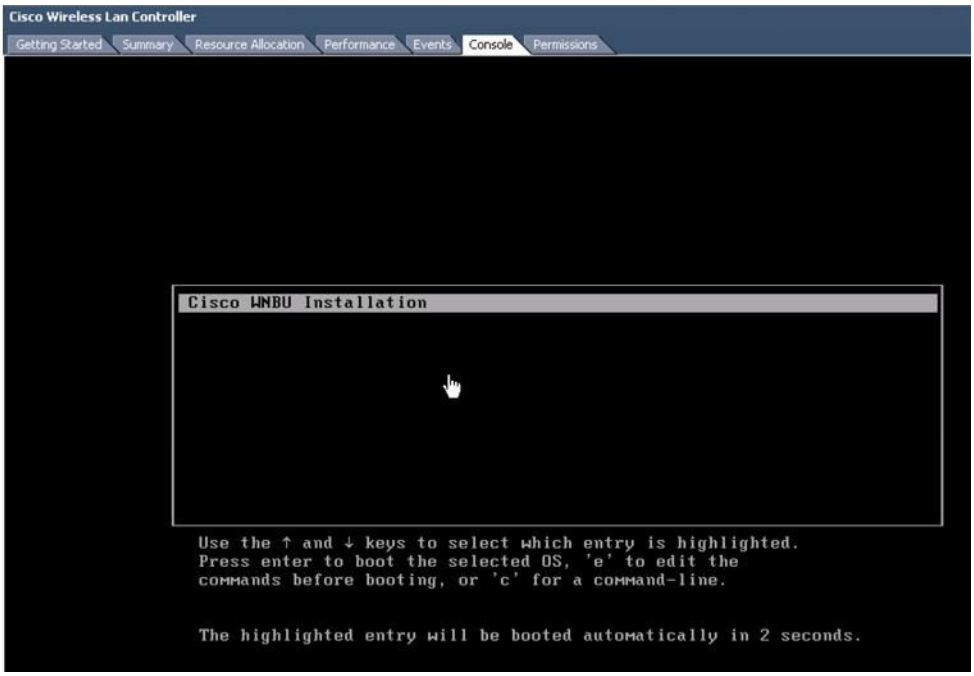
Step 7 The vWLC is ready to proceed in the installation, review the Deployment Settings, and click Finish.



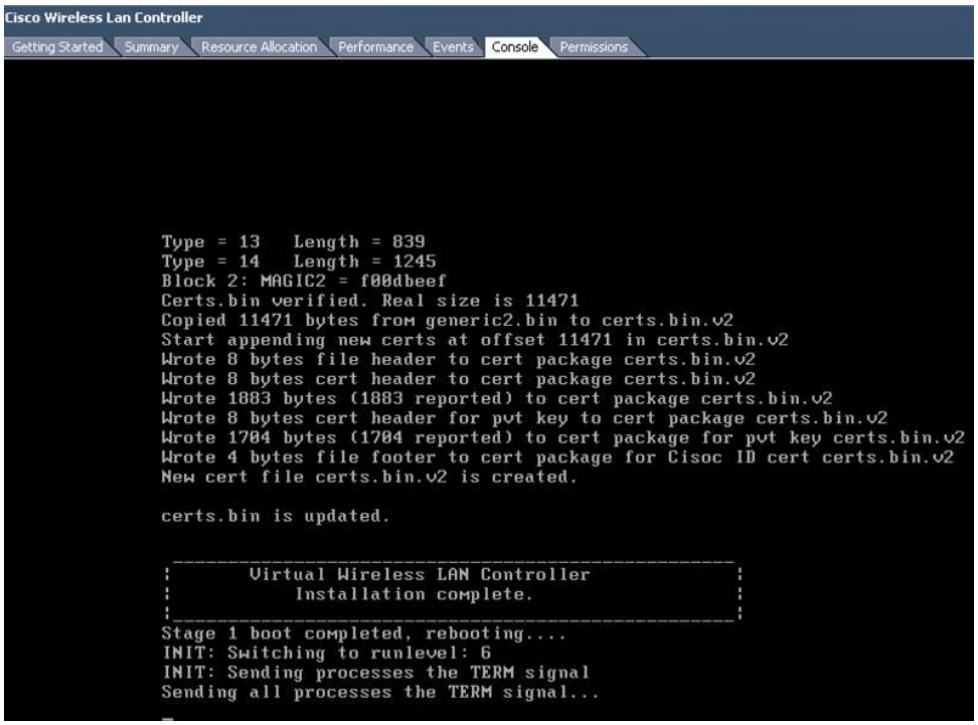
Step 8 Once completed, select and power on the vWLC instance.



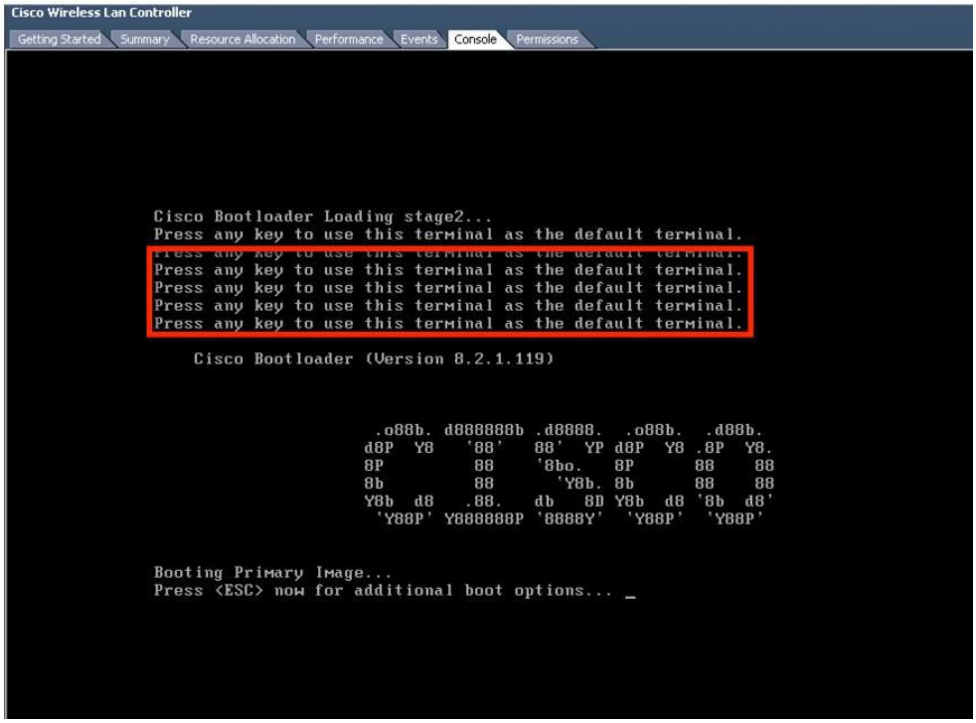
Step 9 Allow the automated installation of vWLC to complete, which may take several minutes.



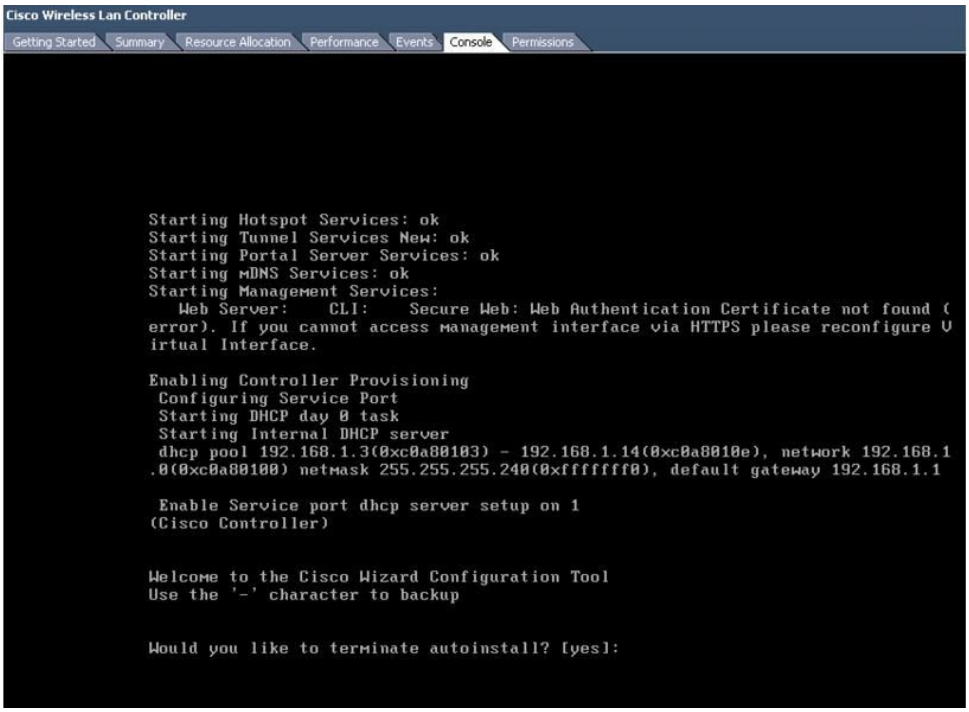
Step 10 On the virtual machine console, the installation will show complete, and a reboot will be initiated.



Step 11 Upon reboot, VMware console will show "**Press any key to use this terminal as the default terminal.**" It is important to click into the console window and press ANY key to access the terminal.



Step 12 Once the vWLC is fully online, it will present the configuration wizard via CLI.



Optional Virtual Controller Console Port

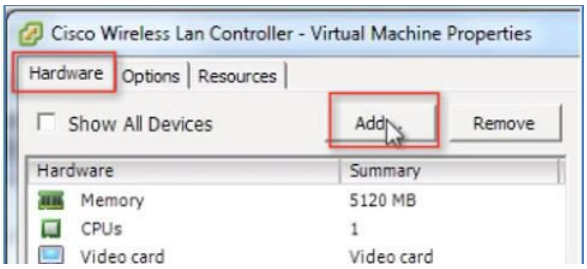
The console port will give access to console prompt of Wireless LAN Controller. So the VM can be provisioned with serial ports to connect to these. In the absence of serial ports, the VSphere Client Console will get connected to the console on vWLC.

VMWare ESXi supports a virtual serial console port that can be added to vWLC VM. The serial port can be accessed in one of the following two ways:

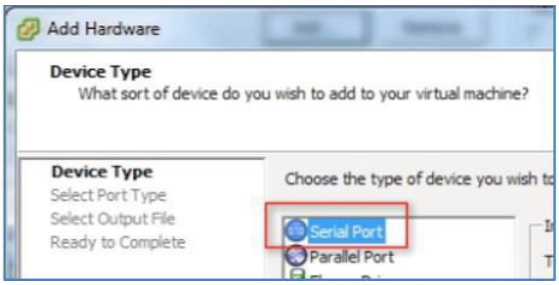
- Physical Serial Port on the Host: vWLC's virtual serial port will be mapped to the hardware serial port on the server. This option is limited to the # of physical serial port(s) on the host, if in a multi-tenant vWLC scenario, this may not be ideal.
- Connect via Network: vWLC's virtual serial port can be accessed using telnet session from a remote machine to a specific port allocated for the VM on hypervisor. For example, if the hypervisor's IP address is 10.10.10.10 and port allocated for a vWLC VM is 9090, using "telnet 10.10.10.10 9090", just like accessing a physical WLC's console using a Cisco terminal server, vWLC's serial console can be accessed.

Procedure

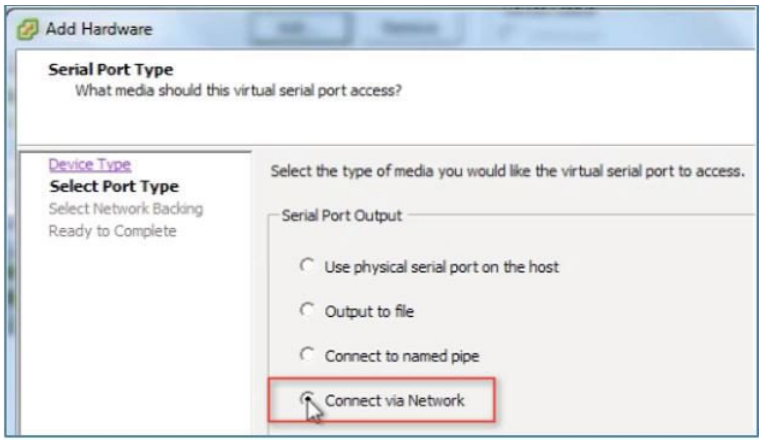
Step 1 In the vWLC Hardware tab, click '**Add**'.



Step 2 Select **Serial Port**, and click Next.

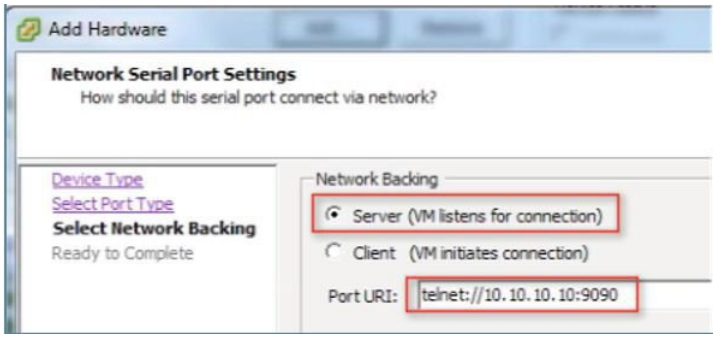


Step 3 In this scenario, select '**Connect via Network**'. Click Next.

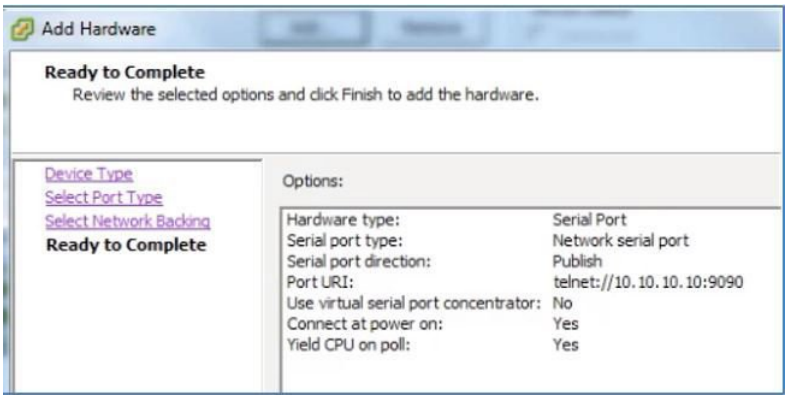


Step 4 Select **Network Backing > Server (VM listens for connection)**

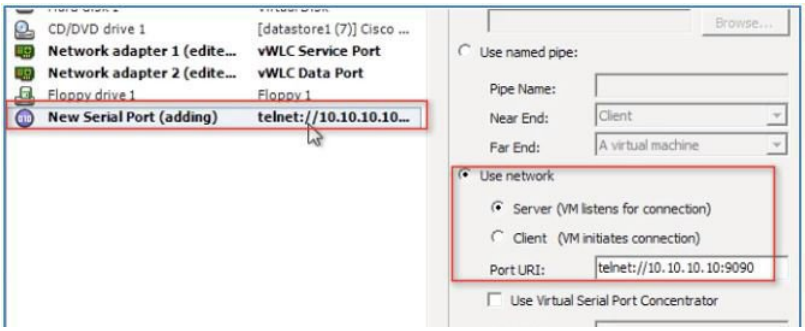
Step 5 Port URI: telnet://<host>:<port> e.g. **telnet://10.10.10.10:9090**



Step 6 Click Next to review options, and click Finish.

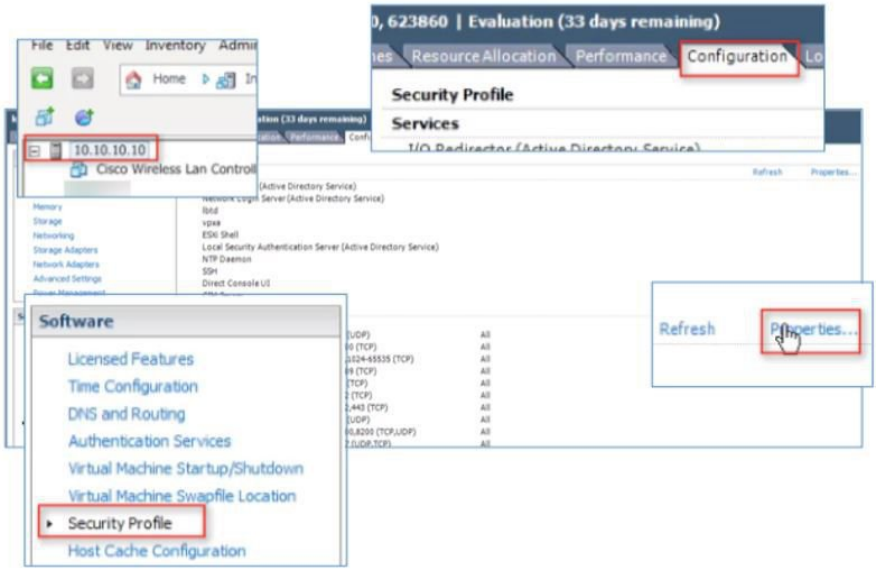


Step 7 Click OK to complete the configured settings.

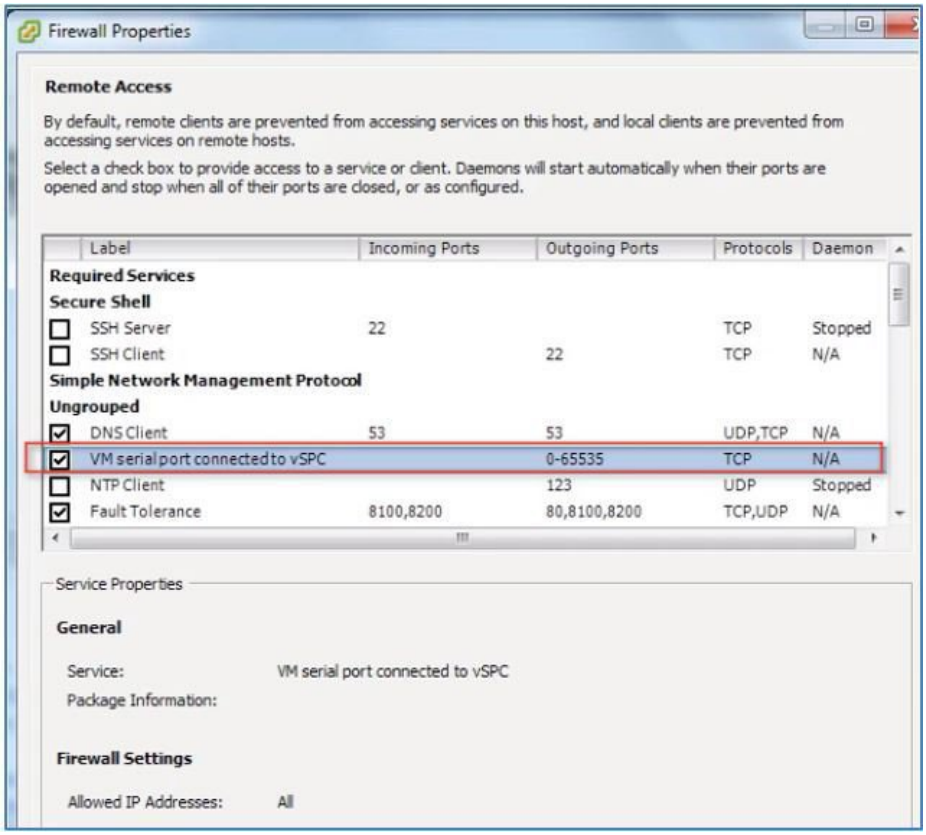


To enable for the serial via network, ESX must be configured to allow for such requests.

Step 8 Navigate to the **ESX > Configuration > Software > Security Profile**, and click **Properties**.

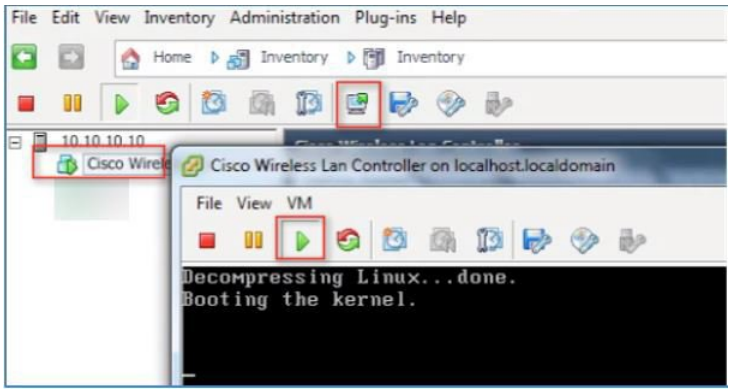


Step 9 In the Firewall Properties > select / check **VM serial port connected to vSPC**, and click OK to finish with settings.

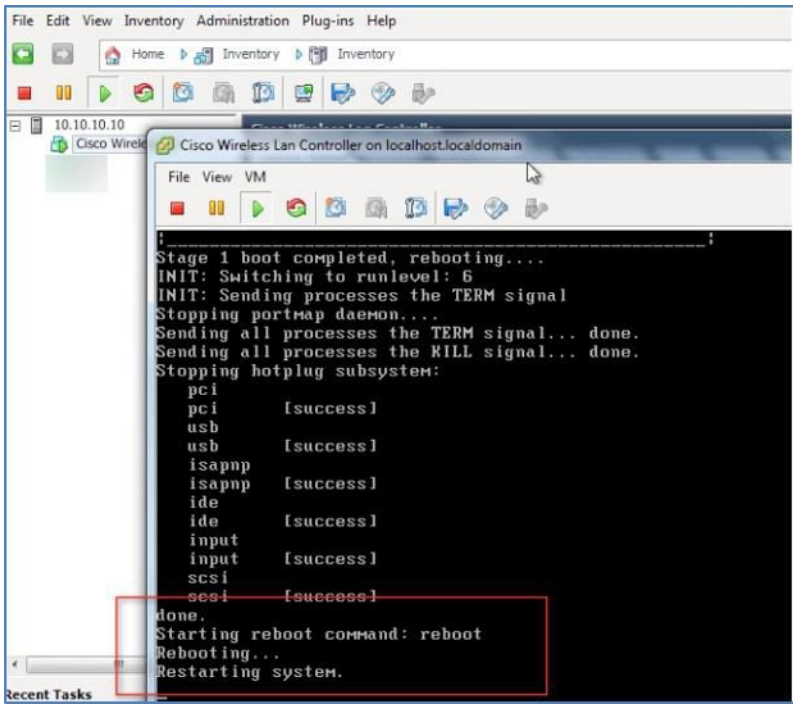


Starting Up the vWLC

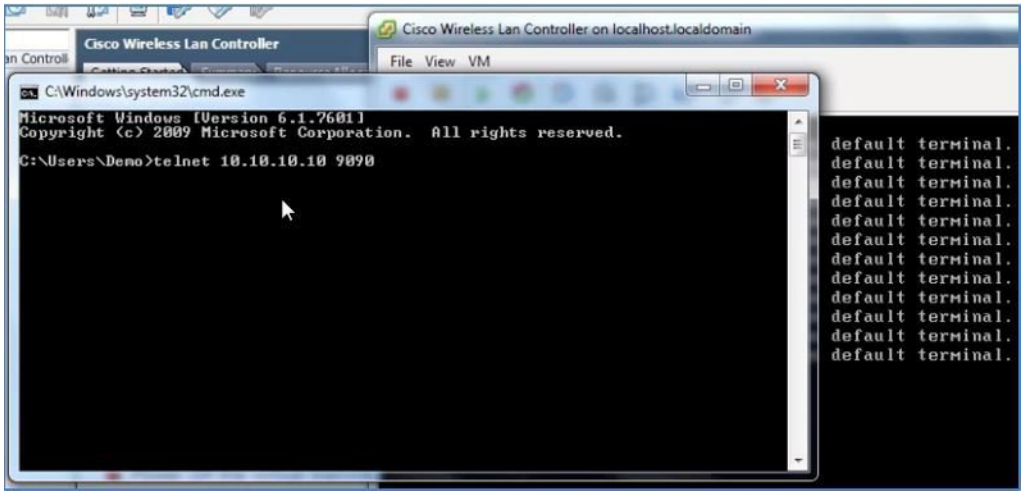
Step 10 Start the virtual WLC, and select console to observe the first-time installation process.



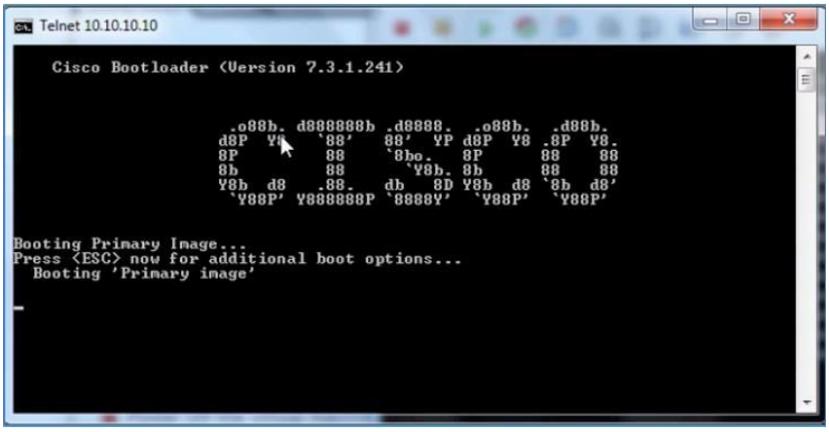
Step 11 Monitor progress until the VM console shows that the vWLC has restarted (this is automatic).



Step 12 At this time, open telnet session to vWLC such as in the example below.

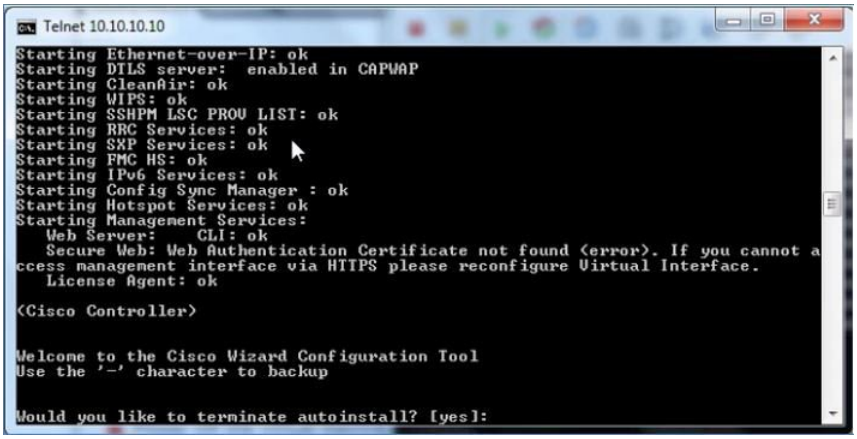


Step 13 Telnet session will now manage the console to vWLC.

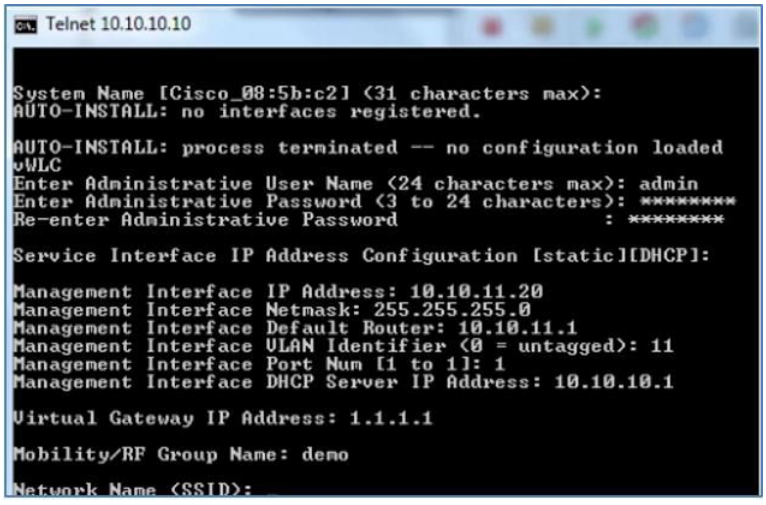


Note Only 1 mode of console can be operational at any time, such as VM console (by key-interrupt at startup), or serial console (physical/network). It is not possible to maintain both at the same time.

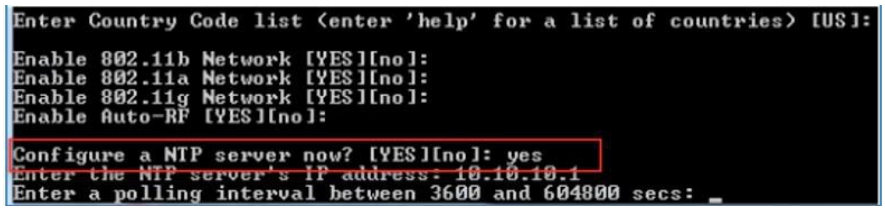
Step 14 Continue to wait until the vWLC has fully come online and prompt to start the configuration tool wizard.



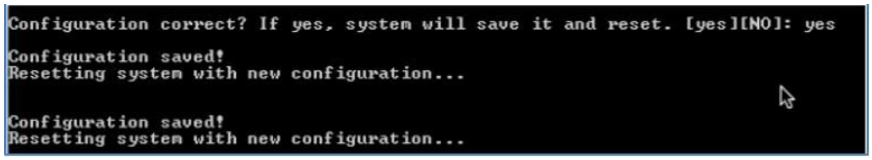
Step 15 Configure the management interface address / mask / gateway. Configure Management Interface VLAN ID if tagged. Continue with the remainder.



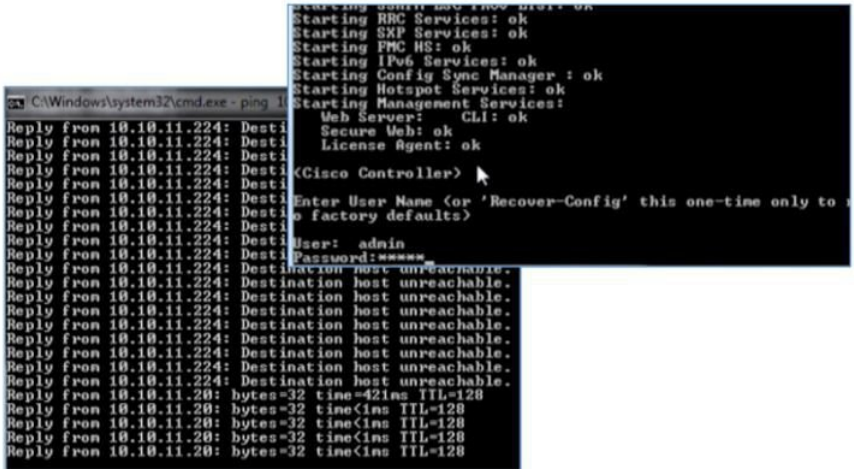
Step 16 Similar to all network device(s), it is **crucial** and **very important** to configure **NTP**. The virtual controller must have correct clock as it is possible to have an incorrect clock on the ESX host, or from manual configuration, which may result in access points not joining in the process.



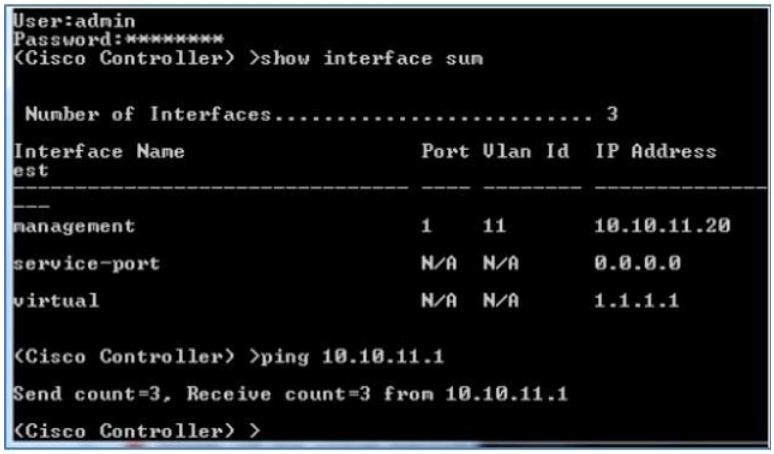
Step 17 Complete the configuration and allow the vWLC to Reset.



Step 18 A suggestion is to ping the vWLC management interface to ensure that it has come online. Log into the vWLC.



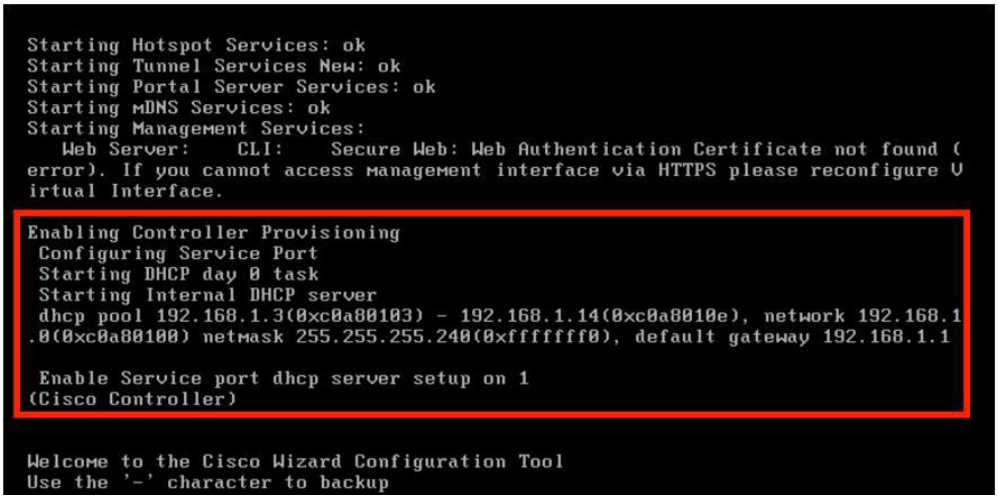
Step 19 You can perform 'show interface summary' and ping the gateway from the vWLC.



Step 20 Connect to vWLC management using a web browser

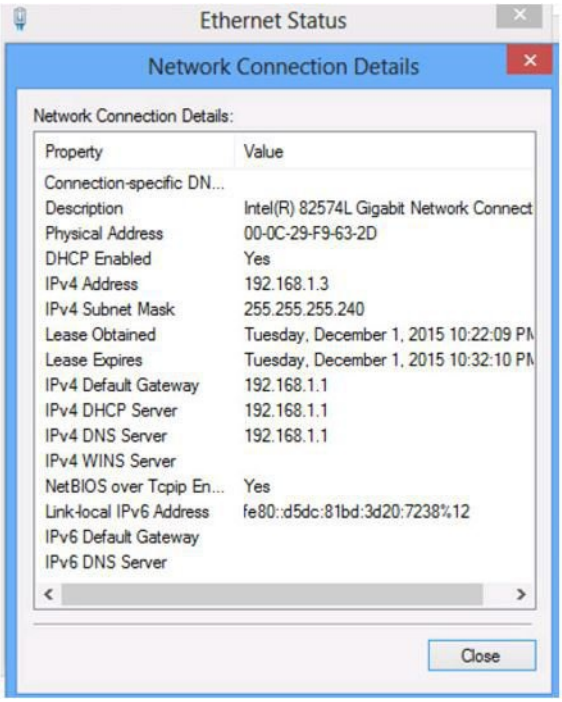
vWLC Simplified Setup

An alternative to configuring the vWLC using CLI through the VMware console, is using the simplified controller provisioning feature, applicable both in VMware or KVM deployment. As mentioned early in this guide, any client PC wired connected accessing the network mapped to the vWLC Service Port will be able to use this feature. This feature is enabled after first boot from an non-configured vWLC, temporarily provides DHCP service on the Service Port segment, and assign PC clients a limited network address. The client PC can connect to the vWLC using a web browser.

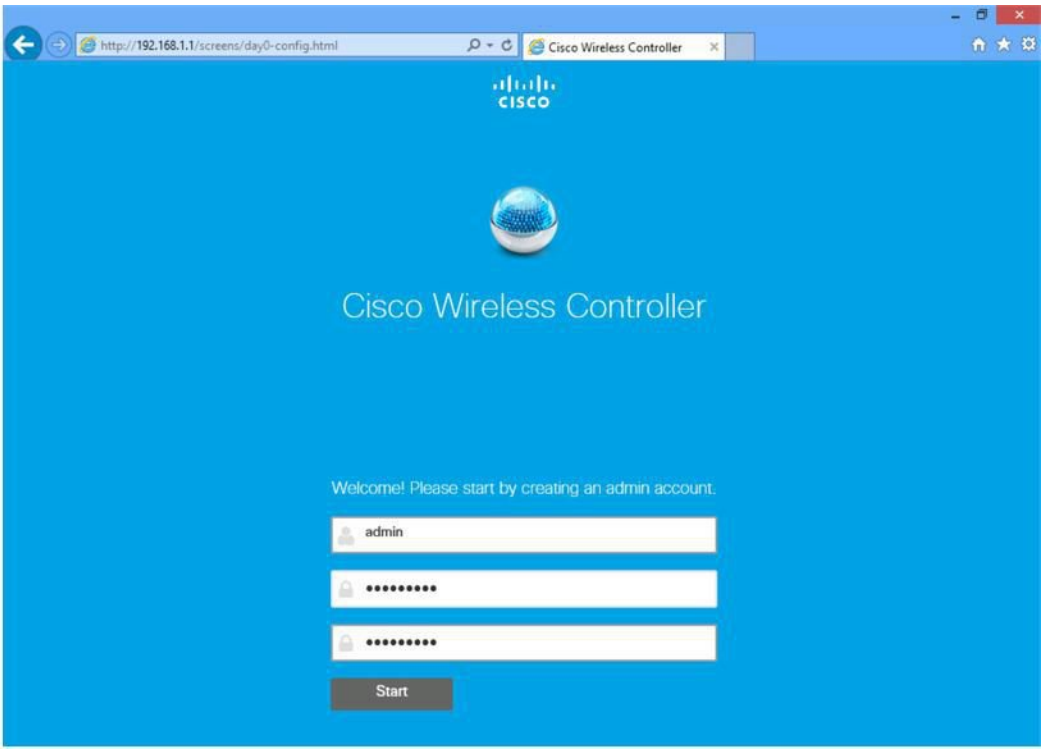


Procedure

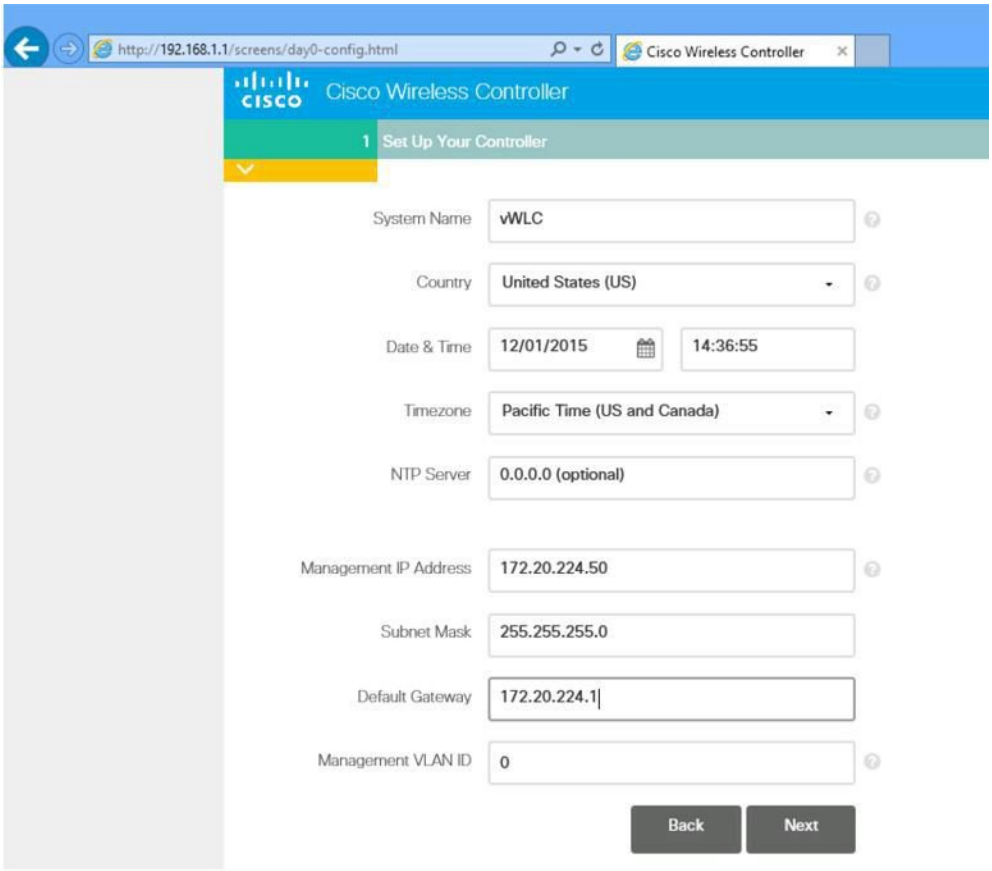
Step 1 With a client PC connected to the vWLC mapped Service Port, it gets an address from a limited range of 192.168.1.3 through 192.168.1.14. The vWLC is assigned a fixed 192.168.1.1.



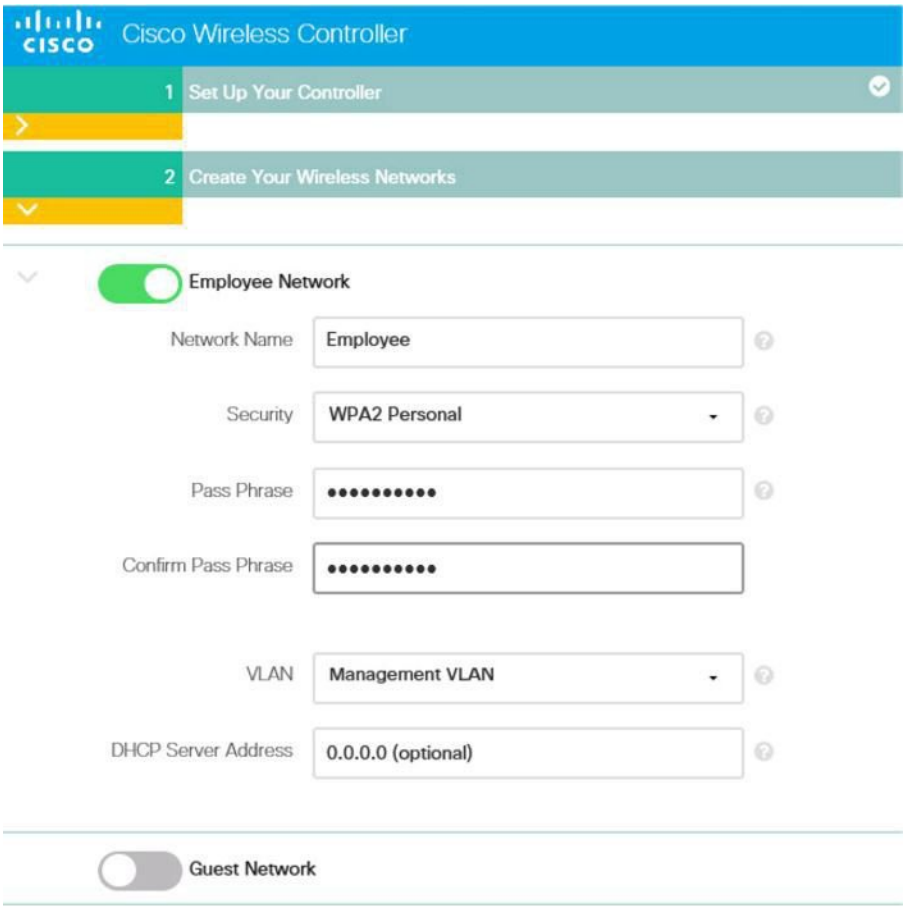
Step 2 From the client PC, open a browser and connect to *http://192.168.1.1*, the Simplified Setup wizard will navigate the admin through the minimal steps required to fully configure vWLC. The first step is creating the admin account, provide the admin username and password, then click Start



Step 3 In step 1 of the simplified setup wizard, set up the vWLC with a system name, country, date/time (automatically taken from client PC clock) and NTP server.
Also, define the management IP address, subnet mask, gateway and VLAN for the management interface. This assignment needs to be configured and available on the Data Port (trunk) from the initial VMware/KVM setup of network interfaces. Click Next.

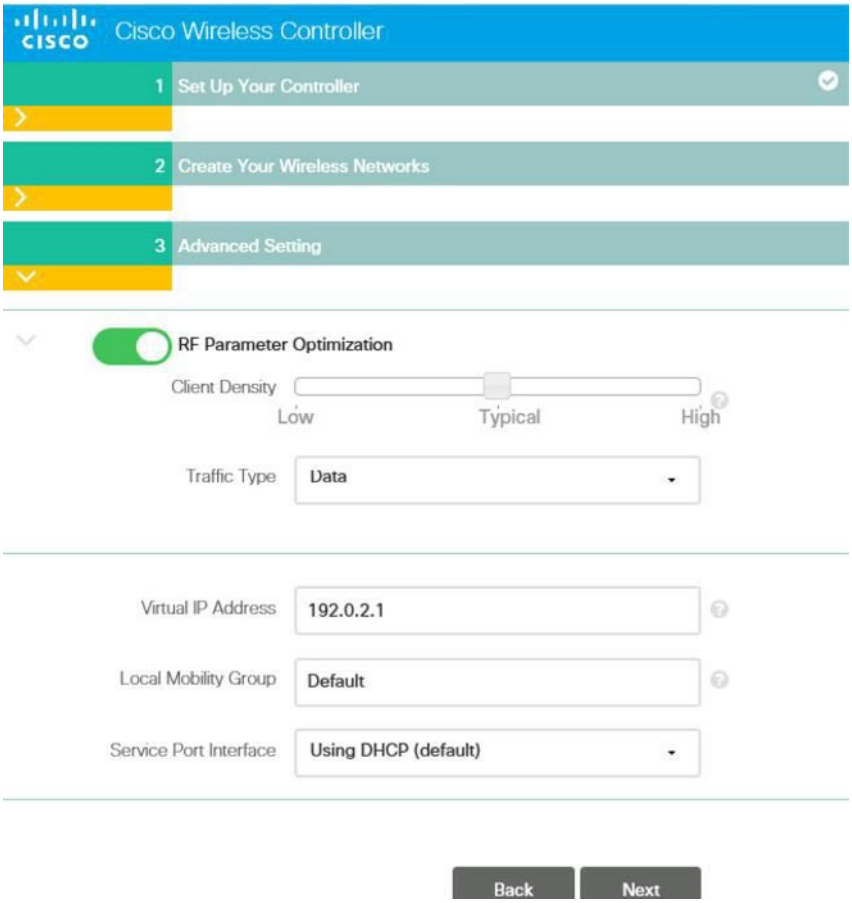


Step 4 In step 2, create the wireless network (SSID), security, and network/VLAN assignment as required. Optional is the inclusion of a Guest Network setup, a quick and simple step to add secure guest access with separate network and access method for guests. Click Next.

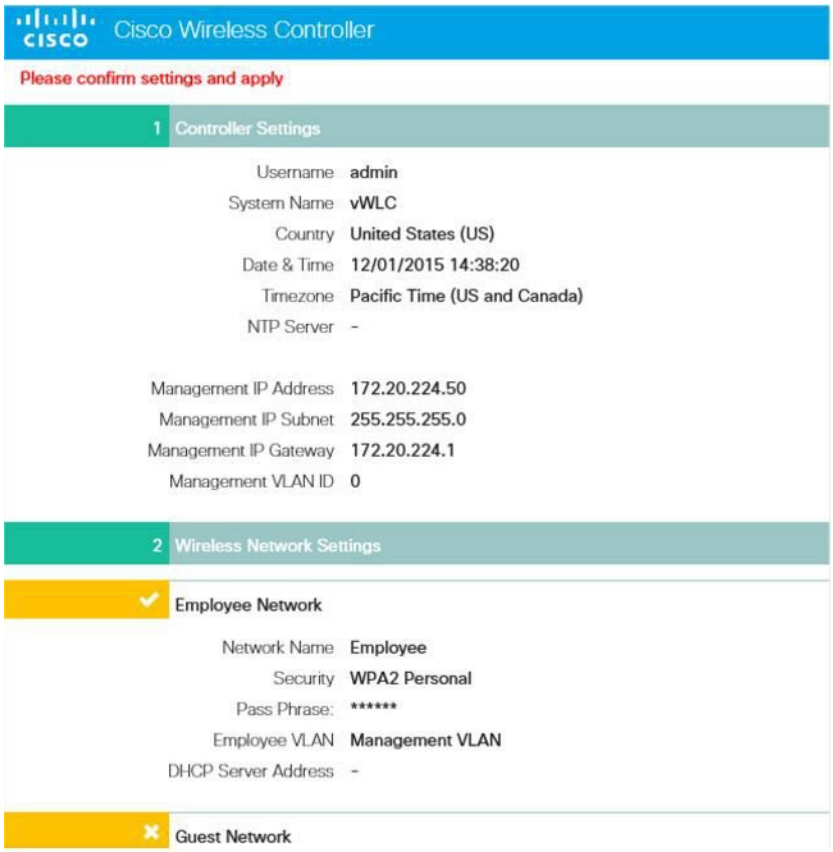


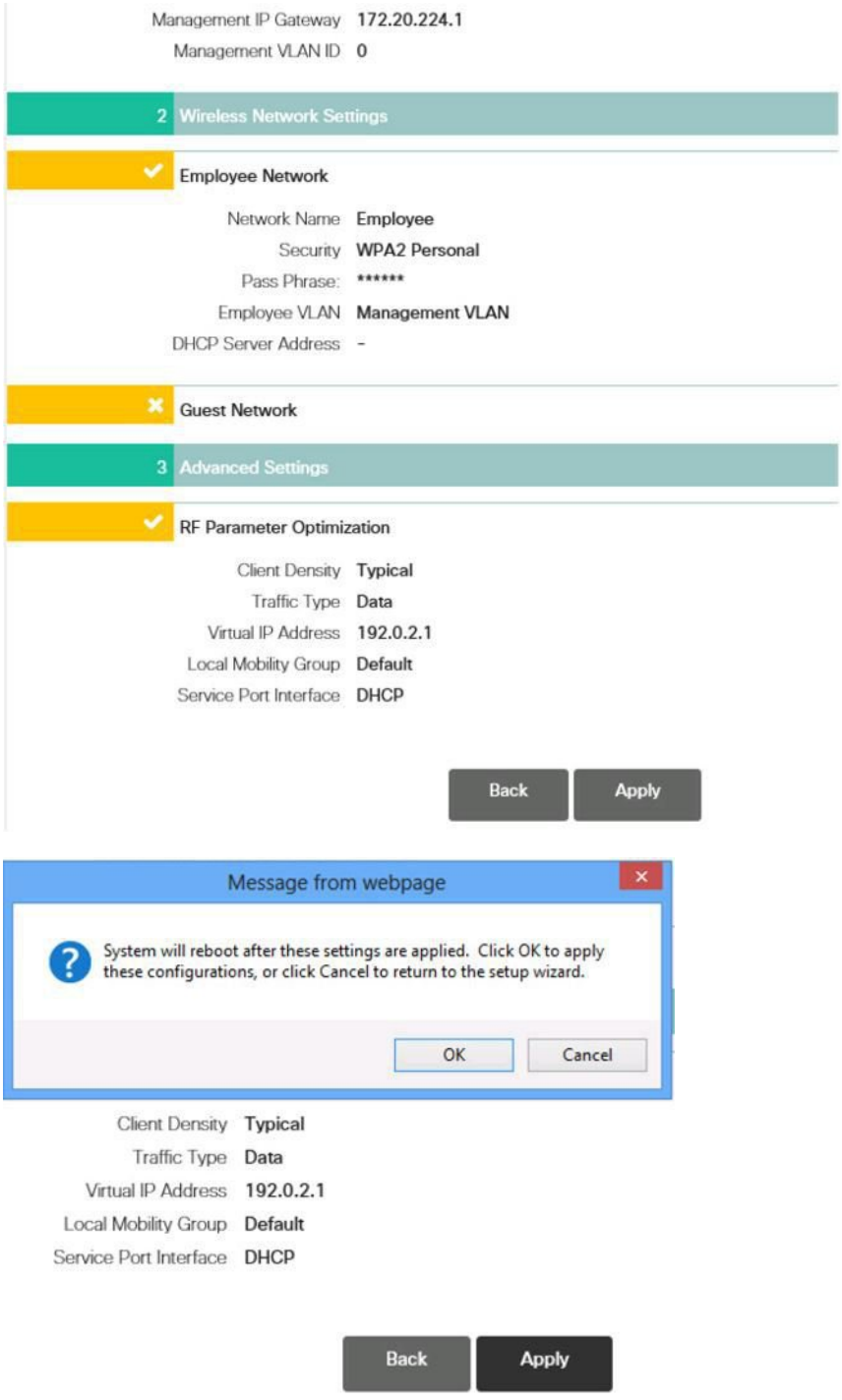
Step 5 In step 3 of the simplified setup, an admin can optimize the WLC setup for intended RF use, and taking advantages of Cisco Wireless LAN Controller best practices defaults. Click Next to finalize the setup.

Note Cisco best practices are continuously updated at this location:http://www.cisco.com/c/en/us/td/docs/wireless/technology/wlc/82463-wlc-config-best-practice.html

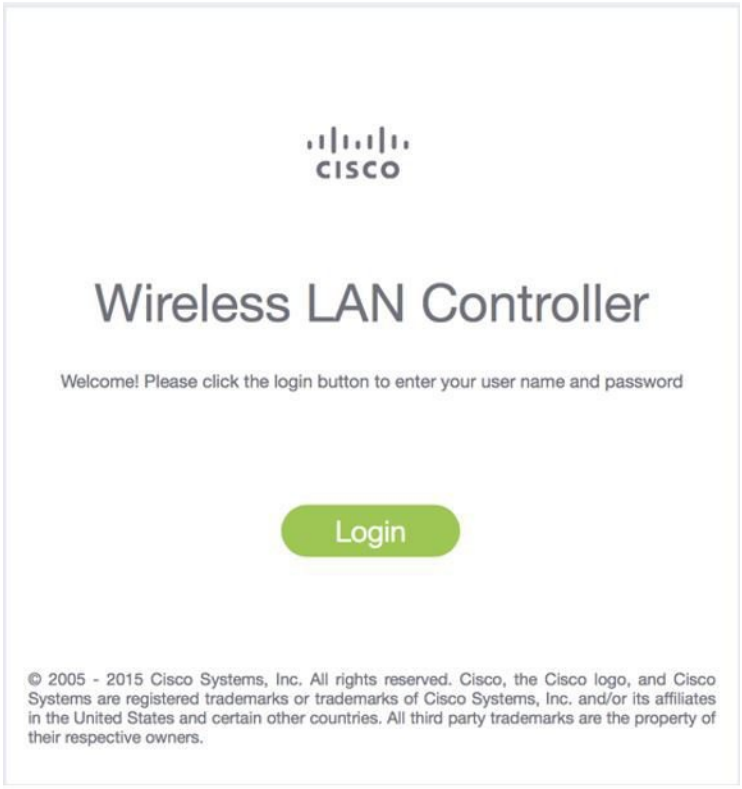


Step 6 The simplified setup wizard will summarize the detail of configuration. Click apply to save and reboot the vWLC.


Cisco Wireless Controller
Please confirm settings and apply
1 Controller Settings
Username admin
System Name vWLC
Country United States (US)
Date & Time 12/01/2015 14:38:20
Timezone Pacific Time (US and Canada)
NTP Server -
Management IP Address 172.20.224.50
Management IP Subnet 255.255.255.0
Management IP Gateway 172.20.224.1
Management VLAN ID 0
2 Wireless Network Settings
Employee Network
Network Name Employee
Security WPA2 Personal
Pass Phrase: ******
Employee VLAN Management VLAN
DHCP Server Address -
Guest Network



Step 7 Once the vWLC reboots, it will disable the simplified setup feature and use of the Service Port. Operation is dedicated to the Data Port, and in effect using the management interface and any dynamic interfaces defined. Log in through the assigned management IP address of the vWLC to continue.



Linux Kernel-based Virtual Machine (KVM)

This document is an update for vWLC based on the CUWN 8.2 software release and the support for Linux Kernel-based Virtual Machine(KVM). KVM is supported in Cisco Wireless Release8.1.102.0 and later releases.

Note After KVM is deployed, it is recommended that you do not downgrade to a Cisco Wireless release that is older than Release 8.1.102.0.

KVM Prerequisite for Hosting Virtual WLC (vWLC)

Following are the KVM prerequisites for hosting vWLC:

- Minimum of 2 G (small) or 8 G (large) memory
- Minimum of 1 vCPU
- Minimum of 2 network interfaces
- Required storage of 8 G
- Network device model is "virtio"

- The physical devicesconnected to Open vswitch bridgeshould not have any IP addresses configured on it.

For more information, refer to http://www.linux-kvm.org/page/FAQ

Installing Fedora OS

To install FedoraOS, perform the following steps:

Procedure

Step 1 Install Fedora21 or later. Click the followinglink to downloadFedora.
https://getfedora.org/en/server/download/

Step 2 After installing Fedora, configure IP address to go to internet.
In this scenario, two dedicated Linuxinterfaces/ports are used for vWLC.

Step 3 Find out your interface using **ifconfig**.
Example:

First interface - for uplink (service-port of WLC); no IP addressis required to this interface but should be connected and up.

Second interface - for WLC Management interface; no IP address is required to this interfacebut should be connected and up.

Third or fourth interface - for Linux accessibility; provide IP address to this interface, so that there is a network connectivity to the Linux box.

Note By default, KVM uses first interface as service-port for vWLC.

Step 4 Configure IP address to the third or fourth interface to access Linux and access internet to get update.
vi /etc/sysconfig/network-scripts/ifcfg-enp2s0f3

Note You will need to change BOOTPROTO from DHCP to static and add IPADDR, NETMASK, BROADCAST, and NETWORK variables. It is recommended to choose the static IP address.

Example

```
NM_CONTROLLED="yes"
BOOTPROTO=static
DEVICE=eth1
ONBOOT=yes
IPADDR=192.168.8.248
NETMASK=255.255.255.0
BROADCAST=192.168.8.255
NETWORK=192.168.8.0
GATEWAY=192.168.8.1
TYPE=Ethernet
PEERDNS=no
```

Step 5 Save the file.
OR

```
ifconfig <interface_name> <IP_address>
ifconfig <interface_name> netmask <netmask_address>
ifconfig <interface_name> broadcast <broadcast_address>
```

OR

```
ifconfig <interface_name> <IP_address> netmask <netmask_address> broadcast <broadcast_address>
```

Note Configure proxy and DNS information if required. Make sure internet is accessible after configuration.

Updating Fedora OS

To update Fedora OS after installation, performthe following steps:

Procedure

Step 1 Update Fedora OS:

```
yum install update
```

Step 2 Install GUI:

```
yum install @gnome-desktop -y
```

Step 3 Install VNC server, http://www.namhuy.net/3134/install-vnc-server-on-fedora-20.html:

```
yum install tigervnc-server -y
```

Step 4 Install x11:

```
yum groupinstall "X Software Development"
```

Installing KVM and openvswitch with Supporting Packages

```
yum install -y @standard @virtualization openvswitch
systemctl enable network.service
systemctl start network.service
systemctl enable openvswitch.service
systemctl start openvswitch.service
```

Verifying the Installation of KVM

```
lsmod | grep kvm
```

Example output on Intel processor:

```
[root@localhost system]# lsmod | grep kvm
kvm_intel 147785  0
kvm 464964 1 kvm_intel
```

Network Configuration

Creating a Bridge and Mapping it to Port (Ethernet Interface)

```
ovs-vsctl add-br ov_10nw
ovs-vsctl add-port ov_10nw enp2s0f0
ovs-vsctl add-br ov_9nw
ovs-vsctl add-port ov_9nw en
```

The bridge name must be the same as created in the XML file.

Viewing the Bridge Mapping

```
ovs-vsctl show
```

Example:

```
[root@localhost ~]# ovs-vsctl show
099e8b7e-bf00-4071-be62-ec55f9b543cc
Bridge "ov_9nw"
Port "ov_9nw"
Interface "ov_9nw"
type: internal
Port"enp2s0f1" Interface
"enp2s0f1"
Bridge "ov_10nw"
Port "ov_10nw"
Interface "ov_10nw"
type: internal
Port"enp2s0f0" Interface
"enp2s0f0"
ovs_version: "2.3.1-git3282e51"
```

Creating XML Files

Create two XML files; one for service-nw (10nw) and the other for management (9nw).

Example:

```
10nw_eth0_ov.xml
9nw_eth1_ov.xml
```

Both XML files containVLAN information based on the network, or based on what you want to allow.

Example: To Allow All VLANs

```
<network>
<name>10-nw</name>
<forward mode='bridge'/>
<bridge name='ov_10nw'/>
<virtualport type='openvswitch'/>
<portgroup name='vlan-any' default='yes'>
</portgroup>
</network>
```

The bridge name must be the same as created during "ovs-vsctl" command.

If only specific VLANs need to be allowed, use the following format:

```
<network>
<name>ov-nw</name>
<forward mode='bridge'/>
<bridge name='bridge_1'/>
<virtualport type='openvswitch'/>
<portgroup name='all_vlans' default='yes'>
</portgroup>
<portgroup name='vlan-152-untagged'>
<vlan>
<vlan mode='native-untagged'/>
<tag id='152'/>
</vlan>
</portgroup>
<portgroup name='vlan-153'>
<vlan>
<tag id='153'/>
</vlan>
</portgroup>
<portgroup name='two-vlan'>
<vlan trunk='yes'>
<tag id='152'/>
```

```
<tag id='153'/>
</vlan>
</portgroup>
</network>
```

In the above configuration:

portgroup name='all_vlans', allows all VLANs.

portgroup name='vlan-152-untagged', allows only untagged VLAN that is 152.

portgroup name='vlan-153', allows only 153 VLAN.

portgroup name='two-vlan', allows only two VLANs,that is, 152 and 153.

Allowing CDP Packets to Forward from Open vSwitch

```
ovs-vsctl set bridge ov_9nw other-config:forward-bpdu=true
```

Viewing the Virtual Network

```
virsh net-list --all
```

Deleting the Default Network

```
virsh net-undefine default
```

Creating Virtual Network

```
virsh net-define <xml_file_name>
```

Viewing the Virtual Network

```
virsh net-list --all
```

Starting the Virtual Network

```
virsh net-start <network_name_that is in the list>
```

Example:

```
[root@localhost ~]# virsh net-list --all
Name State Autostart Persistent
----------------------------------------------------
default inactive no yes
[root@localhost ~]# virsh net-undefine default
Network default has been undefined
[root@localhost ~]# virsh net-define 10nw_eth0_ov.xml
Network 10-nw defined from 10nw_eth0_ov.xml
[root@localhost ~]# virsh net-define 9nw_eth1_ov.xml
Network 9-nw defined from 9nw_eth1_ov.xml
[root@localhost ~]# virsh net-list --all
Name State Autostart Persistent
----------------------------------------------
10-nw inactive no yes
9-nw inactive no yes
[root@localhost ~]# virsh net-start 10-nw
Network 10-nw started
[root@localhost ~]#
[root@localhost ~]# virsh net-start 9-nw
Network 9-nw started
[root@localhost ~]# virsh net-list --all
Name State Autostart Persistent
```

```
-----------------------------------------
10-nw active no yes
9-nw active no yes
```

Installing vWLC Using Virtual Machine Manager (VMM) in Fedora

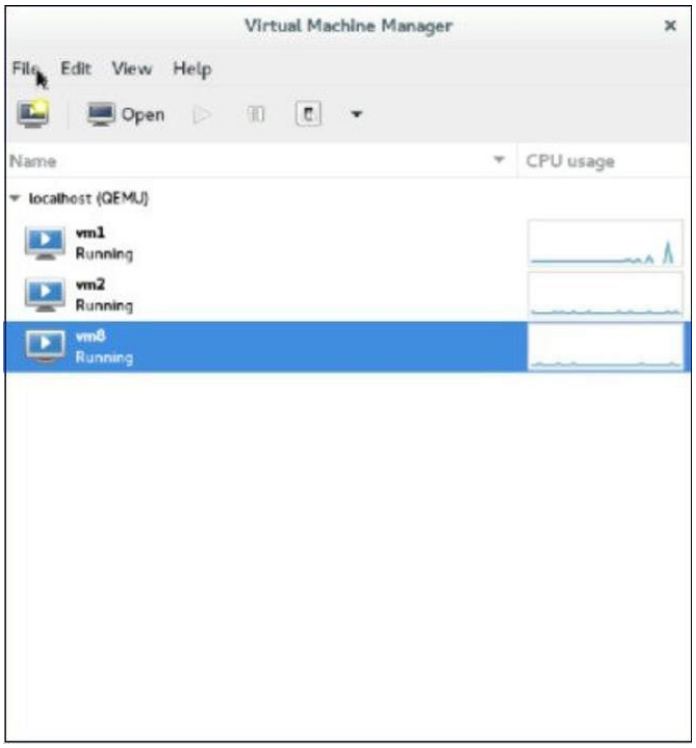
To install vWLC using VMM in Fedora, perform the following steps:

Note Console to Fedora. GUI is required for VMM.

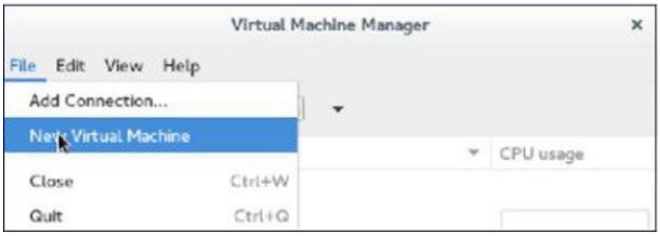
Procedure

Step 1 Open the terminal (command prompt).

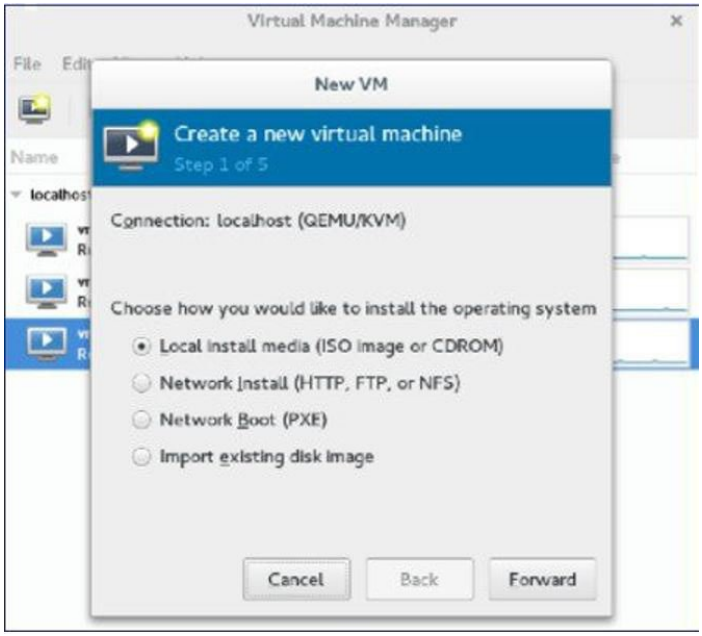
Step 2 Execute the command**virt-manager**.
The Virt Manager(VMM) pop-up window appears.



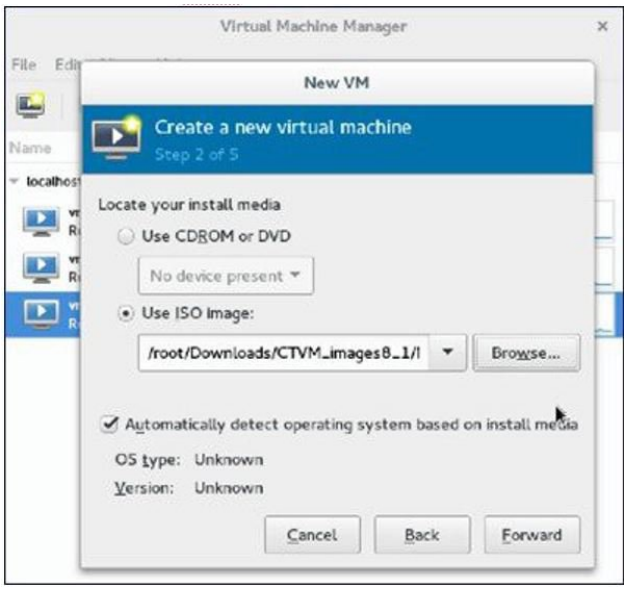
Step 3 Create a new virtual machine (VM).



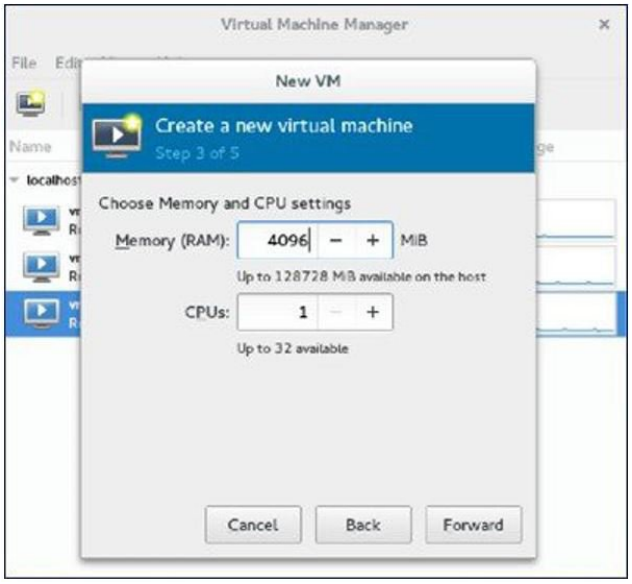
Step 4 Select the path.



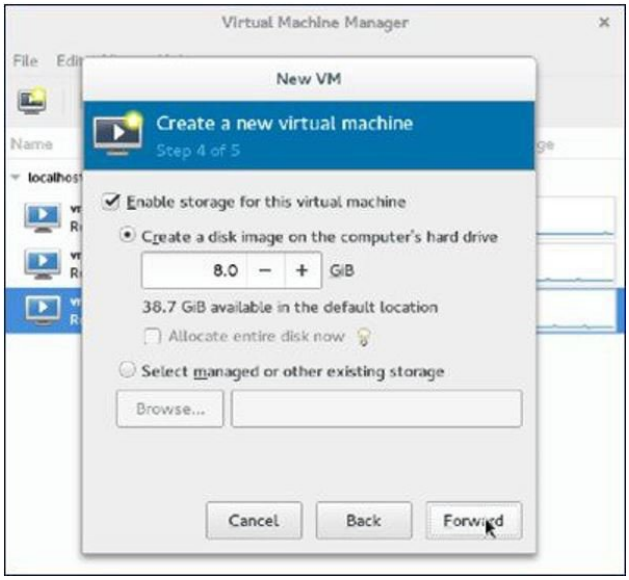
Step 5 Select the ISO file of vWLC.



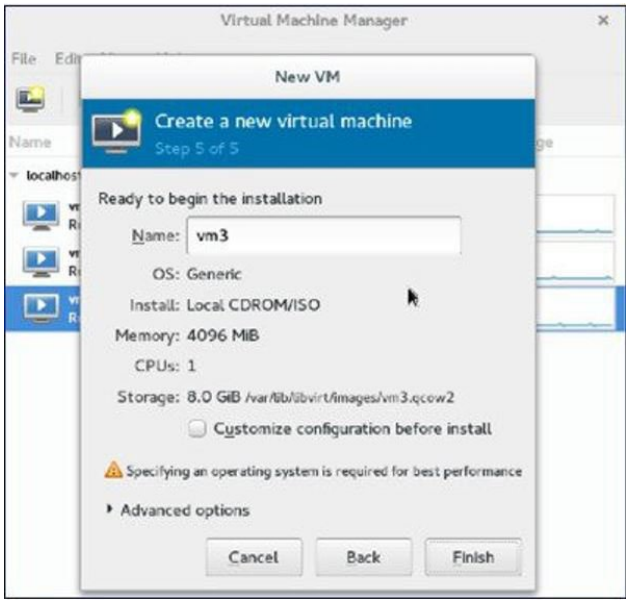
Step 6 Select the memory and CPU.



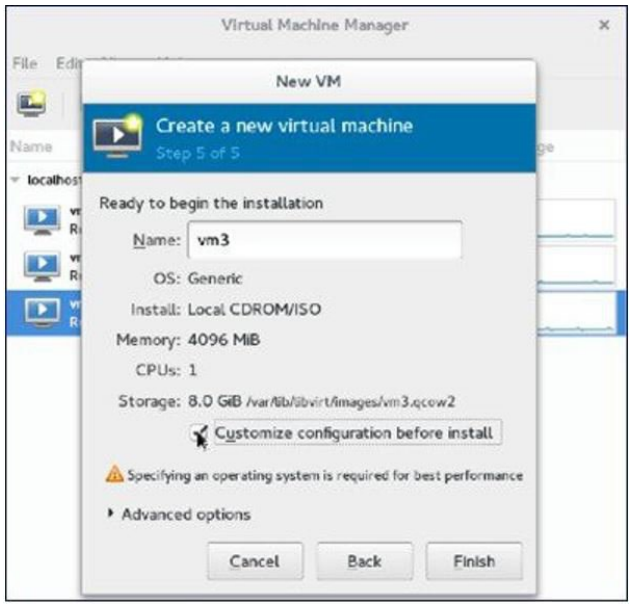
Step 7 Select the disk space.



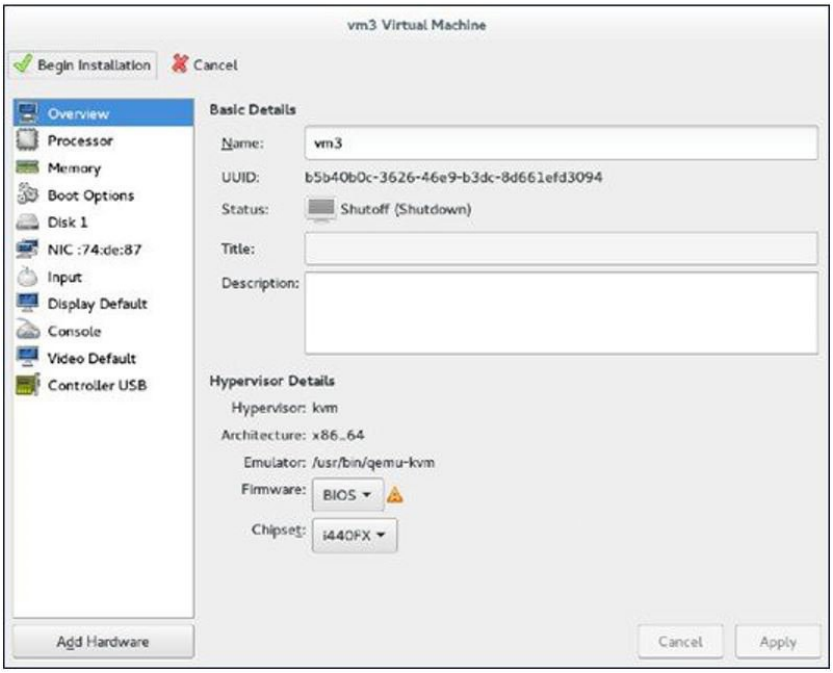
Step 8 Name the VM.



Step 9 Check the **Customize configuration before install** check box and then click **Finish**. (This helps to configure other options)



Step 10 Click **Add Hardware**.
The Add New Virtual Hardware window appears.



This window helps you to configure service port, management interface, and serial connection:

a) Click **Network**and do the following:
—From the **Network source** drop-down list, choose the virtual network.(It is recommended to select the virtual network of service port of vWLC)

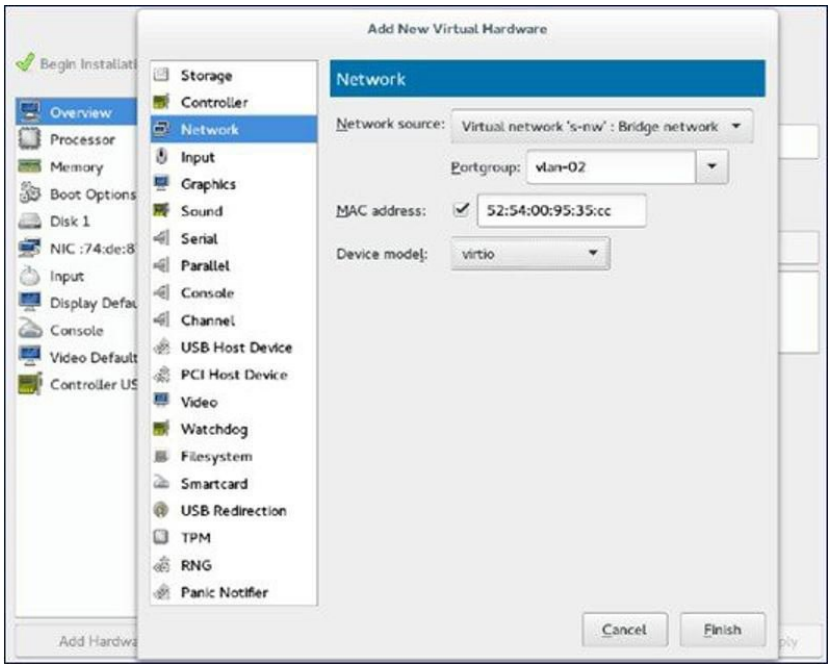
— From the **Portgroup**drop-down list, choose the port group configured in xml if there are many.

— From the **Device model**drop-down list, choose**virtio** (only this is supported as of now) and then click **Finish**.

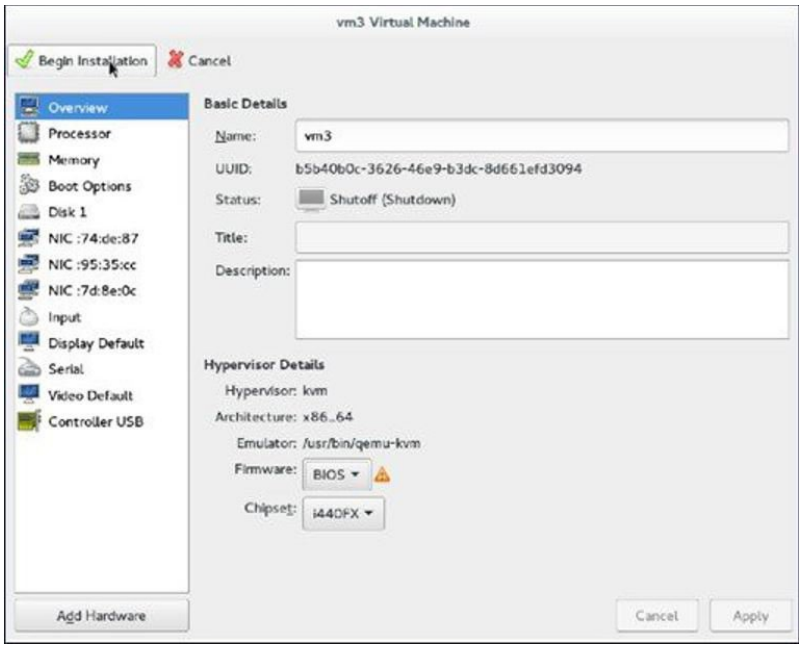
b) Repeat again by selecting **Add Hardware > Network** for virtual network of management interface.
Note vWLC supports only two physical ports; one for service port and the other for management/dynamic interface. The management interface is mapped to management/dynamic interface.

c) Click **Add Hardware > Serial** and then click **Finish**.

Note Fedora 21 has "Virt-Manager" version1.1, which has the **portgroup**option. Older version does not have it.



Step 11 Click **Begin Installation**.



Step 12 Wait for WLC prompt for initial configuration.

Accessing vWLC's Console in Fedora

To access vWLC's console, perform the following steps:

Procedure

Step 1 From the terminal, execute the following command:
```
virsh console <vm_name eg. vm1>
```

Step 2 Reboot vWLC through virt-manager.
To find out the vnet mapped to vWLC, execute the following command on vWLC:
```
show interface detail management
```

Note Match the last six octet with "ifconfig" output.

This is how, you get your targeted "vnet", if there are multiple vWLCs configured.

Installing vWLC and KVM with Ubuntu

To install Ubuntu and KVM, perform the following steps:

Procedure

Step 1 Install Ubuntu Server 13.10 or later, select virtualization module/package during installation.

Step 2 Install QEMU/KVM/Open vSwitch packages:
```
apt-get install qemu-kvm qemu-utils
uml-utilities bridge-utils socat vnc4server vncviewer
apt-get install kvm libvirt-bin virtinst
apt-get install openvswitch-controller openvswitch-switch openvswitch-datapath-source
```

Step 3 Start the open vswitchservice.
```
service openvswitch-switch start
```

Step 4 Reboot the system.

One Time Network Configuration on Ubuntu

To execute one time network configuration on Host Linux, perform the following steps:

Procedure

Step 1 Create two open vswitch bridges and map eth0, eth1 to the corresponding bridges:
```
ovs-vsctl add-br ovsbr0 [bridge name]
ovs-vsctl add-port ovsbr0 eth0
```

```
ovs-vsctl add-br ovsbr1[bridge name]
ovs-vsctl add-port ovsbr1 eth1
ovs-vsctl set bridge ovsbr1 other-config:forward-bpdu=true
Required for CDP packets forwarding from Open Vswitch]
```

Step 2 To define a management network, create an XML file [mgmt.xml] as follows:

```
<network>
<name>VM-Mgmt-Nw</name>
<forward mode='bridge'/>
<bridge name='ovsbr'/>
<virtualport type='openvswitch'/>
<!--
If the linux host port[For eg, eth1] is connected in trunk mode
to the downstream switch[which is also connected to the
openvswitch bridge ovsbr], then by choosing the following
portgroup,traffic from all vlan is passed up to the vWLC.
The management interface should be in vlan tagged mode.
And multiple interfaces can also be created with different vlans.
If the linux host port is connected in untagged mode to the
downstream switch, then on choosing this portgroup,untagged
frames are passed up to the vWLC. Hence management interface
has to be untagged.
-->
<portgroup name='default-portgroup' default='yes'>
</portgroup>
<!--
If the linux host port is connected in trunk mode to the
downstream switch [which is also connected to openvswitch
bridge ovsbr],and if only certain vlans are to be allowed,
choose this portgroup.
Uncomment the following portgroup and edit the tag ids
to the vlans allowed. You are free to add as many vlan ids as needed.
-->
<!--
<portgroup name='Management-Portgroup'>
<vlan trunk='yes'>
<tag id='4092'/>
<tag id='4093'/>
</vlan>
</portgroup>
-->
</network>
```

Note Edit the vlan tags as per requirement.

Step 3 Run the following commands to create the management network:

```
virsh net-define mgmt.xml
virsh net-start VM-Mgmt-Network
```

Step 4 Repeat step 2 for creating a service port network. To define the service port network, create an XML file [service.xml] as follows:

```
<network>
<name>VM-SP-Nw</name>
```

```
<forward mode='bridge'/>
<bridge name='ovsbr'/>
<virtualport type='openvswitch'/>
<!--
If this portgroup is chosen, it is presumed that the linux host port
[For eg :eth0, connected to the openvswitch bridge "ovsbr"]
is connected in access mode to the neighboring switch.
-->
<portgroup name='default-portgroup' default='yes'>
</portgroup>
<!--
If the same linux host port[connected to the openvswitch
bridge "ovsbr"] as that of management interface is mapped
to Service interface in vWLC and if the linux host port
is in trunk mode ,then choose the following portgroup to
have untagged packets for service port access.
Uncomment the following portgroup and create the network.
Also, edit the native-vlan as per your network settings.
-->
<!--
<portgroup name='Service-portgroup'>
<vlan>
<vlan mode='native-untagged'/>
<tag id='4094'/>
</vlan>
</portgroup>
-->
</network>
```

Note Edit the vlan tags as per requirement.

Step 5 Run the following commands to create the service network:

```
virsh net-define mgmt.xml
virsh net-start VM-Service-Network
```

Step 6 Check the virtual network status by using the following command:

```
virsh net-list --all
All the created networks are listed as active.
```

Launching vWLC Using VMM

To launch vWLC using VMM, perform the following steps:

Note This is similar to installation using Fedora.

Procedure

Step 1 Launch Virtual Machine Manager (VMM):

a) Launch VMM from GUI or type **virt-manager** from shell.
The GUI takes you through the following steps to create the vWLC instance easily.

b) Choose an ISO image.
c) Choose Memory as 4 GB.
d) Choose CPU as 1.
e) Provide a qcow2 image or raw image.
f) Click Customize configuration before install.
g) Click **NIC**, change device model to **virtio**, and change host device to **VM-Service-Network**.
h) Click **Add hardware**.
i) In the new window, click **Network**, and change host device to **VM-Mgmt-network** and device model to **virtio**.
j) Click **Begin installation**.

Step 2 From the command prompt, vWLC can be instantiated from shell as well with the following command (modify the filename and path as needed):

```
virt-install --connect=qemu:///system
--network=network:VM-Service-network,model=virtio
--network=network:VM-Mgmt-network,model=virtio --name=vm1
--cdrom=/home/user/vWLC/images/<AS_CTVM_8_1_xx_xx.iso>
--disk path=/var/lib/libvirt/images/4.img,size=8
--ram 2048 --vcpus=1 --vnc --vncport=5926
```

Accessing vWLC in VMM

Virtual WLC (vWLC)can be accessed in following ways:

Procedure

Step 1 Open virsh console <Virtual Machinename>

Step 2 VNCviewer: For example, check the VNC details of vWLC through "virsh vncviewer <VirtualMachine name>" and then use that VNC connection details and access vWLC as "vncviewer 127.0.0.1:11".

Step 3 Access console from VMM.

Installing vWLC and Host Linux with Suse Linux

Download SLEs 12 - https://www.suse.com. (You must create a login)

- eth0—for uplink (service-port of WLC); no IP address is required to this interface but should be connected and up.
- eth1—for WLC Management interface; no IP address is required to this interface but should be connected and up.

- eth2 or 3— for Linux accessibility; provide IP address to this interface, so that there is a network connectivity for Linux box and internet from it.

Note Before working on any other package or KVM/vswitch, check the Linux kernel. Make sure the kernel version is 3.12.36-38 or above.

If the kernel version is not 3.12.36-38 or above, upgrade it by performing the following steps:

Procedure

Step 1 Install SLES 12 on the server.

Step 2 Once the server is up, copy the kernel rpm to the machine.

Step 3 On a terminal, execute **rpm --ivh <kernel>.rpm**.
The rpm is installed and would take some time to configure.

Step 4 Reboot the machine once the installation is complete, and verify that the latest kernel is loaded using **uname --a**.

Install KVM and Supporting Packages in Suse

Install KVM and supporting packages using the following commands:

```
zipper install openvswitch openvswitch-switch
zypper install kvm libvirt libvirt-python qemu virt-manager
```

Enabing SSH

Execute the following commands:

```
zisystemctl enable sshd.service →  enabling sshd daemon
systemctl start sshd.service →  starting ssh
netstat -an | grep :22 →  to see if port# 22 is listening
```

Network Configuration

Creating a Bridge and Mapping it to Port (Ethernet Interface)

```
ovs-vsctl add-br ov_10nw
ovs-vsctl add-port ov_10nw eth0 ovs-vsctl add-br ov_9nw
ovs-vsctl add-port ov_9nw eth1
```

The bridge name must be the same as created in the XML file.

Viewing the Bridge Mapping

```
ovs-vsctl show
```

Example:

```
linux-f8es:~ # ovs-vsctl show
51600b63-b508-45b0-9d0c-9f74036114c5
Bridge "ov_9nw"
Port "ov_9nw"
Interface "ov_9nw"
type: internal
Port "eth1"
Interface "eth1"
Bridge "ov_10nw"
Port"ov_10nw"
Interface "ov_10nw"
type: internal
Port "eth0"
Interface "eth0"
ovs_version: "2.1.2"
```

Creating XML Files

Create two XML files; one for service-nw (10nw) and the other for management (9nw).

```
10nw_eth0_ov.xml
9nw_eth1_ov.xml
```

Both XML files contain VLAN information based on the network, or based on what you want to allow.

Example: To Allow All VLANs

```
<network>
<name>10-nw</name>
<forward mode='bridge'/>
<bridge name='ov_10nw'/>
<virtualport type='openvswitch'/>
<portgroup name='vlan-any' default='yes'>
</portgroup>
</network>
```

The bridge name must be the same as created during "ovs-vsctl" command.

Starting Open vSwitch

```
service openvswitch-switch start
```

Configuring Open vSwitch to Start When the System Boots

```
chkconfig openvswitch-switch on
```

Note vSwitch must be started before creating the bridge using above command.

Starting libvirt

```
service libvirtd restart
```

Allowing CDP Packets to Forward from Open vSwitch

```
ovs-vsctl set bridge ov_9nw other-config:forward-bpdu=true
```

Viewing the Virtual Network

```
virsh net-list --all
```

Deleting the Default Network

```
virsh net-undefine default
```

Creating Virtual Network

```
virsh net-define <xml_file_name>
```

Viewing the Virtual Network

```
virsh net-list --all
```

Starting the Virtual Network

```
virsh net-start <network_name_that is in the list>
```

Example:

```
linux-f8es:~ # virsh net-list --all
Name      State     Autostart      Persistent

----------------------------------------------------------
default   inactive     no            yes
linux-f8es:~ # virsh net-undefine default
Network default has been undefined
linux-f8es:~ # virsh net-define 10nw_eth0_ov.xml
Network 10-nw defined from 10nw_eth0_ov.xml
linux-f8es:~ # virsh net-define 9nw_eth1_ov.xml
Network 9-nw defined from 9nw_eth1_ov.xml
linux-f8es:~ # virsh net-list --all
Name      State     Autostart      Persistent
----------------------------------------------------------
10-nw    inactive     no            yes
9-nw     inactive     no            yes
linux-f8es:~ # virsh net-start 10-nw Network 10-nw started
linux-f8es:~ #
linux-f8es:~ # virsh net-start 9-nw Network 9-nw started
linux-f8es:~ # virsh net-list --all
Name      State    Autostart     Persistent
----------------------------------------------------------
10-nw    active     no            yes
9-nw     active     no            yes
```

Installing vWLC Using VMM

To install vWLC using VMM in SUSE Linux, perform the following steps:

Procedure

Step 1 Similar to Fedora, go to the terminal and type virt-manager.
The Virt Manager (VMM) pop-up appears.

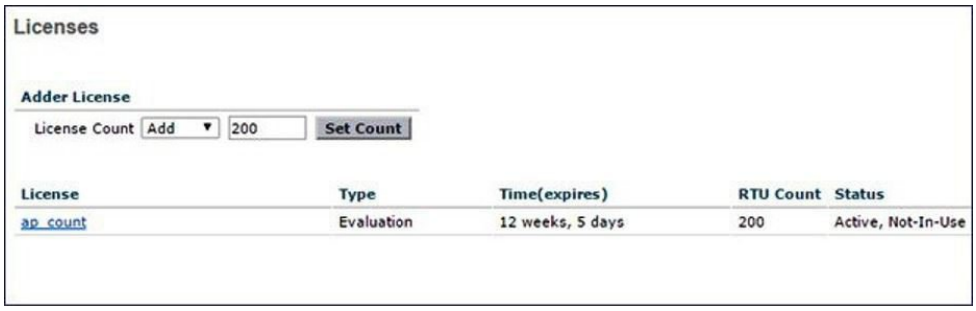
Step 2 Follow the steps covered in Installing vWLC Using Virtual Machine Manager (VMM).

RTU Licensing

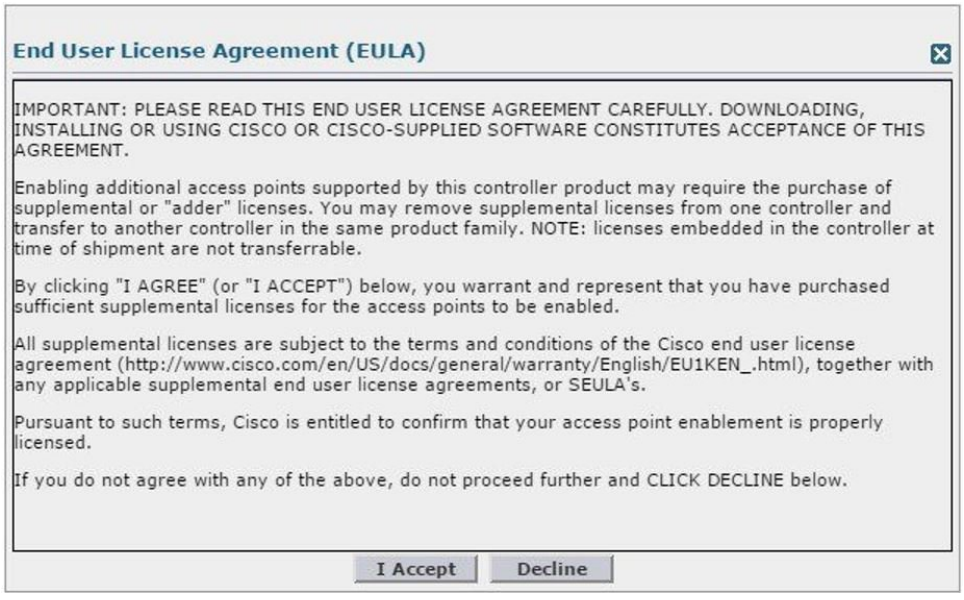
Procedure

Step 1 To install AP adder licenses, click **Management > Software Activation > Licenses**.

Step 2 In the **Adder License**area, in the **License Count** field, set the license task to **Add**, enter the number of AP licenses you have purchased for the vWLC, and then click **Set Count**.



Step 3 Read the **End User License Agreement (EULA)** and click **I Accept**.



The AP adder licenses are installed and activated on the vWLC.

RTU Licensing Using CLI

Procedure

Step 1 To install AP adder licenses using the CLI, enter the following command:
(Cisco Controller) > **license add ap-count<1-200>**

Step 2 Read the **End User License Agreement(EULA)**, type **Y**, and press **Enter** to accept:
Feature Name: ap-count

```
Right to Use

Enabling additional access points supported by this controller
product may require the purchase of supplemental or "adder"
licenses. You may remove supplemental licenses from one controller
and transfer to another controller in the same product family.
NOTE: licenses embedded in the controller at time of
shipment are not transferrable.
By clicking "I AGREE" (or "I ACCEPT") below, you warrant
and represent that you have purchased sufficient supplemental
licenses for the access points to be enabled.
All supplemental licenses are subject to the terms and
conditions of the Cisco end user license agreement
(http://www.cisco.com/en/US/docs/general/warranty/English/EU1KEN_.html),
together with any applicable supplemental end user license agreements,
or SEULA's.
Pursuant to such terms, Cisco is entitled to confirm that your
access point enablement is properly licensed.
If you do not agree with any of the above, do not proceed further
and CLICK "DECLINE" below. ACCEPT? [y/n]: Y
Successfully added the license.
```

Step 3 The AP adder licenses are installed and activated on the vWLC. You can view the installed licenses by typing the **show license summary** command:
(Cisco Controller) > **show license summary**

```
Feature name:
```

```
ap_count License type:
Evaluation License Eula:
Not Accepted
Evaluation total period: 12
weeks 6 days License state:
Inactive, Not-In-Use
RTU License Count: 200

Feature name:
ap_count (adder)
License type:
Permanent
License state:
Active, Not-In-Use
RTU License Count:
200
```

Step 4 To activate or deactivate a feature license, enter the following command:
license {activate | deactivate} feature *license_name*

Smart Licensing

Cisco Smart Software Licensing makes it easier to buy, deploy, track, and renew Cisco software by removing today's entitlement barriers and providing information about your software install base. This is a major change to Cisco's software strategy, moving away from a PAK-based model to a new approach that enables flexibility and advanced consumer-based models.

With Cisco Smart Software Licensing, you will have:

- Visibility into devices and software that you have purchased and deployed
- Automatic license activation
- Product simplicity with standard software offers, licensing platform, and policies
- Possibility of decreased operational costs

You, your chosen partners, and Cisco can view your hardware, software entitlements, and eventually services in the Cisco Smart Software Manager interface.

All Smart Software Licensed products, upon configuration and activation with a single token, will self-register, removing the need to go to a website and register product after product with PAKs. Instead of using PAKs or license files, Smart Software Licensing establishes a pool of software licenses or entitlements that can be used across your entire portfolio in a flexible and automated manner. Pooling is particularly helpful with RMAs because it eliminates the need to re-host licenses. You may self manage license deployment throughout your company easily and quickly in the Cisco Smart Software Manager.

Through standard product offers, a standard license platform, and flexible contracts you will have a simplified, more productive experience with Cisco software.

Smart Licensing Using Web GUI

The below steps are for the Direct Cloud Access, the most common deployment mode. This guide is not intended to explain or cover Smart Licensing in-depth. It is expected that the user already has access and fully understands Smart Licensing feature and administration.

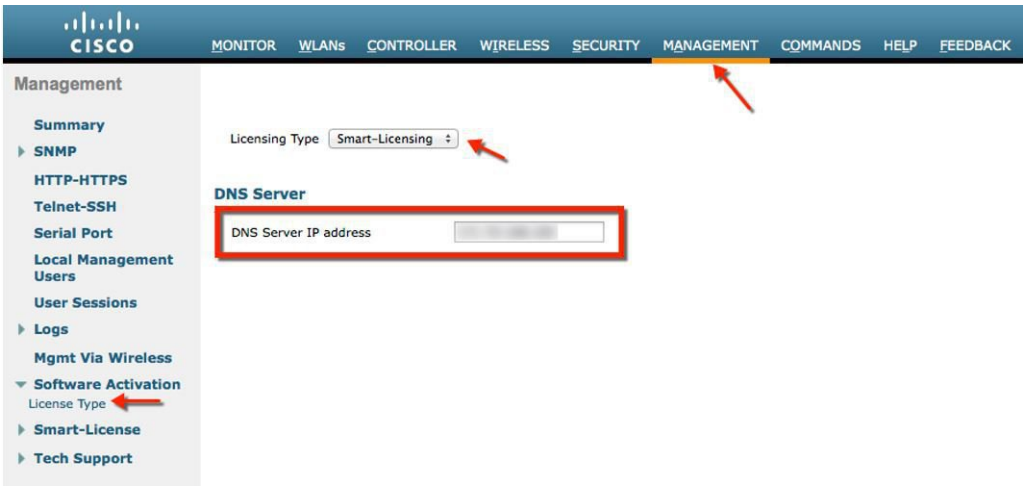
The user must have the ability to create a token-ID required to register the vWLC. Please refer to the deployment guide for more information regarding Smart Licensing if needed.

Enable Smart Licensing and Register Device

Procedure

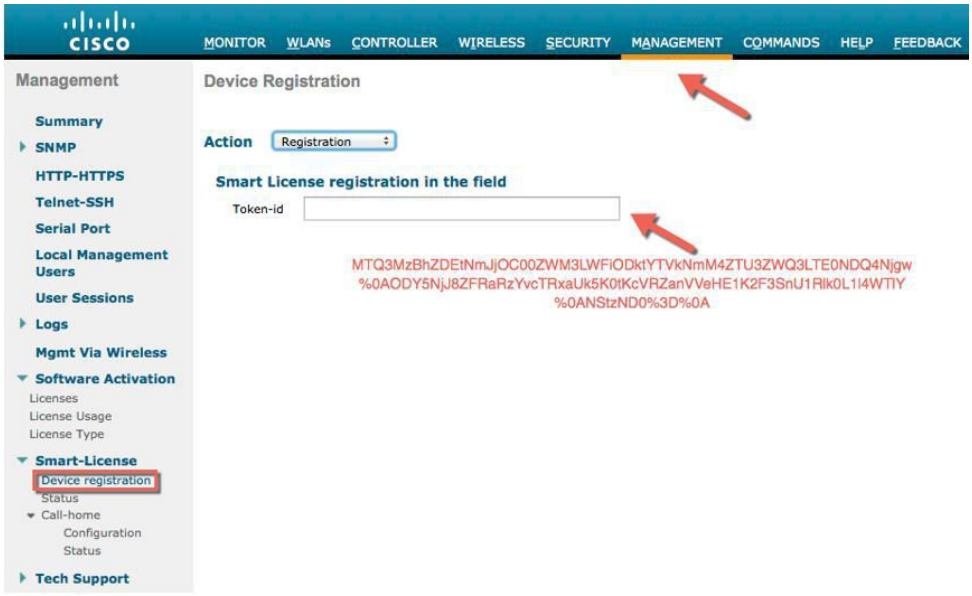
Step 1 To activate Smart Licensing on the WLC go to **Management > Software Activation > License Type.**

Step 2 Select Licensing Type as **Smart-Licensing** from the drop-down menu. Enter the DNS server IP address that will be used to resolve the Smart License and Smart call-home URLs in the call-home profile. Click **Apply**.

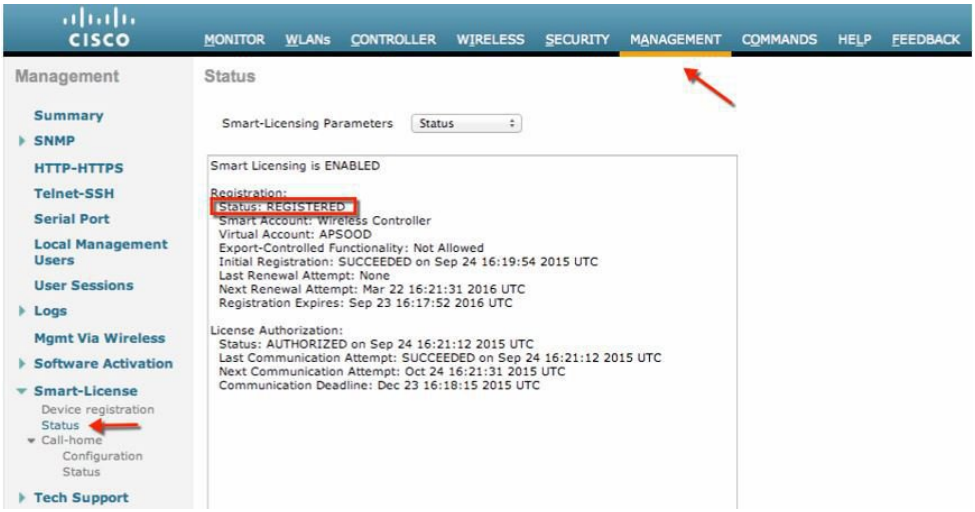


After this step, restart the controller under **Commands > Restart**.

Step 3 Go to **Management > Smart-License > Device registration**. Select action as **Registration**. Register the device by entering the copied token ID.

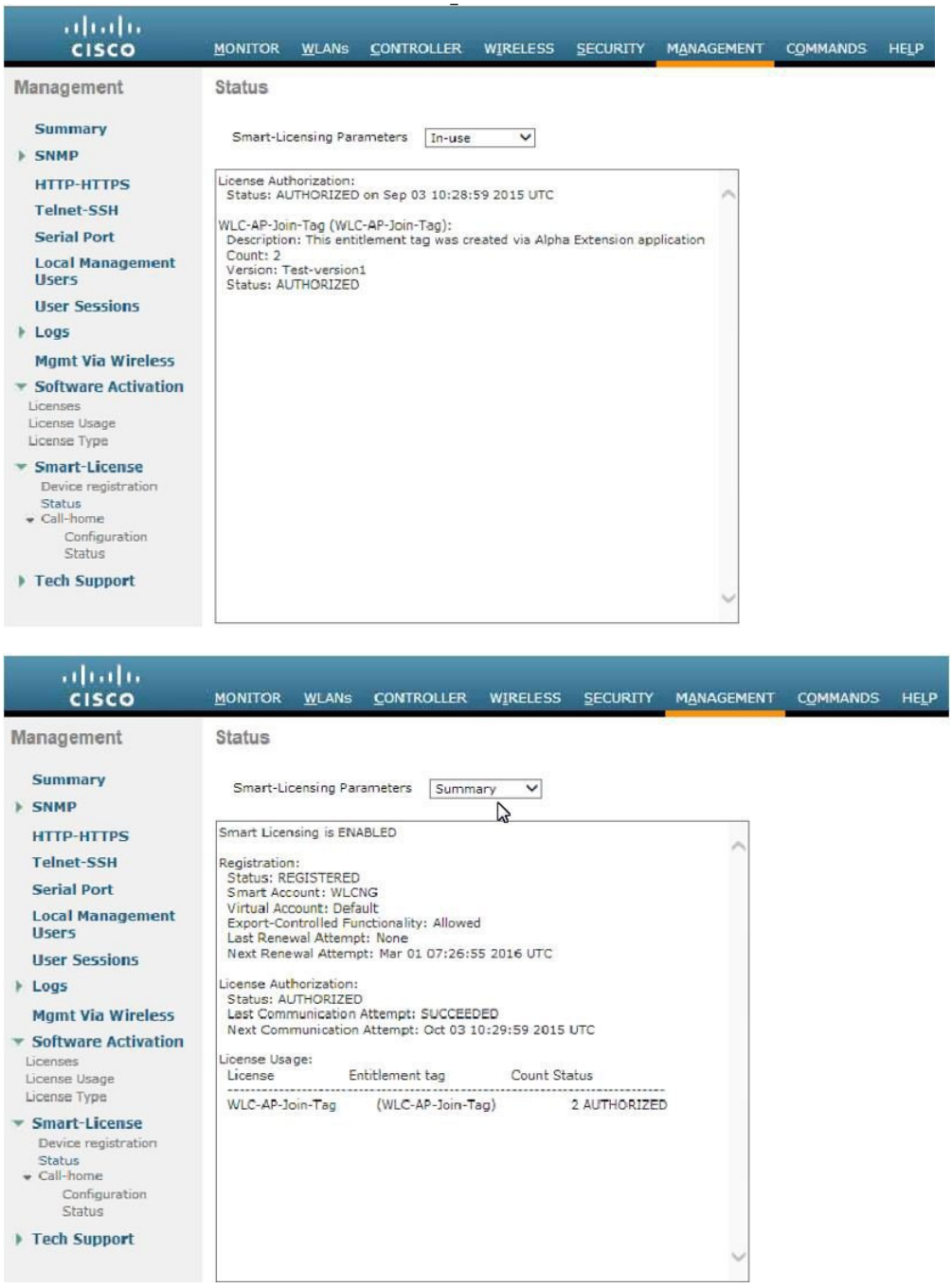


Step 4 Verify the status of Registration and Authorization under **Management > Smart-License > Status**.



In the CSSM portal the device will show up under the **Product Instances** tab on the corresponding virtual account that the device was registered with.

Step 5 Once APs join the WLC, entitlements are requested once in 24 hours and the status of entitlements can be viewed under **Management > Smart-license > Status**.



Virtual Controller Management with Cisco Prime 3.0

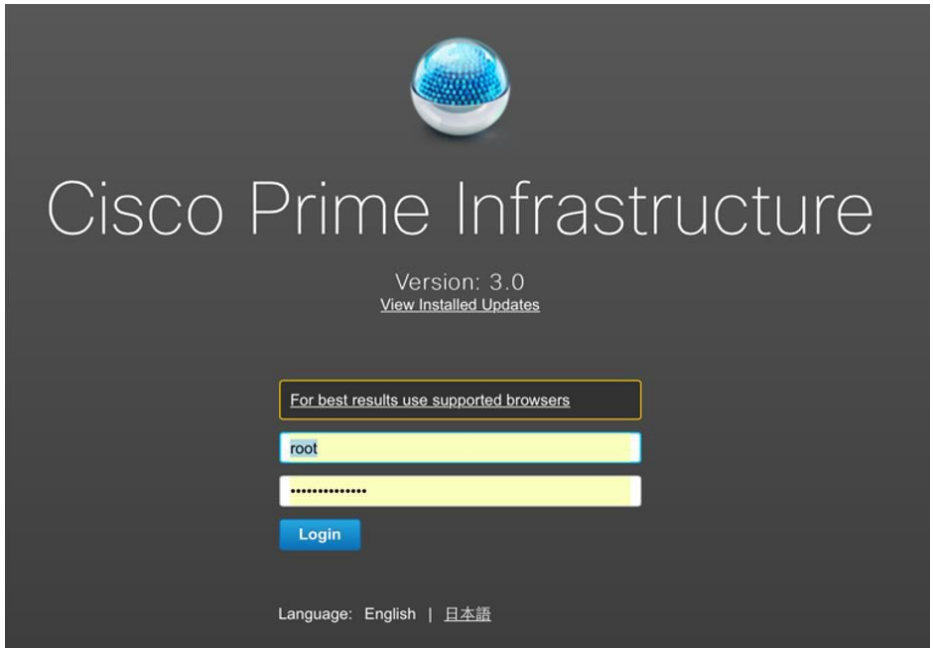
Cisco Prime Infrastructure version 3.0 is the minimum release required to centrally manage one or more Cisco Virtual Controller(s). CPI 3.0 provides configuration, software management, monitoring, reporting and troubleshooting of virtual controllers. Refer to Cisco Prime Infrastructure documentation as required for administrative and management support.

Cisco Prime Compatibility Matrix:

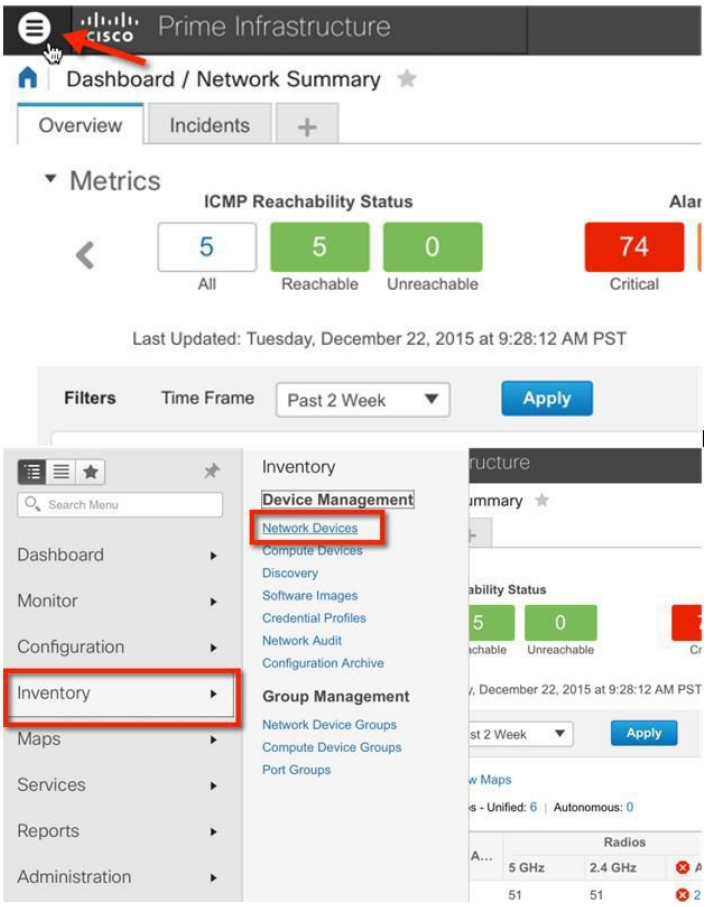
http://www.cisco.com/c/en/us/td/docs/wireless/compatibility/matrix/compatibility-matrix.html#52734

Procedure

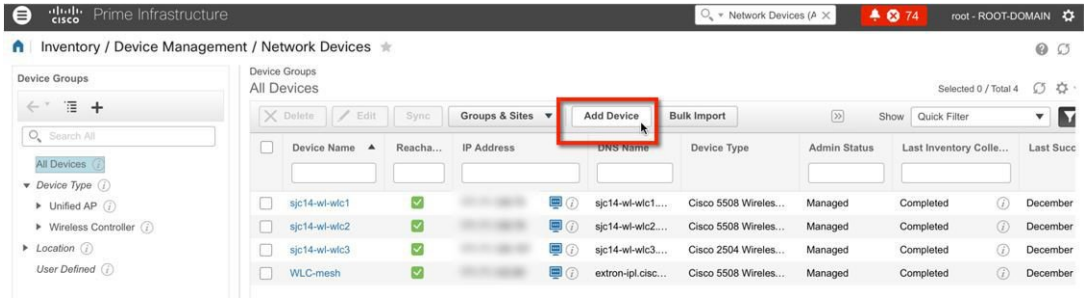
Step 1 Log into Cisco Prime Infrastructure server as root.



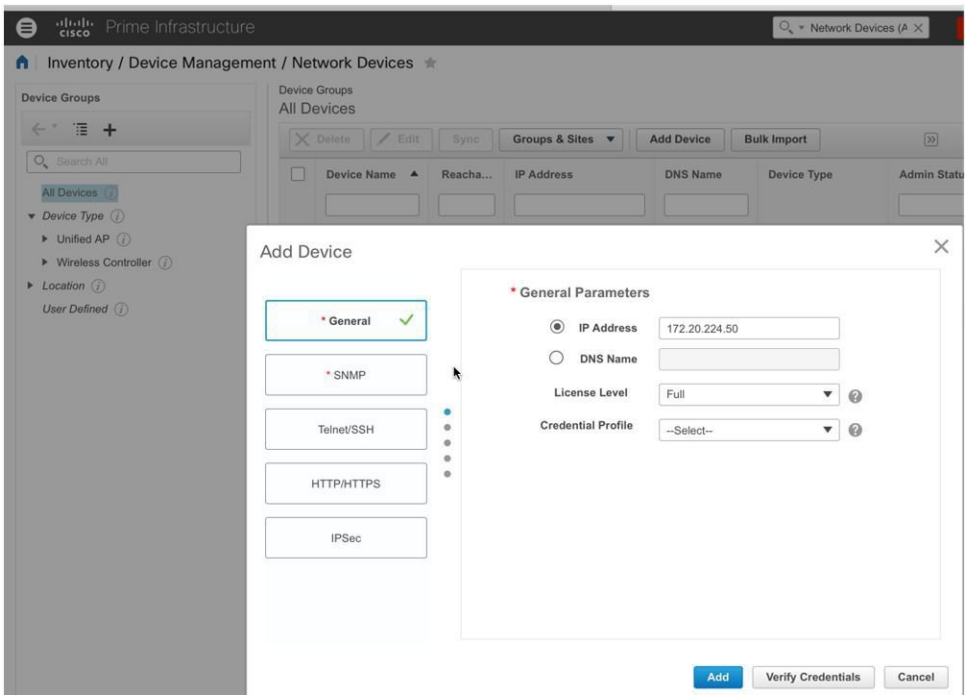
Step 2 Navigate to Inventory, and **Device Management > Network Devices**.

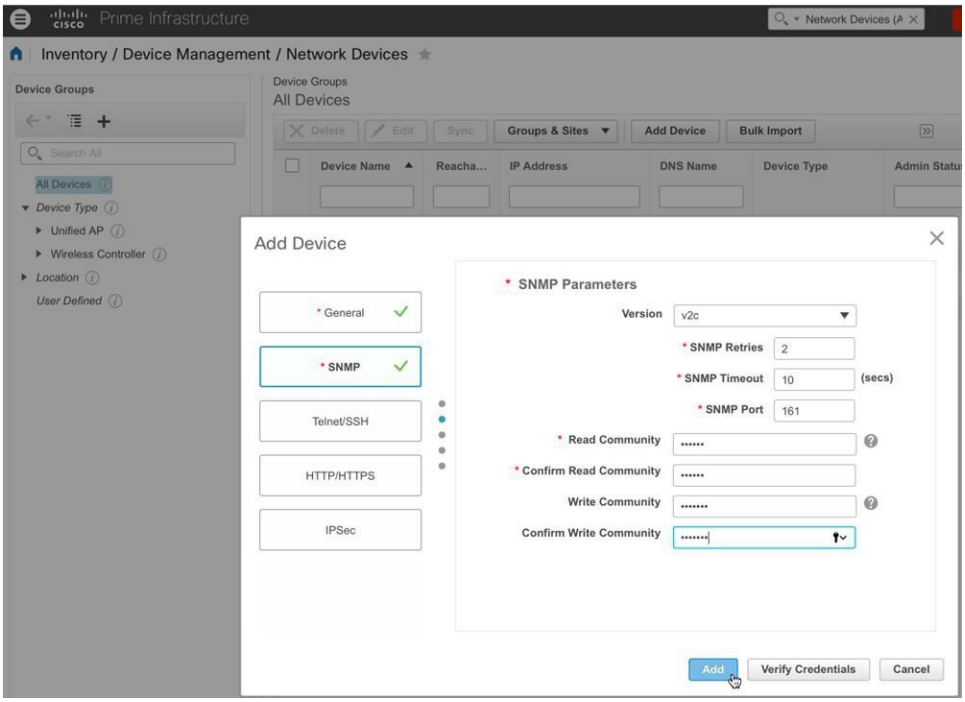


Step 3 In Network Devices, click **Add Device**.

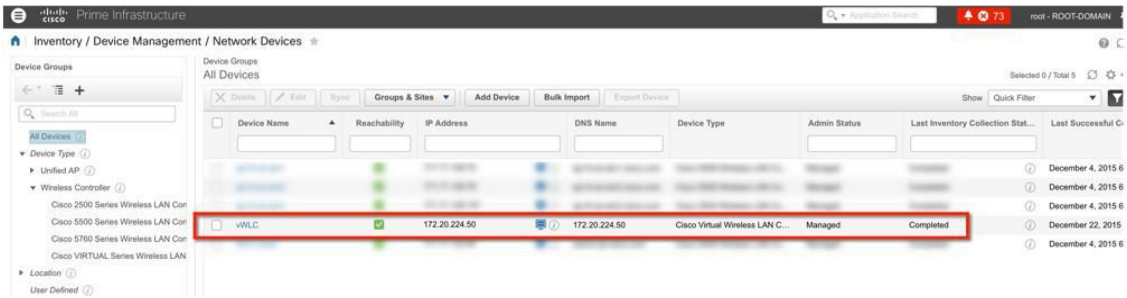


Step 4 Enter the IP address and SNMP community string (Read/Write). By default, the SNMP RW for the controller is **Private**, and click **Add**.





Step 5 Cisco Prime Infrastructure will discover and synchronize with the virtual controller, and click on the refresh button to update the screen. When the virtual controller is discovered, it will list as **Managed**, with good Reachability shown in green. Add any other virtual controller(s) at this point if available.



Step 6 The new controller will be listed in the Device Type, **Cisco Virtual Series Wireless LAN Controller**.

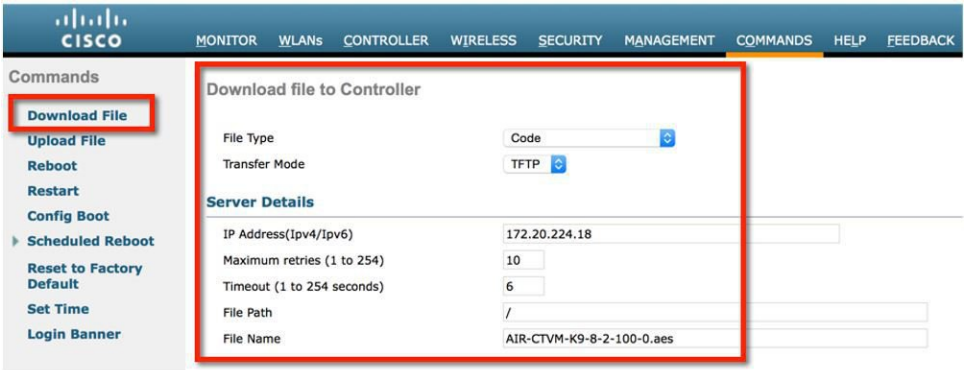
Upgrading the Virtual Controller

In the early steps of installation, the Cisco Virtual Controller initially required an OVA file for new virtual appliance creation; however, maintaining virtual controller features and software upgrade require a common AES file downloadable from Cisco site.

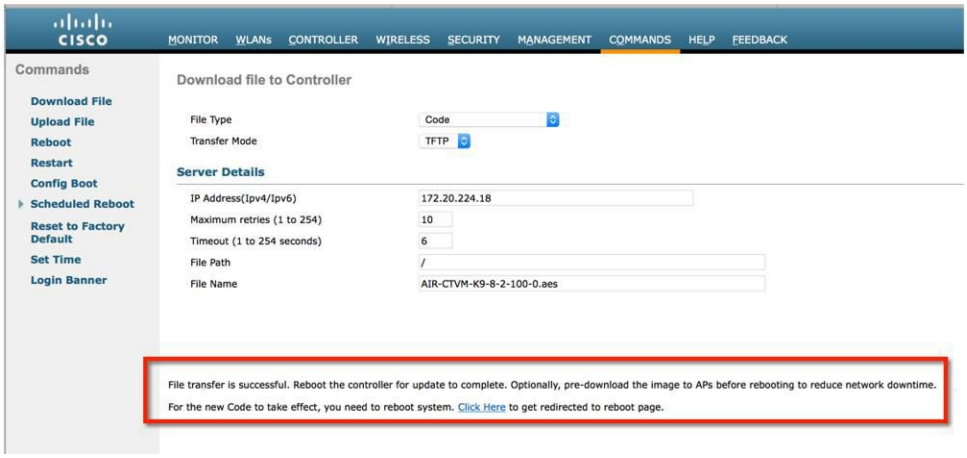
Procedure

Step 1 Download the upgrade software *aes file to a target host (e.g. TFTP/FTP) or use HTTP file transfer.

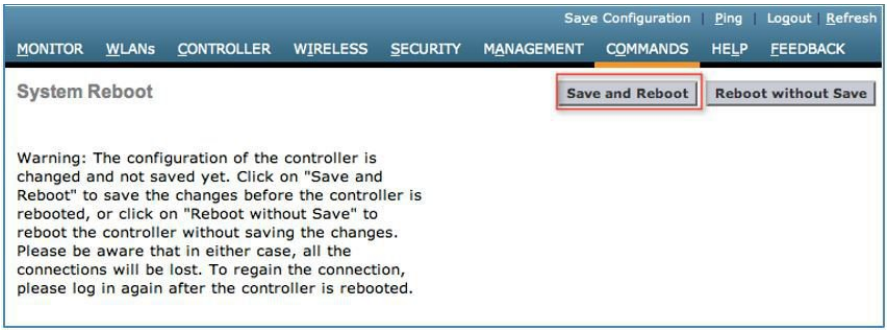
Step 2 Same as for legacy controllers, navigate to the web GUI of the controller, **COMMANDS** > **Download File**. Select File Type, Transfer Mode, IP address, path and File Name (aes file). Click **Download** button to start the process.



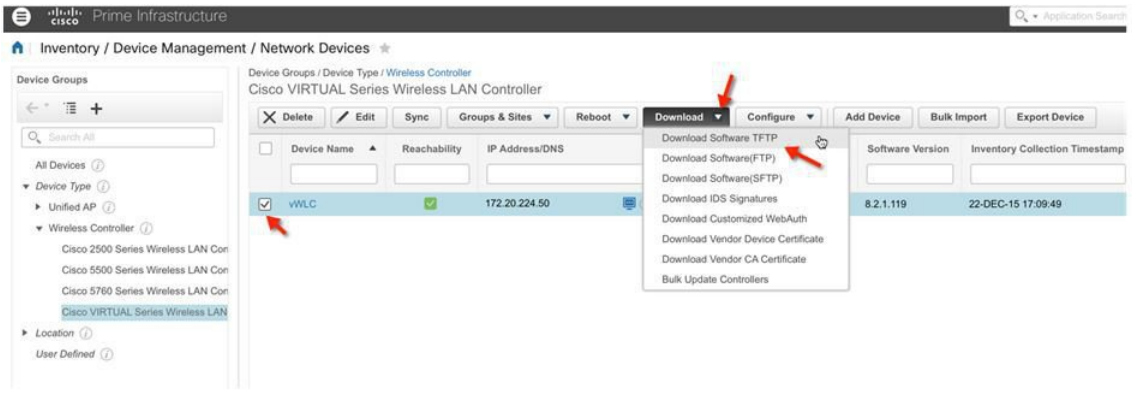
Step 3 When the process is completed successfully, user will be prompted to Reboot to take into effect of the new software image. Click on the link to the Reboot Page to continue.



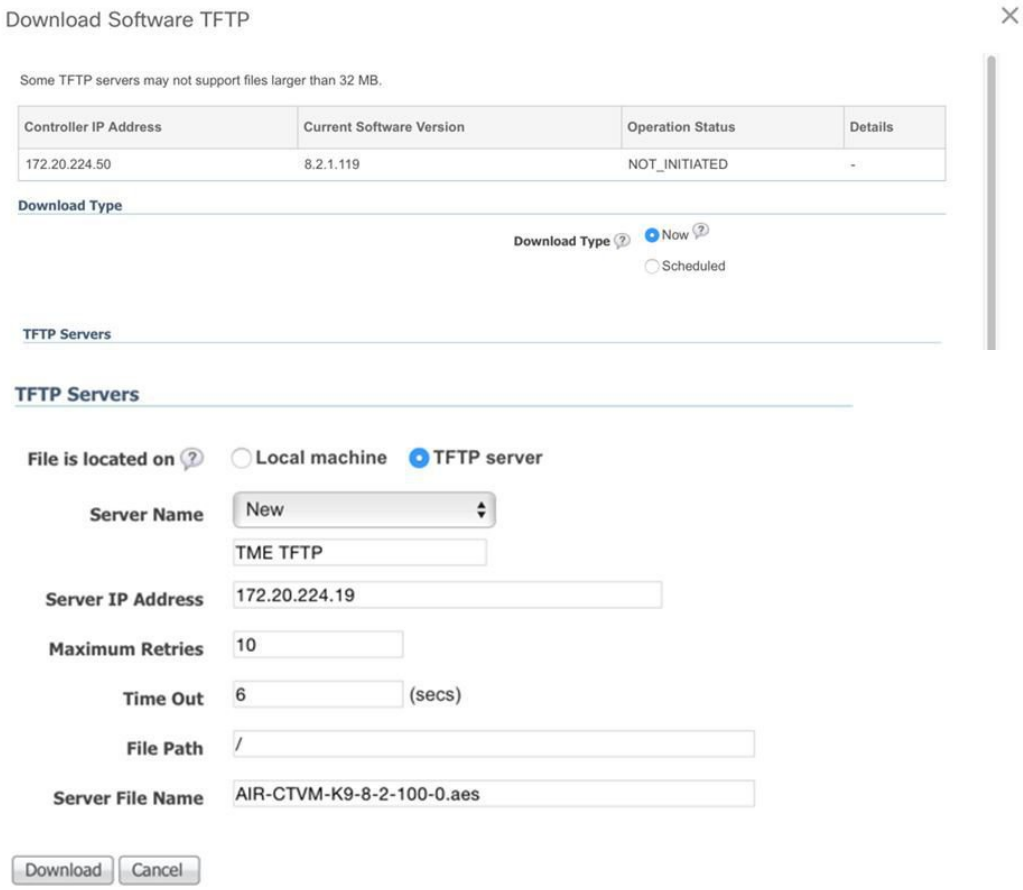
Step 4 Click **Save and Reboot**.



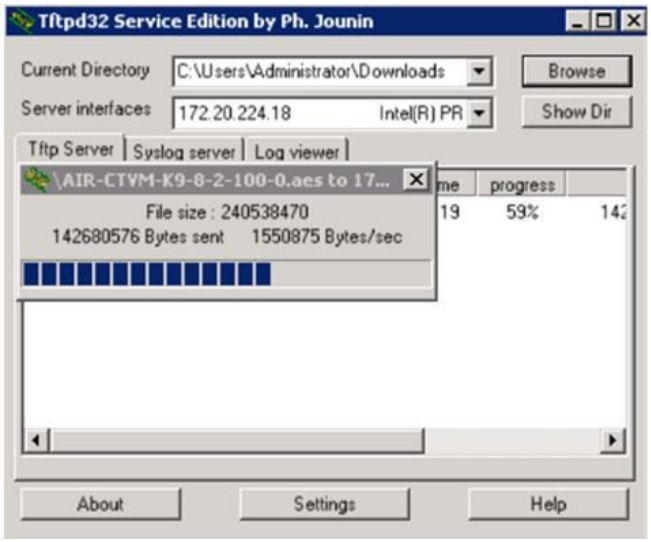
Step 5 Cisco Prime Infrastructure 3.0 can also be useful for upgrading virtual controller, or many virtual controllers at the same time. Navigate to Network Device. Select (check box) one or more virtual controller(s) > from the command pull-down select **Download (TFTP/TFTP)**. This example uses TFTP mode of image upgrade.



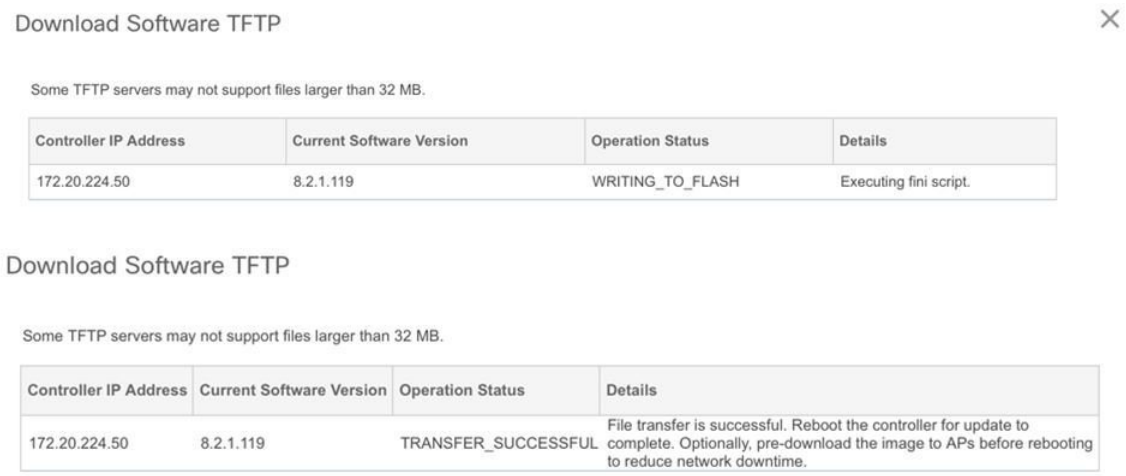
Step 6 Provide the Download Type (Now / Scheduled) > New or Existing server IP address, path and Server File Name (*.aes upgrade software). Click Download to begin.



Step 7 The following screen is an example of the AES image being transferred to the virtual controllers from a TFTP server.



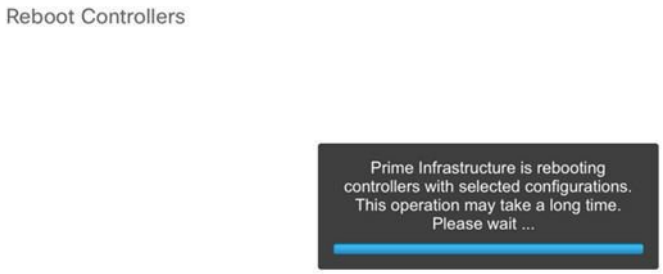
Step 8 Cisco Prime Infrastructure will update the status until the software has successfully been transferred.



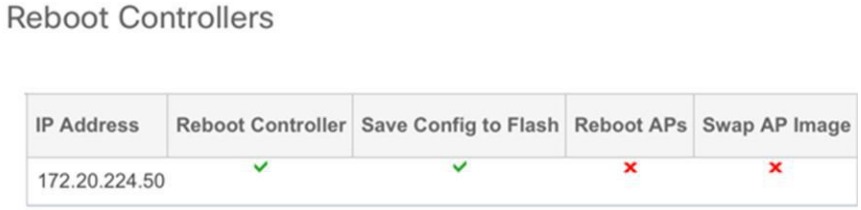
Step 9 Similar to the experience directly from the controller, when the transfer is complete a reboot is required. Navigate in Cisco Prime Infrastructure by selecting the virtual controller(s), and select from command pull-down, Reboot > Reboot Controllers.

Step 10 Cisco Prime Infrastructure will prompt for reboot parameters such as save configuration, etc. Click OK to continue.

Step 11 Cisco Prime Infrastructure will notify the admin that the virtual controllers are being rebooted.



Step 12 When complete, Cisco Prime Infrastructure will provide the result of the process.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA 95134-1706
USA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands