Installing Cisco Open SDN Controller

This chapter contains the following sections:

Installing Open SDN Controller—VMware ESXi

This procedure describes how to install Open SDN Controller on VMware ESXi hypervisors.

Before You Begin

Note the following points before completing this procedure:

- Hostname resolution is recommended, but not required, for the installation. If you decide to make use of it, specify a fully qualified domain name either in the Deploy OVF Template wizard's Properties page or the /etc/hosts file.
- The config field in the Deploy OVF Template wizard's Properties page can safely be left blank.
- If you are setting up a 3-node cluster, you also need to complete Step 3 for the other 2 nodes in the cluster.
- When configuring Open SDN controller from the browser, use only its IP address in the address bar and configuration fields. Do not use its FQDN name.
- If you are using a multiple Network Interface Card (NIC) setup, have the IP addresses for the second and third NICs ready.
- Have values for the following controller settings ready:
    - IP address
    - Hostname
    - Netmask
    - Gateway address
    - DNS server addresses (recommended, but not mandatory)
    - NTP server address (recommended, but not mandatory)

You will need these for Step 3i.

Procedure

Step 1 Download a copy of the Open SDN Controller distribution file:

a) Access the main Download Software page by opening the URL provided in the confirmation email you received after purchasing Open SDN Controller.

b) If prompted, log into Cisco.com.
If you don't already have a Cisco.com account, sign up for one here.

c) From the navigation pane, select **Products** > **Cloud and Systems Management** > **Network Controllers and Applications** > **Cisco Open SDN Controller** > **Cisco Open SDN Controller 1.2**.
Note You may need to click an item more than once in order to view its sub-elements.

d) From Open SDN Controller's Download Software page, locate osc-fcs-vmware-1-2-25005_signed.zip and click **Download**.

e) Unzip the zip file to a local directory.
Two files should now be available: the distribution file and the documentation overview (which links to the documentation provided with this release).

Step 2 Log in to your VMware vSphere client and import the OVA distribution.

Step 3 Complete the Deploy OVF Template wizard:

a) From the client's main menu, select **File > Deploy OVF Template**. The Deploy OVF Template wizard opens.

b) Deploy OVF Template wizard
Click **Browse** to navigate to the OVA distribution.

c) Select the OVA distribution and then click **Open**.

d) Click **Next**.
From the OVF Template Details page, you can view information such as the corresponding product, vendor, and download size.

e) Click **Next**.
From the Name and Location page, you can specify the name and location of the template you are deploying.

f) Click **Next**.
From the Host/Cluster page, you can specify the host or cluster on which to run the template.

g) Click **Next**.
From the Disk Format page, you can select the format in which virtual disks are stored. We recommend that you choose the Thick Provision Lazy Zeroed option.

h) Click **Next**.
From the Network Mapping page, you can specify the networks that the deployed template will use and map every source network with the correct destination network. Although it is not mandatory, we recommend that you pair each source network with a unique destination network.

i) Click **Next**.
From the Properties page, you can customize the configuration settings for this deployment. At this point, you have two options:

- You can leave this wizard page blank and move on to the last wizard page. See Step 3j.

- You can enter the appropriate settings. Values must be entered for the following four fields:
  - ip_0 (IP address): Note that you must specify an IPv4 address. IPv6 addresses are not supported.
  - host_fqdn (hostname)
  - netmask_0 (netmask)
  - gateway_0 (gateway address)

  Caution If you fail to enter a value for any of these four fields, the installation will not complete successfully.

  While they are not required, we recommend that you also enter values for the following fields:

  - dns_0 and dns_1 (DNS server addresses)
  - ntp (NTP server address)

j) Click **Next**.
From the Ready to Complete page, you can view a summary of all the settings you have specified in the wizard.

k) Click **Finish** to deploy the template. After a few minutes, a dialog box opens and indicates that the deployment has successfully completed.

l) Click **Close**.

Step 4 Determine the controller's IP address, which you will need for Step 5a:

a) From your vSphere client's device list, right-click the controller's entry and then select **Open Console**.

b) Log in to the controller as the sysadmin user with the following credentials:

1. login: sysadmin
2. password: sysadmin

At this point, you are prompted to configure a new password for the sysadmin user.

c) Enter a new password for the admin user and then press the Enter key.
The OS Configuration Console opens.

d) Open the Network Settings page and note the value listed in the IP Address field.

Step 5 Complete the setup wizard:

a) Open the following URL: https://<*controller's-IP-address*>
The setup wizard's Cluster Configuration page opens.

b) Configure the cluster that will run on the controller:

1. Select whether you want to create a one or three-node cluster.
2. Specify the nodes that belong to the cluster.

   Note the following:

   - The first field is automatically populated with the IP address of the node you just accessed.
   - If you select the three-node option, you will need to enter the IP addresses for the other two nodes you want to add to the cluster before proceeding.

- Open SDN Controller will validate every IP address you enter and indicate whether the address is reachable.

3 Do one of the following:

- To skip multiple NIC setup, click **Cluster mode**.

  The setup wizard's Cluster Mode page opens. Skip ahead to Step 5bv.

- To set up multiple NICs, select the **Use multiple interface config** check box and then click **Multiple NIC configuration**.

  The setup wizard's Network Configuration page opens. Proceed to Step 5biv.

4 Do one of the following:

- Click **Back** to correct any errors you made when specifying the IP addresses of the cluster nodes.
- Enter the relevant device (Southbound) and controller–cluster (East–West) interface information and then click **Cluster mode**.

  The setup wizard's Cluster Mode page opens.

  Note the following:

  - Open SDN Controller will use tooltips to indicate any invalid IP addresses you have entered, as well as any fields that require an IP address in order to complete the validation process.
  - This button is available only after you have entered valid network configuration information.

5 Specify whether to use Simple or Enhanced cluster configuration mode:

- If you select Simple mode and want to configure a virtual IP address for use with the cluster, select the **Virtual IP Configuration** check box and then click **Setup VIP**.

  The setup wizard's VIP Configuration page opens. Proceed to Step 5bvi.

- If you select Simple mode and do not want to configure a virtual IP address, skip ahead to Step 5bvii.
- If you select Enhanced mode, you are required to configure a virtual IP address for use with the cluster. Click **Setup VIP**.

  The setup wizard's VIP Configuration page opens. Proceed to Step 5bvi.

  Note For more information on Simple and Enhanced mode, see Cluster Configuration Modes.

6 Enter the virtual IP address to be used with the cluster and assign each cluster node with the appropriate priority setting.

If the cluster nodes reside in multiple subnets, you will also need to pair the virtual IP address with adjacent BGP routers. Select the BGP Peering check box and enter the required settings.

For more information on the settings in the VIP Configuration page, see Virtual IP Address Configuration Settings.

Note If you set up multiple NICs, Open SDN Controller supports the virtual address you specify for northbound IP traffic only.

7 Click **Submit Cluster Configuration**.

The setup wizard's Configuration Status page opens:

- If configuration completes successfully (this typically takes about 5 minutes) and the authentication/login service starts, the setup wizard's Admin Account page opens. Proceed to Step 6.
- If configuration does not complete:
  1. Check ansible.log and platform_services.log (located in the /var/log/ directory) to determine the errors that took place and make the necessary fixes.
  2. Establish an SSH connection with the controller's VM.
  3. Run the following command:

     sudo vi /opt/cisco/platform/platform-services/data/node-config-state
  4. In the resulting file, set the state as Not Configured and then save the file.
  5. Refresh your browser to restart the setup wizard.
  6. Repeat Step 5b.

Step 6 Enter a new passphrase for the admin user twice (the second time to confirm it) and then click **Change Passphrase**.
Note the following:

- We recommend that you do not edit the value already set for the Current Passphrase field.
- Passwords must contain a minimum of 6 characters.
- After the password is changed, you are automatically directed to the Login page.

Step 7 Log in to the controller, using the username **admin** and the password you just set.
Note that the necessary Open SDN Controller plug-ins are installed automatically when you install the controller. To view all of the plug-ins that are available, select **Features** from the main toolbar's Management menu.

Installing Open SDN Controller—Oracle VM VirtualBox

Complete the following procedure to install Open SDN Controller on a virtual machine using Oracle VM VirtualBox. When configuring Open SDN Controller from the browser, use only its IP address in the address bar and configuration fields. Do not use its FQDN name.

Procedure

Step 1 Download a copy of the Open SDN Controller distribution file:

a) Access the main Download Software page by opening the URL provided in the confirmation email you received after purchasing Open SDN Controller.

b) If prompted, log into Cisco.com.
If you don't already have a Cisco.com account, sign up for one here.

c) From the navigation pane, select **Products** > **Cloud and Systems Management** > **Network Controllers and Applications** > **Cisco Open SDN Controller** > **Cisco Open SDN Controller 1.2**.
Note You may need to click an item more than once in order to view its sub-elements.

d) From Open SDN Controller's Download Software page, locate osc-fcs-vbox-1-2-25005_signed.zip and click **Download**.

e) Unzip the zip file to a local directory.
Two files should now be available: the distribution file and the documentation overview (which links to the documentation provided with this release).

Step 2 Create the virtual machine on which you will install the controller:

a) Launch VirtualBox 4.3.x

b) Select **File** > **Import Appliance**.

c) Navigate to the distribution file you downloaded in Step 1, select it, and then click **Open**.
The required OS, memory, and hard drive settings are automatically set.

Note If you plan to use Open SDN Controller for development purposes only, you can lower the amount of memory allocated to the controller from 16 GB of ram to 8 GB.

d) Click **Import**.

Step 3 Specify the network settings necessary in order for the controller to operate properly on the virtual machine:

a) Select the new virtual machine and then click **Settings** from the VirtualBox main menu.

b) From the Settings menu, click **Network**.

c) If necessary, select the Enable Network Adapter checkbox.

d) From the Attached to: drop-down list, select **Bridged Adapter**.

e) From the Name: drop-down list, select a wired network adapter.
VirtualBox does not provide wireless support for bridged networking.

Note the following:

- If multiple network adapters are listed, select each adapter's tab and repeat Steps 3c through 3e.
- If you plan to create a 3 node cluster in Step 8 of this procedure, complete Steps 3f through 3h. Otherwise, skip ahead to Step 4.

f) Click **Advanced** to display additional network adapter options.

g) From the Adapter Type: drop-down list, select **Paravirtualized Network (virtio-net)**.

h) Click **OK**.

Step 4 Start the virtual machine by doing one of the following:

- Select the virtual machine and then click **Start** from the VirtualBox main menu.
- Right-click the virtual machine and then select Start.

Once you start the virtual machine, it will automatically grab a DHCP address.

Step 5 Log in to the controller as the sysadmin user with the following credentials:

a) login:sysadmin

b) password: sysadmin
At this point, you are prompted to configure a new password for the sysadmin user.

Step 6 Enter a new password for the sysadmin user and then press the Enter key.
The OS Configuration Console opens.

Step 7 Determine the controller's IP address, which you will need for Step 8a:

a) Select the **Drop to shell** option.
b) Run the following command: **ifconfig eth0 | grep inet**
c) Note the value listed for **inet addr**.

Step 8 Complete the setup wizard:

a) Open the following URL: https://<*controller's-IP-address*>
The setup wizard's Cluster Configuration page opens.

b) Configure the cluster that will run on the controller:

1 Select whether you want to create a one or three-node cluster.

2 Specify the nodes that belong to the cluster.

Note the following:

- The first field is automatically populated with the IP address of the node you just accessed.
- If you select the three-node option, you will need to enter the IP addresses for the other two nodes you want to add to the cluster before proceeding.
- Open SDN Controller will validate every IP address you enter and indicate whether the address is reachable.

3 Do one of the following:

- To skip multiple NIC setup, click **Cluster mode**.

  The setup wizard's Cluster Mode page opens. Skip ahead to Step 8bv.

- To set up multiple NICs, select the **Use multiple interface config** check box and then click **Multiple NIC configuration**.

  The setup wizard's Network Configuration page opens. Proceed to Step 8biv.

4 Do one of the following:

- Click **Back** to correct any errors you made when specifying the IP addresses of the cluster nodes.
- Enter the relevant device (Southbound) and controller–cluster (East–West) interface information and then click **Cluster mode**.

  The setup wizard's Cluster Mode page opens.

  Note the following:

  ◦ Open SDN Controller will use tooltips to indicate any invalid IP addresses you have entered, as well as any fields that require an IP address in order to complete the validation process.

  ◦ This button is available only after you have entered valid network configuration information.

5 Specify whether to use Simple or Enhanced cluster configuration mode:

- If you select Simple mode and want to configure a virtual IP address for use with the cluster, select the **Virtual IP Configuration** check box and then click **Setup VIP**.

The setup wizard's VIP Configuration page opens. Proceed to Step 8bvi.

- If you select Simple mode and do not want to configure a virtual IP address, skip ahead to Step 8bvii.
- If you select Enhanced mode, you are required to configure a virtual IP address for use with the cluster. Click **Setup VIP**.

  The setup wizard's VIP Configuration page opens. Proceed to Step 8bvi.

  Note For more information on Simple and Enhanced mode, see Cluster Configuration Modes.

6 Enter the virtual IP address to be used with the cluster and assign each cluster node with the appropriate priority setting.

If the cluster nodes reside in multiple subnets, you will also need to pair the virtual IP address with adjacent BGP routers. Select the BGP Peering check box and enter the required settings.

For more information on the settings in the VIP Configuration page, see Virtual IP Address Configuration Settings.

Note If you set up multiple NICs, Open SDN Controller supports the virtual address you specify for northbound IP traffic only.

7 Click **Submit Cluster Configuration**.

The setup wizard's Configuration Status page opens:

- If configuration completes successfully (this typically takes about 5 minutes) and the authentication/login service starts, the setup wizard's Admin Account page opens. Proceed to Step 9.
- If configuration does not complete:

  1 Check ansible.log and platform_services.log (located in the /var/log/ directory) to determine the errors that took place and make the necessary fixes.

  2 Establish an SSH connection with the controller's VM.

  3 Run the following command:

  sudo vi /opt/cisco/platform/platform-services/data/node-config-state

  4 In the resulting file, set the state as Not Configured and then save the file.

  5 Refresh your browser to restart the setup wizard.

  6 Repeat Step 8b.

Step 9 Enter a new passphrase for the admin user twice (the second time to confirm it) and then click **Change Passphrase**.
Note the following:

- We recommend that you do not edit the value already set for the Current Passphrase field.
- Passwords must contain a minimum of 6 characters.
- After the password is changed, you are automatically directed to the Login page.

Step 10 Click the arrow at the top of the page to open the Admin Configuration page.

Step 11 (Optional) Create a secondary admin user for the controller by entering the necessary information and then clicking **Create User**. You can skip this step by clicking **Skip User Creation**.

Step 12 Click the arrow at the top of the page to complete cluster configuration and open the Cisco Open SDN controller login page.

Step 13 Log in to the controller.
If you set up a secondary admin user, enter that user's credentials. Otherwise, enter the default admin user's credentials.

Note that the necessary Open SDN Controller plug-ins are installed automatically when you install the controller. To view all of the plug-ins that are available, select **Features** from the main toolbar's Management menu.

Cluster Configuration Modes

During the installation process, you can choose one of the following cluster configuration modes:

Simple Mode

When Simple mode is selected, a cluster operates just as it did in previous Open SDN Controller releases. If you want to take things a step further, you can also specify a virtual IP address for use with that cluster. Doing so accomplishes two things: First, it enables either a user accessing the Open SDN Controller GUI or an application communicating with Open SDN Controller via REST APIs to access the system using a single IP address. And second, it provides built-in high availability (HA) by automatically associating the virtual IP address with an another active cluster node if the node that is currently associated with the virtual IP address goes down. In this mode, Open SDN Controller automatically assigns the same priority to each cluster node and chooses the best available node to associate the virtual IP address with.

Enhanced Mode

When Enhanced mode is selected, you are required to specify a virtual IP address for cluster use. Doing so provides the same benefits described for Simple mode: system access with a single IP address and HA. However, there are a few key differences between the two modes:

- In Enhanced mode, the cluster can continue to operate even if only one node is active. In Simple mode, at least 2 nodes need to be active at any given time.
- Unlike Simple mode, Enhanced mode allows you to assign priority settings to cluster nodes as you see fit.

For more information on virtual IP address configuration, see Virtual IP Address Configuration Settings.

Virtual IP Address Configuration Settings

The following table describes the settings you need to specify when configuring a virtual IP address for use with an Open SDN Controller cluster in the setup wizard's Virtual IP Configuration page. Note than you can enter the settings for multiple BGP routers (if necessary).

Setting	Description
Virtual IP Address	The virtual IP address to be used by the nodes in an Open SDN Controller cluster.
BGP Peering check box	Select to configure the settings necessary to pair the virtual IP address with adjacent BGP routers. You will need to do this if your cluster nodes reside in separate subnets. **Note** Most of the settings described in this table are available only if this check box is selected.
Priority drop-down list	Set the appropriate priority setting for each cluster node. You can select one of three values (from highest priority to lowest): `Primary`, `Secondary`, and `Tertiary`. Open SDN Controller associates the virtual IP address with the active node that has the highest priority. Note the following: • You can set the same priority for multiple cluster nodes. In this case, Open SDN Controller associates the virtual IP address with the active node that has the lowest IP address. For example, say that the IP address for your cluster nodes are 10.0.0.11, 10.0.0.12, and 10.0.0.13 respectively and you have assigned all three nodes with Primary priority. When all of these nodes are active, Open SDN Controller will associate the virtual IP address with 10.0.0.11 because its IP address is the lowest. If that device was to go down for some reason, 10.0.0.12 would then be associated with the virtual IP address until 10.0.0.11 comes back online. • You cannot assign priority settings to cluster nodes when Simple cluster mode is selected. In this case, Open SDN Controller chooses the best available node to associate the virtual IP address with.
BGP peer IP address	The IP address of a BGP router.
BGP local ASN	The autonomous system number (ASN) configured for the virtual IP address.
BGP peer remote peer ASN	The ASN for a BGP router.
BGP password	Password required to log into a BGP router.
BGP AS_PATH to use	(Optional) The space-delimited autonomous system (AS) path to be included in unsigned 16 or 32-bit values.
BGP MED to use	The Multi Exit Discriminator (MED) attribute provides a dynamic way to influence another AS in the way to reach a certain route when there are multiple entry points for that AS. When all other factors are equal, the exit point with the lowest MED is prefererred.
SETUP_VIP_BGP_LOCAL_PREF	Indicates to the AS which path has preference to exit the AS in order to reach a certain network. Paths with a higher local preference are preferred.

Setting	Description
BGP Communities to use	The community to be used by the network group for BGP policies. BGP communities are space-delimited and formatted as follows: <*unsigned-16-bit-value*>:<*unsigned-16-bit-value*>.
BGP priority community value	A special unsigned 16-bit value used to form a dynamic community with another 16-bit value, which indicates a node's priority. It is formatted as follows: <*unsigned-16-bit-value*>:<*node's-priority-value*>.
BGP origin to use	The BGP origin code to be used for path selection. Specify one of the following values: • `IGP`—Remote Interior Gateway Protocol (IGP) system • `EGP`—Local Exterior Gateway Protocol (EGP) system • `Incomplete`—Unknown heritage
BGP no-export	When set to `true`, the well-known BGP community is disabled to prevent the prefix from being advertised outside of the ASN.
BGP no-advertise	When set to `true`, the well-known BGP community is disabled to prevent the prefix from being advertised to other peers.