Nexus Dashboard Orchestrator Infrastructure Management, Release 4.3.x

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Pod Profile and Policy Group

In each site's APIC, you must have one Pod profile with a Pod policy group. If your site does not have a Pod policy group you must create one. Typically, these settings will already exist as you will have configured them when you first deployed the fabric.

1. Log in to the site's APIC GUI.
2. Check that the Pod profile contains a Pod policy group.

   Navigate to **Fabric > Fabric Policies > Pods > Profiles > Pod Profile default**.

3. If necessary, create a Pod policy group.
   a. Navigate to **Fabric > Fabric Policies > Pods > Policy Groups**.
   b. Right-click **Policy Groups** and select **Create Pod Policy Group**.
   c. Enter the appropriate information and click **Submit**.
4. Assign the new Pod policy group to the default Pod profile.
   a. Navigate to **Fabric > Fabric Policies > Pods > Profiles > Pod Profile default**
   b. Select the default profile.
   c. Choose the new pod policy group and click **Update**.

Configuring Fabric Access Policies for All APIC Sites

Before your APIC fabrics can be added to and managed by the Nexus Dashboard Orchestrator, there is a number of fabric-specific access policies that you must configure on each site.

Configuring Fabric Access Global Policies

This section describes the global fabric access policy configurations that must be created for each APIC site before it can be added to and managed by the Nexus Dashboard Orchestrator.

1. Log in directly to the site's APIC GUI.
2. From the main navigation menu, select **Fabric > Access Policies**.

   You must configure a number of fabric policies before the site can be added to the Nexus Dashboard Orchestrator. From the APIC's perspective, this is something you do just like you would if you were connecting a bare-metal host, where you would configure domains, AEPs, policy groups, and interface selectors; you must configure the same options for connecting the spine switch interfaces to the inter-site network for all the sites that will be part of the same Multi-Site domain.

3. Specify the VLAN pool.

   The first thing you configure is the VLAN pool. We use Layer 3 sub-interfaces tagging traffic with VLAN-4 to connect the spine switches to the inter-site network.

   a. In the left navigation tree, browse to **Pools > VLAN**.
   b. Right-click the **VLAN** category and choose **Create VLAN Pool**.

      In the **Create VLAN Pool** window, specify the following:

      - For the **Name** field, specify the name for the VLAN pool, for example msite.
      - For **Allocation Mode**, specify Static Allocation.
      - And for the **Encap Blocks**, specify just the single VLAN 4. You can specify a single VLAN by entering the same number in both **Range** fields.

4. Configure Attachable Access Entity Profiles (AEP).
   a. In the left navigation tree, browse to **Global Policies > Attachable Access Entity Profiles**.
   b. Right-click the **Attachable Access Entity Profiles** category and choose **Create Attachable Access Entity Profiles**.

      In the **Create Attachable Access Entity Profiles** window, specify the name for the AEP, for example msite-aep.

   c. Click **Next** and **Submit**

      No additional changes, such as interfaces, are required.

5. Configure domain.

The domain you configure is what you will select from the Nexus Dashboard Orchestrator when adding this site.

a. In the left navigation tree, browse to **Physical and External Domains > External Routed Domains**.

b. Right-click the **External Routed Domains** category and choose **Create Layer 3 Domain**.

In the **Create Layer 3 Domain** window, specify the following:

- For the **Name** field, specify the name the domain, for example msite-l3.
- For **Associated Attachable Entity Profile**, select the AEP you created in Step 4.
- For the **VLAN Pool**, select the VLAN pool you created in Step 3.

c. Click **Submit**.

No additional changes, such as security domains, are required.

What to do next:

After you have configured the global access policies, you must still add interfaces policies as described in Configuring Fabric Access Interface Policies.

Configuring Fabric Access Interface Policies

Before you begin:

You must have configured the global fabric access policies, such as VLAN Pool, AEP, and domain, in the site's APIC, as described in Configuring Fabric Access Global Policies.

This section describes the fabric access interface configurations that must be done for the Nexus Dashboard Orchestrator on each APIC site.

1. Log in directly to the site's APIC GUI.
2. From the main navigation menu, select **Fabric > Access Policies**.

   In addition to the VLAN, AEP, and domain you have configured in previous section, you must also create the interface policies for the fabric's spine switch interfaces that connect to the Inter-Site Network (ISN).

3. Configure a spine policy group.

   a. In the left navigation tree, browse to **Interface Policies > Policy Groups > Spine Policy Groups**.

   This is similar to how you would add a bare-metal server, except instead of a Leaf Policy Group, you are creating a Spine Policy Group.

   b. Right-click the **Spine Policy Groups** category and choose **Create Spine Access Port Policy Group**.

   In the **Create Spine Access Port Policy Group** window, specify the following:

   - For the **Name** field, specify the name for the policy group, for example Spine1-PolGrp.

- For the **Link Level Policy** field, specify the link policy used between your spine switch and the ISN.
- For **CDP Policy**, choose whether you want to enable CDP.
- For the **Attached Entity Profile**, select the AEP you have configured in previous section, for example msite-aep.

c. Click **Submit**.

No additional changes, such as security domains, are required.

4. Configure a spine profile.
   a. In the left navigation tree, browse to **Interface Policies > Profiles > Spine Profiles**.
   b. Right-click the **Spine Profiles** category and choose **Create Spine Interface Profile**.

   In the **Create Spine Interface Profile** window, specify the following:

   - For the **Name** field, specify the name for the profile, for example Spine1-ISN.
   - For **Interface Selectors**, click the **+** sign to add the port on the spine switch that connects to the ISN. Then in the **Create Spine Access Port Selector** window, provide the following:
     - For the **Name** field, specify the name for the port selector, for example Spine1-ISN.
     - For the **Interface IDs**, specify the switch port that connects to the ISN, for example 5/32.
     - For the **Interface Policy Group**, choose the policy group you created in the previous step, for example Spine1-PolGrp.

     Then click **OK** to save the port selector.

   c. Click **Submit** to save the spine interface profile.
5. Configure a spine switch selector policy.
   a. In the left navigation tree, browse to **Switch Policies > Profiles > Spine Profiles**.
   b. Right-click the **Spine Profiles** category and choose **Create Spine Profile**.

   In the **Create Spine Profile** window, specify the following:

   - For the **Name** field, specify the name for the profile, for example Spine1.
   - For **Spine Selectors**, click the **+** to add the spine and provide the following:
     - For the **Name** field, specify the name for the selector, for example Spine1.
     - For the **Blocks** field, specify the spine node, for example 201.

   c. Click **Update** to save the selector.
   d. Click **Next** to proceed to the next screen.
   e. Select the interface profile you have created in the previous step

   For example Spine1-ISN.

   f. Click **Finish** to save the spine profile.

Configuring Sites That Contain Remote Leaf Switches

Multi-Site architecture supports {FabricControllerShortName} sites with Remote Leaf switches. The following sections describe guidelines, limitations, and configuration steps required to allow Nexus Dashboard Orchestrator to manage these sites.

Remote Leaf Guidelines and Limitations

If you want to add an APIC site with a Remote Leaf to be managed by the Nexus Dashboard Orchestrator, the following restrictions apply:

- You must upgrade your Cisco APIC to Release 4.2(4) or later.
- Only physical Remote Leaf switches are supported in this release
- Only -EX and -FX or later switches are supported as Remote Leaf switches for use with Multi-Site
- Remote Leaf is not supported with back-to-back connected sites without IPN switches
- Remote Leaf switches in one site cannot use another site's L3Out
- Stretching a bridge domain between one site and a Remote Leaf in another site is not supported

You must also perform the following tasks before the site can be added to and managed by the Nexus Dashboard Orchestrator:

- You must enable Remote Leaf direct communication and configure routable subnets directly in the site's {FabricControllerShortName}, as described in the following sections.
- You must add the routable IP addresses of Cisco APIC nodes in the DHCP-Relay configuration applied on the interfaces of the Layer 3 routers connecting to the Remote Leaf switches.

  The routable IP address of each APIC node is listed in the **Routable IP** field of the **System > Controllers > <controller-name>** screen of the APIC GUI.

Configuring Routable Subnets for Remote Leaf Switches

Before you can add a site that contains one or more Remote Leaf switches to the Nexus Dashboard Orchestrator, you must configure routable subnets for the pod with which the Remote Leaf nodes are associated.

1. Log in directly to the site's {FabricControllerShortName} GUI.
2. From the menu bar, select **Fabric > Inventory**.
3. In the Navigation pane, click **Pod Fabric Setup Policy**.
4. In the main pane, double-click the pod where you want to configure the subnets.
5. In the **Routable Subnets** area, click the **+** sign to add a subnet.
6. Enter the **IP** and **Reserve Address Count**, set the state to Active or Inactive, then click **Update** to save the subnet.

   When configuring routable subnets, you must provide a netmask between /22 and /29.

7. Click **Submit** to save the configuration.

Enabling Direct Communication for Remote Leaf Switches

Before you can add a site that contains one or more Remote Leaf switches to the Nexus Dashboard Orchestrator, you must configure direct remote leaf communication for that site. Additional information about remote leaf direct communication feature is available in the *Cisco APIC Layer 3 Networking Configuration Guide*. This section outlines the steps and guidelines specific to the integration with Multi-Site.

Once you enable Remote Leaf switch direct communication, the switches will function in the new mode only

1. Log in directly to the site's {FabricControllerShortName}.
2. Enable direct traffic forwarding for Remote Leaf switches.
   a. From the menu bar, navigate to **System > System Settings**.
   b. From the left side bar, select **Fabric Wide Setting**.
   c. Check the **Enable Remote Leaf Direct Traffic Forwarding** checkbox.

You cannot disable this option after you enable it.

   d. Click **Submit** to save the changes.

Cisco Mini ACI Fabrics

Cisco Multi-Site supports Cisco Mini ACI fabrics as typical on-premises sites without requiring any additional configuration. This section provides a brief overview of Mini ACI fabrics, detailed info on deploying and configuring this type of fabrics is available in *Cisco Mini ACI Fabric and Virtual APICs*.

Cisco ACI, Release 4.0(1) introduced Mini ACI Fabric for small scale deployment. Mini ACI fabric works with [CiscoAPICShortName] cluster consisting of one physical APIC and two virtual APICs (vAPIC) running in virtual machines. This reduces the physical footprint and cost of the APIC cluster, allowing ACI fabric to be deployed in scenarios with limited rack space or initial budget, such as a colocation facility or a single-room data center, where a full-scale ACI installations may not be practical due to physical footprint or initial cost.

The following diagram shows an example of a mini [CiscoACIShortName2] fabric with a physical APIC and two virtual APICs (vAPICs):

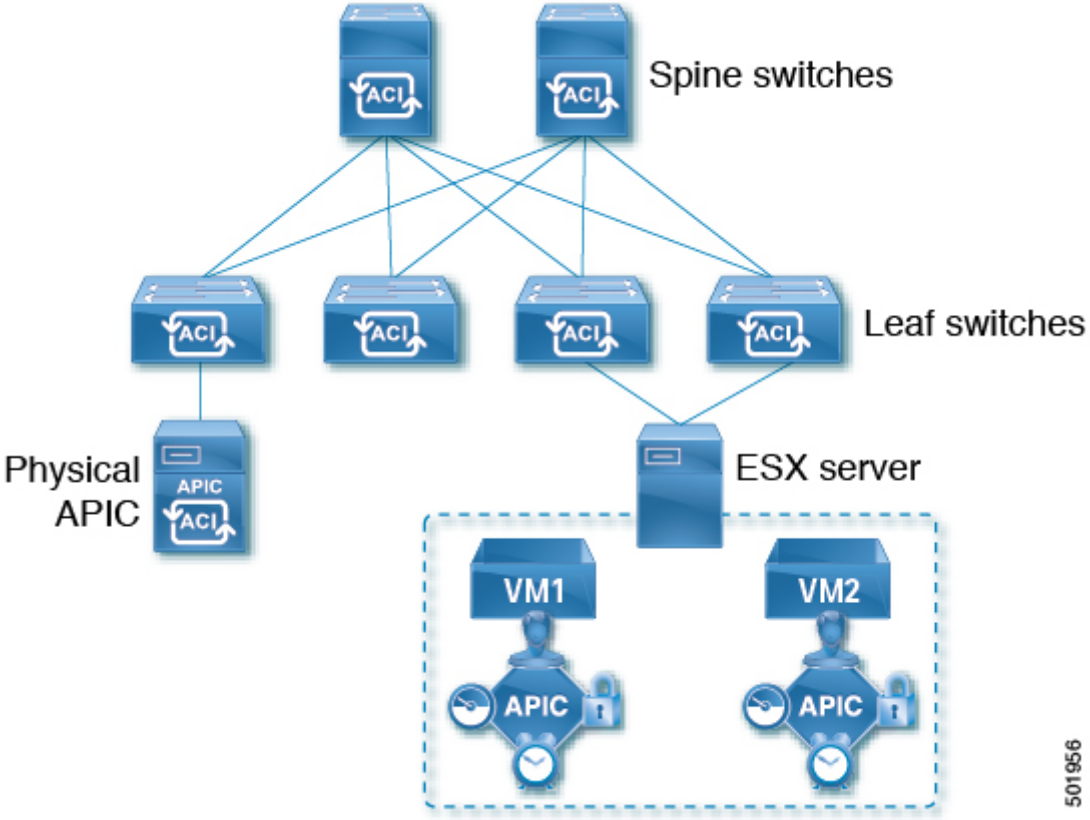


Figure 1. Cisco Mini ACI Fabric

Adding and Deleting Sites

Cisco NDO and APIC Interoperability Support

Cisco Nexus Dashboard Orchestrator (NDO) does not require a specific version of APIC to be running in all sites. The APIC clusters in each site as well as the NDO itself can be upgraded independently of each other and run in mixed operation mode as long as the fabric can be on-boarded to the Nexus Dashboard where the Nexus Dashboard Orchestrator service is installed. As such, we recommend that you always upgrade to the latest release of the Nexus Dashboard Orchestrator.

However, keep in mind that if you upgrade the NDO before upgrading the APIC clusters in one or more sites, some of the new NDO features may not yet be supported by an earlier APIC release. In that case a check is performed on each template to ensure that every configured option is supported by the target sites.

The check is performed when you save a template or deploy a template. If the template is already assigned to a site, any unsupported configuration options will not be saved; if the template is not yet assigned, you will be able to assign it to a site, but not be able to save or deploy the schema if it contains configuration unsupported by that site.

In case an unsupported configuration is detected, an error message will show, for example: This APIC site version *<site-version>* is not supported by NDO. The minimum version required for this *<feature>* is *<required-version>* or above.

The following table lists the features and the minimum required APIC release for each one:

While some of the following features are supported on earlier Cisco APIC releases, Release 4.2(4) is the earliest release that can be on-boarded to the Nexus Dashboard and managed by this release of Nexus Dashboard Orchestrator.

Feature	Minimum APIC Version
ACI Multi-Pod Support	Release 4.2(4)
Service Graphs (L4-L7 Services)	Release 4.2(4)
External EPGs	Release 4.2(4)
ACI Virtual Edge VMM Support	Release 4.2(4)
DHCP Support	Release 4.2(4)
Consistency Checker	Release 4.2(4)
vzAny	Release 4.2(4)
Host Based Routing	Release 4.2(4)
CloudSec Encryption	Release 4.2(4)
Layer 3 Multicast	Release 4.2(4)
MD5 Authentication for OSPF	Release 4.2(4)
EPG Preferred Group	Release 4.2(4)
Intersite L3Out	Release 4.2(4)

Feature	Minimum APIC Version
EPG QoS Priority	Release 4.2(4)
Contract QoS Priority	Release 4.2(4)
Single Sign-On (SSO)	Release 5.0(1)
Multicast Rendezvous Point (RP) Support	Release 5.0(1)
Transit Gateway (TGW) support for AWS and Azure Sites	Release 5.0(1)
SR-MPLS Support	Release 5.0(1)
Cloud LoadBalancer High Availability Port	Release 5.0(1)
Service Graphs (L4-L7 Services) with UDR	Release 5.0(2)
3rd Party Device Support in Cloud	Release 5.0(2)
Cloud Loadbalancer Target Attach Mode Feature	Release 5.1(1)
Support security and service insertion in Azure for non-ACI networks reachable through Express Route	Release 5.1(1)
CSR Private IP Support	Release 5.1(1)
Extend ACI policy model and automation for Cloud native services in Azure	Release 5.1(1)
Flexible segmentation through multiple VRF support within a single VNET for Azure	Release 5.1(1)
Private Link automation for Azure PaaS and third-party services	Release 5.1(1)
Openshift 4.3 IPI on Azure with ACI-CNI	Release 5.1(1)
Cloud Site Underlay Configuration	Release 5.2(1)

Adding Cisco ACI Sites

Before you begin:

- If you are adding on-premises ACI site, you must have completed the site-specific configurations in each site's APIC, as described in previous sections in this chapter.
- You must ensure that one or more sites you are adding are running Release 4.2(4) or later.

This section describes how to add a Cisco APIC or Cloud Network Controller site using the Cisco Nexus Dashboard GUI and then enable that site to be managed by Cisco Nexus Dashboard Orchestrator.

1. Log in to your Cisco Nexus Dashboard and open the **Admin Console**.
2. From the left navigation menu, choose **Operate** and click **Sites**..
3. Choose **Add Site** and provide site information.
    a. For **Site Type**, select **ACI** or **Cloud Network Controller** depending on the type of ACI fabric you are adding.

b. Provide the controller information.

- You must provide the **Host Name/IP Address**, **User Name**, and **Password.** for the APIC controller currently managing your ACI fabrics.

For APIC fabrics, if you use the site with Cisco Nexus Dashboard Orchestrator service only, you can provide either the in-band or out-of-band IP address of the APIC. If you use the site with Cisco Nexus Dashboard Insights as well, you must provide the in-band IP address.

- For on-premises ACI sites managed by Cisco APIC, if you plan to use this site with Day-2 Operations applications such as Cisco Nexus Insights, you must also provide the **In-Band EPG** name that is used to connect the Cisco Nexus Dashboard to the fabric you are adding. Otherwise, if you use this site with Cisco Nexus Dashboard Orchestrator only, you can leave this field blank.
- For Cloud Network Controller sites, **Enable Proxy** if your cloud site is reachable through a proxy.

  Proxy must be already configured in your Cisco Nexus Dashboard's cluster settings. If the proxy is reachable through management network, a static management network route must also be added for the proxy IP address. For more information about proxy and route configuration, see Nexus Dashboard User Guide for your release.

c. Click **Save** to finish adding the site.

Currently, the sites are available in the Cisco Nexus Dashboard, but you still must enable them for Cisco Nexus Dashboard Orchestrator management as described in the following steps.

4. Repeat the previous steps for any additional ACI or Cloud Network Controller sites.
5. From the Cisco Nexus Dashboard's **Services** page, open the Cisco Nexus Dashboard Orchestrator service.

   You are automatically signed in using the Cisco Nexus Dashboard user's credentials.

6. In the Cisco Nexus Dashboard Orchestrator GUI, manage the sites.
   a. From the left navigation menu, select **Sites**.
   b. In the main pane, change the **State** from Unmanaged to Managed for each fabric that you want the NDO to manage.

   When managing the sites, you must provide a unique site ID for each site.

Ensure that ACI site names are limited to 125 characters or less to avoid any issues when enabling orchestration.

Removing Sites

Before you begin:

You must ensure that all templates associated with the site you want to remove are not deployed.

This section describes how to disable site management for one or more sites using the Cisco Nexus

Dashboard Orchestrator GUI. The sites remain present in the Cisco Nexus Dashboard.

1. Open the Cisco Nexus Dashboard Orchestrator GUI.

   You can open the NDO service from the Cisco Nexus Dashboard's **Service Catalog**. You are automatically signed in using the Cisco Nexus Dashboard user's credentials.

2. Remove the site from all templates.

   You must remove the site from all templates with which it is associated before you can unmanaged the site and remove it from your Cisco Nexus Dashboard.

   a. Navigate to **Configure > Tenant Template > Applications**.
   b. Click a **Schema** that contains one or more templates that are associated with the site.
   c. From the **Overview** drop-down, choose a template that's associated with the site that you want to remove.
   d. From the **Actions** drop-down, choose **Add/Remove Sites** and uncheck the site that you want to remove.

      This removes configurations that were deployed using this template to this site.

      For nonstretched templates, you can choose to preserve the configurations that are deployed by the template to the sites by selecting **Actions > Dissociate Sites** instead. This option allows you to retain configurations that are deployed by NDO but no longer manage those objects from NDO.

   e. Repeat this step for all templates associated with the site that you want to unmanage in this and all other schemas.

3. Remove the site's underlay configuration.
   a. From the left navigation menu, select **Configure > Site To Site Connectivity**.
   b. In the main pane, click **Configure**.
   c. In the left sidebar, select the site that you want to unmanage.
   d. Click **View Details** to load site settings.

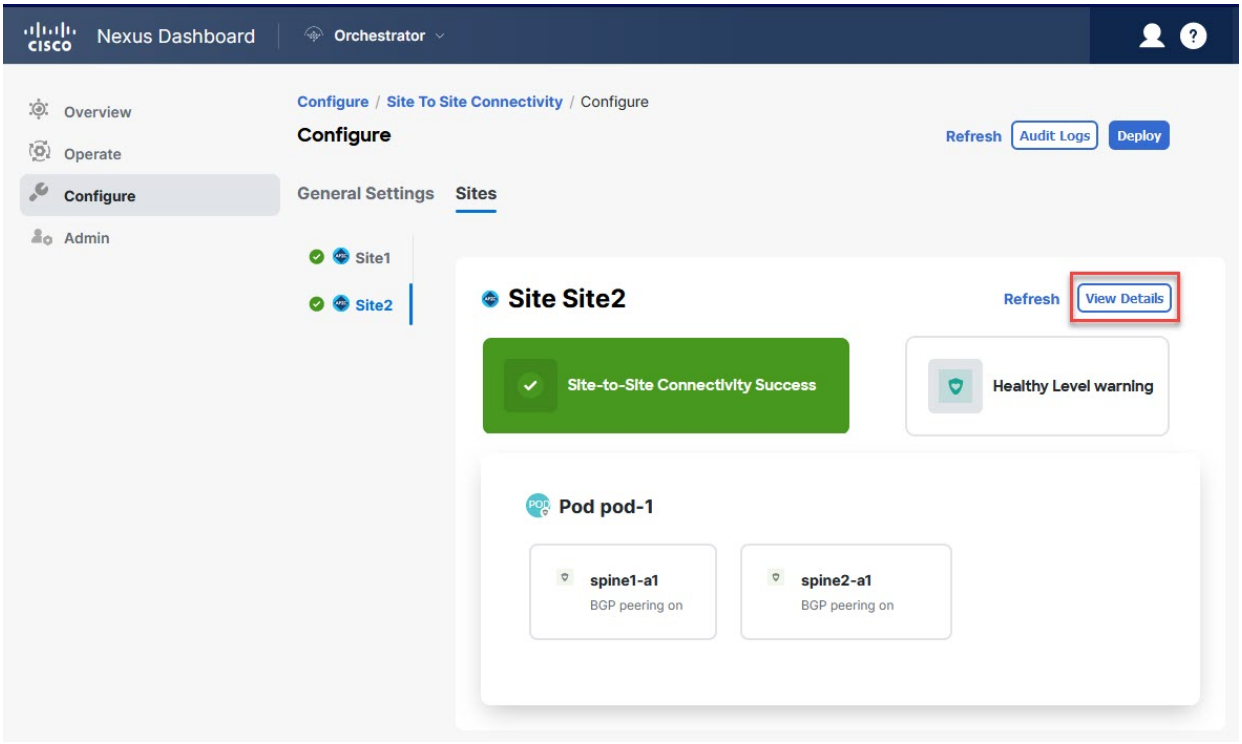


Figure 2. Configure > Site to Site Connectivity > Site > View Details

e. In right sidebar's **Inter-Site Connectivity** tab, disable the **Multi-Site** check box.

This disables EVPN peering between this site and other sites.

f. Click **Deploy** to deploy the changes to the site.

4. In the Cisco Nexus Dashboard Orchestrator GUI, disable the sites.

a. From the left navigation menu, select **Sites**.

b. In the main pane, change the **State** from Managed to Unmanaged for the site that you want to unmanage.

If the site is associated with one or more deployed templates, you will not be able to change its state to Unmanaged until you undeploy those templates, as described in the previous step.

5. Delete the site from Cisco Nexus Dashboard.

If you no longer want to manage this site or use it with any other applications, you can delete the site from the Cisco Nexus Dashboard as well.

The site must not be currently in use by any of the services that are installed in your Cisco Nexus Dashboard cluster.

a. In the top navigation bar, click the **Home** icon to return to the Cisco Nexus Dashboard GUI.

b. From the left navigation menu of the Cisco Nexus Dashboard GUI, select **Operate > Sites**.

c. Select one or more sites that you want to delete.

d. In the top right of the main pane, select **Actions > Delete Site**.

e. Provide the site's sign-in information and click **OK**.

The site will be removed from the Cisco Nexus Dashboard.

Cross Launch to Fabric Controllers

Cisco Nexus Dashboard Orchestrator currently supports several configuration options for each type of fabrics. For many extra configuration options, you may need to sign in directly into the fabric's controller.

You can cross-launch into the specific site controller's GUI from the NDO's **Operate > Sites** screen by selecting the actions (...) menu next to the site and clicking **Open in user interface**. Cross-launch works with out-of-band (OOB) management IP of the fabric.

If the same user is configured in Cisco Nexus Dashboard and the fabric, you will be signed in automatically into the fabric's controller using the same log in information as the Cisco Nexus Dashboard user. For consistency, we recommend configuring remote authentication with common users across Cisco Nexus Dashboard and the fabrics.

Configuring Infra General Settings

Infra Configuration Dashboard

The **Config > Site To Site Connectivity** page displays a summary of all sites and intersite connectivity in your Cisco Nexus Dashboard Orchestrator deployment and contains the following information:

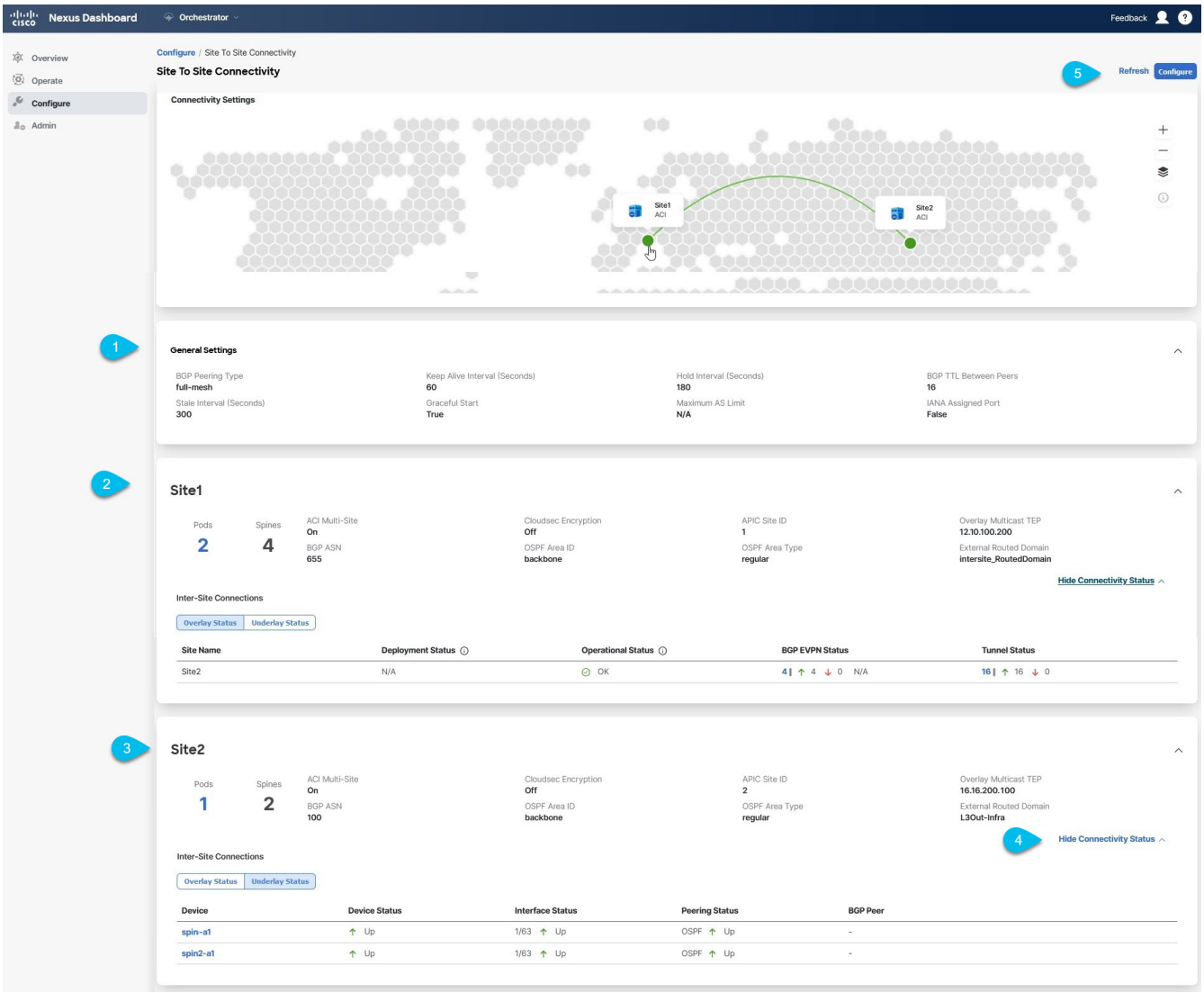


Figure 3. Infra Configuration Overview

1. The **General Settings** tile displays information about BGP peering type and its configuration.

   This is described in detail in the next section.

2. The **On-Premises** tiles display information about every on-premises site that is part of your Multi-Site domain along with their number of Pods and spine switches, OSPF settings, and overlay IPs.

   You can click the **Pods** tile that displays the number of Pods in the site to show information about the Overlay Unicast TEP addresses of each Pod.

   This is described in detail in Configuring Infra for Cisco APIC Sites.

3. The **Cloud** tiles display information about every cloud site that is part of your Multi-Site domain along with their number of regions and basic site information.

This is described in detail in Configuring Infra for Cisco Cloud Network Controller Sites.

4. You can click **Show Connectivity Status** to display intersite connectivity details for a specific site.
5. You can use the **Configure** button to navigate to the intersite connectivity configuration, which is described in detail in the following sections.

The following sections describe the steps necessary to configure the general fabric Infra settings. Fabric-specific requirements and procedures are described in the following chapters based on the specific type of fabric that you are managing.

Before you proceed with Infra configuration, you must have configured and added the sites as described in previous sections.

In addition, any infrastructure changes such as adding and removing spine switches or spine node ID changes require a Cisco Nexus Dashboard Orchestrator fabric connectivity information refresh described in the Refreshing Site Connectivity Information as part of the general Infra configuration procedures.

Partial Mesh Intersite Connectivity

In addition to full mesh connectivity where you configure intersite connectivity from every site managed by your Nexus Dashboard Orchestrator to every other site, this release also supports partial mesh configuration. In partial mesh configuration, you can manage sites in standalone mode with no intersite connectivity to any other site or limit the intersite configuration to only a subset of other sites in your Multi-Site domain.

Prior to Nexus Dashboard Orchestrator, Release 3.6(1), you could stretch templates between sites and refer to policies from other templates, which were deployed to other sites, even if the intersite connectivity between those sites was not configured, resulting in intended traffic flow between the sites to not work.

Beginning with release 3.6(1), the Orchestrator will allow you to stretch template and remote reference policies from other templates (deployed on other sites) between two or more sites only if the intersite connectivity between those sites is properly configured and deployed.

When configuring site infra for Cisco APIC and Cisco Cloud Network Controller sites as described in the following sections, for each site you can explicitly choose to which other sites infra connectivity will be established and provide that configuration information only.

Partial Mesh Connectivity Guidelines

When configuring partial mesh connectivity, consider the following guidelines:

- Partial mesh connectivity is supported between two cloud sites or a cloud and on-premises site.

  Full mesh connectivity is automatically established between all on-premises sites.

- Partial mesh connectivity is supported using BGP-EVPN or BGP-IPv4 protocols.

  Note however that stretching a template is allowed only for sites that are connected using BGP-EVPN protocol. If you are using BGP-IPv4 to connect two or more sites, any template assigned to any of those sites can be deployed to one site only.

Configuring Infra: General Settings

This section describes how to configure general Infra settings for all the sites.

Some of the following settings apply to all sites, while others are required for specific type of sites (for example, Cloud Network Controller sites). Ensure that you complete all the required configurations in infra general settings before proceeding to the site-local settings specific to each site.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Configure > Site To Site Connectivity**.
3. In the main pane, click **Configure**.
4. In the left sidebar, select **General Settings**.
5. Provide **Control Plane Configuration**.
   a. Select the **Control Plane Configuration** tab.
   b. Choose **BGP Peering Type**.
      - full-mesh-All border gateway switches in each site establishes peer connectivity with remote sites' border gateway switches.

        In full-mesh configuration, Cisco Nexus Dashboard Orchestrator uses the spine switches for ACI-managed fabrics and border gateways for NDFC-managed fabrics.
      - route-reflector-The route-reflector option allows you to specify one or more control-plane nodes to which each site establishes MP-BGP EVPN sessions. The use of route-reflector nodes avoids creating MP-BGP EVPN full mesh adjacencies between all the sites that are managed by NDO.

        For ACI fabrics, the route-reflector option is effective only for fabrics that are part of the same BGP ASN.

   c. In the **Keepalive Interval (Seconds)** field, enter the keepalive interval seconds.

      We recommend keeping the default value.

   d. In the **Hold Interval (Seconds)** field, enter the hold interval seconds.

      We recommend keeping the default value.

   e. In the **Stale Interval (Seconds)** field, enter stale interval seconds.

      We recommend keeping the default value.

   f. Choose whether you want to turn on the **Graceful Helper** option.
   g. Provide the **Maximum AS Limit**.

      We recommend keeping the default value.

   h. Provide the **BGP TTL Between Peers**.

We recommend keeping the default value.

i. Provide the **OSPF Area ID**.

If you do not have any Cloud Network Controller sites, this field will not be present in the UI.

This is OSPF area ID used by cloud sites for on-premises IPN peering.

j. (Optional) Enable **IANA Assigned Port** for CloudSec encryption.

By default, CloudSec uses a proprietary UDP port. This option allows you to configure CloudSec to use the official IANA-reserved port 8017 for CloudSec encryption between sites.

The IANA-reserved port is supported for Cisco APIC sites running release 5.2(4) or later.
To change this setting, CloudSec must be disabled on all sites. If you want to enable IANA reserved port, but already have CloudSec encryption that is enabled for one or more of your sites, disable CloudSec for all sites, enable **IANA Reserve UDP Port** option, then re-enable CloudSec for the required sites.

For detailed information and steps for configuring CloudSec, see the "CloudSec Encryption" chapter of the *Nexus Dashboard Orchestrator Configuration Guide for ACI Fabrics*.

6. Provide the **IPN Devices** information.

If you do not plan to configure intersite connectivity between on-premises and cloud sites, you can skip this step.

When you configure intersite underlay connectivity between on-premises and cloud sites as described in later sections, you must select an on-premises IPN device which establishes connectivity to the cloud CSRs. These IPN devices must first be defined here before they are available in the on-premises site configuration screen, which is described in more detail in Configuring Infra: On-Premises Site Settings.

a. Select the **On Premises IPsec Devices** tab.

b. Click **+Add On-Premises IPsec Device**.

c. Choose whether the device is **Unmanaged** or **Managed** and provide the device information.

This defines whether the device is directly managed by NDFC:

- For **Unmanaged** IPN devices, simply provide the **Name** and the **IP Address** of the device.

  The IP address that you provide will be used as the tunnel peer address from the cloud CSRs, not the IPN device's management IP address.

- For **Managed** IPN devices, choose the NDFC **Site** that contains the device and then the **Device** from that site.

  Then choose the **Interface** on the device that is facing the Internet and provide the **Next Hop** IP address, which is the IP address of the gateway that is connecting to the Internet.

d. Click the check mark icon to save the device information.

e. Repeat this step for any additional IPN devices that you want to add.

7. Provide the **External Devices** information.

   If you do not have any Cloud Network Controller sites, this tab will not be present in the UI.

   If you do not have any Cloud Network Controller sites in your Multi-Site domain or you do not plan to configure connectivity between cloud sites and branch routers or other external devices, you can skip this step.

   The following steps describe how to provide information about any branch routers or external devices to which you want to configure connectivity from your cloud sites.

   a. Select the **External Devices** tab.

      This tab will only be available if you have at least one cloud site in your Multi-Site domain.

   b. Click **Add External Device**.

      The **Add External Device** dialogue opens.

   c. Provide the **Name**, **IP Address**, and **BGP Autonomous System Number** for the device.

      The IP address that you provide will be used as the tunnel peer address from the Cloud Network Controller's CSRs, not the device's management IP address. The connectivity will be established over public Internet using IPsec.

   d. Click the check mark icon to save the device information.

   e. Repeat this step for any additional IPN devices that you want to add.

   After you have added all the external devices, ensure to complete the next step to provide the IPsec tunnel subnet pools from with the internal IP addresses will be allocated for these tunnels.

8. Provide the **IPsec Tunnel Subnet Pools** information.

   If you do not have any Cloud Network Controller sites, this tab will not be present in the UI.

   There are two types of subnet pools that you can provide here:

   - **External Subnet Pool**-Used for connectivity between cloud site CSRs and other sites (cloud or on-premises).

     These are large global subnet pools that are managed by Cisco Nexus Dashboard Orchestrator. The Orchestrator, creates smaller subnets from these pools and allocates them to sites to be used for intersite IPsec tunnels and external connectivity IPsec tunnels.

     You must provide at least one external subnet pool if you want to enable external connectivity from one or more of your cloud sites.

   - **Site-Specific Subnet Pool**-Used for connectivity between cloud site CSRs and external devices.

     These subnets can be defined when the external connectivity IPsec tunnels must be in a specific range. For example, where a specific subnet is already being used to allocate IP addresses to the external router and you want to continue using those subnets for IPsec

tunnels for NDO and cloud sites. These subnets are not managed by the Orchestrator and each subnet is assigned to a site in its entirety to be used locally for external connectivity IPsec tunnels.

If you do not provide any named subnet pools but still configure connectivity between cloud site's CSRs and external devices, the external subnet pool will be used for IP allocation. .

The minimum mask length for both subnet pools is /24.

To add one or more **External Subnet Pools**:

a. Select the **IPsec Tunnel Subnet Pools** tab.

b. In the **External Subnet Pool** area, click **+Add IP Address** to add one or more external subnet pools.

This subnet will be used to address the IPsec tunnel interfaces and loopbacks of the Cloud Routers that are used for on-premises connectivity, which you previously configured in the Cloud Network Controller for intersite connectivity in earlier Cisco Nexus Dashboard Orchestrator releases.

The subnets must not overlap with other on-premises TEP pools, should not begin with 0.x.x.x or 0.0.x.x, and should have a network mask between /16 and /24, for example 30.29.0.0/16.

c. Click the check mark icon to save the subnet information.

d. Repeat these substeps for any additional subnet pools that you want to add.

To add one or more **Site-Specific Subnet Pools**:

a. Select the **IsSec Tunnel Subnet Pools** tab.

b. In the **Site-Specific Subnet Pools** area, click **+Add IP Address** to add one or more external subnet pools.

The **Add Named Subnet Pool** dialogue opens.

c. Provide the subnet **Name**.

You can use the subnet pool's name to choose the pool from which to allocate the IP addresses later on.

d. Click **+Add IP Address** to add one or more subnet pools.

The subnets must have a network mask between /16 and /24`and not begin with `0.x.x.x or 0.0.x.x, for example 30.29.0.0/16.

e. Click the check mark icon to save the subnet information.

Repeat the steps if you want to add multiple subnets to the same named subnet pool.

f. Click **Save** to save the named subnet pool.

g. Repeat these substeps for any additional named subnet pools that you want to add.

What to do next:

After you have configured general infra settings, you must still provide additional information for site-specific configurations based on the type of sites (ACI, Cloud Network Controller, or NDFC) you are managing. Follow the instructions described in the following sections to provide site-specific infra configurations.

Configuring Infra for Cisco APIC Sites

Refreshing Site Connectivity Information

Any infrastructure changes, such as adding and removing spines or changing spine node IDs, require a multi-site fabric connectivity site Refresh. This section describes how to pull up-to-date connectivity information directly from each site's APIC.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Config > Site To Site Connectivity**.
3. In the top right of the main pane, click **Configure**.
4. In the left pane, under **Sites**, select a specific site.
5. In the main window, click the **Refresh** button to pull fabric information from the APIC.
6. (Optional) For on-premises sites, in the **Confirmation** dialog, check the box if you want to remove configuration for decommissioned spine switch nodes.

   If you choose to enable this check box, all configuration info for any currently decommissioned spine switches will be removed from the database.

7. Finally, click **Yes** to confirm and load the connectivity information.

   This discovers any new or removed spines and all site-related fabric connectivity will be reimported from the APIC.

Configuring Infra: On-Premises Site Settings

This section describes how to configure site-specific Infra settings for on-premises sites.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Configure > Site To Site Connectivity**.
3. In the top right of the main pane, click **Configure**.
4. In the left pane, under **Sites**, select a specific on-premises site.
5. Click **View Details** to load site settings.

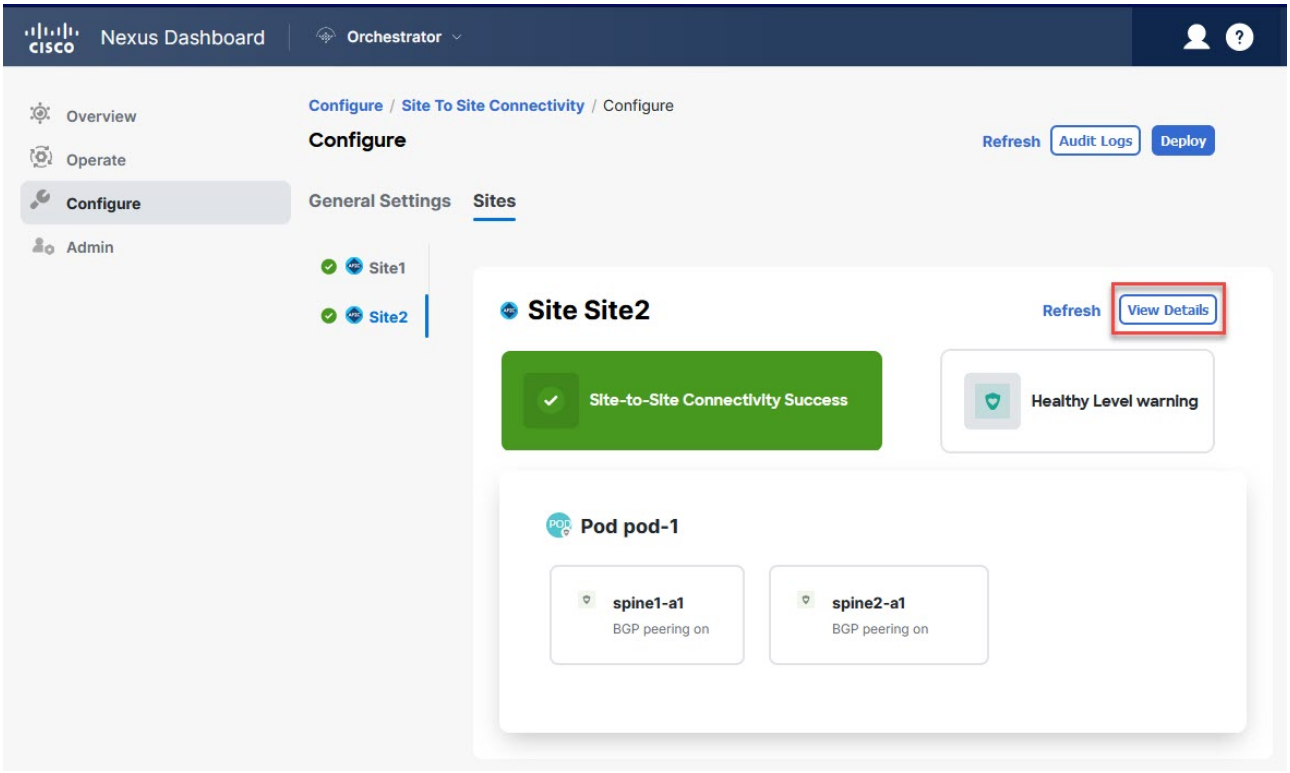


Figure 4. Configure > Site to Site Connectivity > Site > View Details

6. Provide the **Inter-Site Connectivity** information.
   a. In the right **<Site> Settings** pane, enable the **Multi-Site** knob.

      This defines whether the overlay connectivity is established between this site and other sites.

   b. (Optional) Enable the **CloudSec Encryption** knob encryption for the site.

      CloudSec Encryption provides intersite traffic encryption. The "Infrastructure Management" chapter in the *Cisco Multi-Site Configuration Guide* covers this feature in detail.

   c. Specify the **Overlay Multicast TEP**.

      This address is used for the intersite L2 BUM and L3 multicast traffic. This IP address is deployed on all spine switches that are part of the same fabric, regardless of whether it is a single pod or multipod fabric.

      This address should not be taken from the address space of the original fabric's Infra TEP pool or from the 0.x.x.x range.

   d. Specify the **BGP Autonomous System Number**.
   e. (Optional) Specify the **BGP Password**.
   f. Provide the **OSPF Area ID**.

      The following settings are required if you are using OSPF protocol for underlay connectivity between the site and the IPN. If you plan to use BGP instead, you can skip this step. BGP underlay configuration is done at the port level, as described in Configuring Infra: Spine Switches.

   g. Select the **OSPF Area Type** from the drop-down list.

The following settings are required if you are using OSPF protocol for underlay connectivity between the site and the IPN. If you plan to use BGP instead, you can skip this step. BGP underlay configuration is done at the port level, as described in Configuring Infra: Spine Switches.

The OSPF area type can be one of the following:

- nssa
- regular

h. Configure OSPF policies for the site.

The following settings are required if you are using OSPF protocol for underlay connectivity between the site and the IPN. If you plan to use BGP instead, you can skip this step. BGP underlay configuration is done at the port level, as described in Configuring Infra: Spine Switches.

You can either click an existing policy (for example, msc-ospf-policy-default) to modify it or click **+Add Policy** to add a new OSPF policy. Then in the **Add/Update Policy** window, specify the following:

- In the **Policy Name** field, enter the policy name.
- In the **Network Type** field, choose either broadcast, point-to-point, or unspecified.

  The default is broadcast.
- In the **Priority** field, enter the priority number.

  The default is 1.
- In the **Cost of Interface** field, enter the cost of interface.

  The default is 0.
- From the **Interface Controls** drop-down list, choose one of the following:
  - **advertise-subnet**
  - **bfd**
  - **mtu-ignore**
  - **passive-participation**
- In the **Hello Interval (Seconds)** field, enter the hello interval in seconds.

  The default is 10.
- In the **Dead Interval (Seconds)** field, enter the dead interval in seconds.

  The default is 40.
- In the **Retransmit Interval (Seconds)** field, enter the retransmit interval in seconds.

  The default is 5.

- In the **Transmit Delay (Seconds)** field, enter the transmit delay in seconds.

  The default is 1.

i. (Optional) From the **External Routed Domain** drop-down, select the domain that you want to use.

   Choose an external router domain that you have created in the Cisco APIC GUI. For more information, see the *Cisco APIC Layer 3 Networking Configuration Guide* specific to your APIC release.

j. (Optional) Enable **SDA Connectivity** for the site.

   If the site is connected to an SDA network, enable the **SDA Connectivity** knob and provide the **External Routed Domain**, **VLAN Pool**, and **VRF Lite IP Pool Range** information.

   If you enable SDA connectivity for the site, you need to configure extra settings as described in the SDA use case chapter of the *Cisco Multi-Site Configuration Guide for ACI Fabrics*.

k. (Optional) Enable **SR-MPLS Connectivity** for the site.

   If the site is connected through an MPLS network, enable the **SR-MPLS Connectivity** knob and provide the Segment Routing global block (SRGB) range.

   The Segment Routing Global Block (SRGB) is the range of label values that are reserved for Segment Routing (SR) in the Label Switching Database (LSD). These values are assigned as segment identifiers (SIDs) to SR-enabled nodes and have global significance throughout the domain.

   The default range is 16000-23999.

   If you enable MPLS connectivity for the site, you need to configure extra settings as described in the "Sites Connected through SR-MPLS" chapter of the *Cisco Multi-Site Configuration Guide for ACI Fabrics*.

7. Configure intersite connectivity between on-premises and cloud sites.

   If you do not need to create intersite connectivity between on-premises and cloud sites, for example if your deployment contains only cloud or only on-premises sites, skip this step.

   When you configure underlay connectivity between on-premises and cloud sites, you must provide an IPN device IP address to which the Cloud Network Controller's CSRs establish a tunnel and then configure the cloud site's infra settings.

   a. Click **+Add IPN Device** to specify an IPN device.

   b. From the drop-down, select one of the IPN devices you defined previously.

      The IPN devices must be already defined in the **General Settings > IPN Devices** list, as described in link:https://www-author3.cisco.com/c/en/us/td/docs/dcn/ndo/4x/articles-431/nexus-dashboard-orchestrator-aci-preparing-cisco-apic-sites-431.html#_configuring_infra_general_settings_2Configuring Infra: General Settings].

   c. Configure intersite connectivity for cloud sites.

Any previously configured connectivity from the cloud sites to this on-premises site will be displayed here, but any additional configuration must be done from the cloud site's side as described in Configuring Infra for Cisco Cloud Network Controller Sites.

What to do next:

While you have configured all the required intersite connectivity information, it has not been pushed to the sites yet. You must deploy the configuration as described in Deploying Infra Configuration.

Configuring Infra: Pod Settings

This section describes how to configure Pod-specific settings in each site.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Configure > Site To Site Connectivity**.
3. In the top right of the main pane, click **Configure**.
4. In the left pane, under **Sites**, select a specific site.
5. In the main window, select a Pod.
6. In the right **Pod Properties** pane, add the Overlay Unicast TEP for the Pod.

   This IP address is deployed on all spine switches that are part of the same Pod and used for sourcing and receiving VXLAN encapsulated traffic for Layer2 and Layer3 unicast communication.

7. Click **+Add TEP Pool** to add an external routable TEP pool.

   The external routable TEP pools are used to assign a set of IP addresses that are routable across the IPN to APIC nodes, spine switches, and border leaf nodes. This is required to enable Multi-Site architecture.

   External TEP pools previously assigned to the fabric on APIC are automatically inherited by NDO and displayed in the GUI when the fabric is added to the Multi-Site domain.

8. Repeat the procedure for every Pod in the site.

Configuring Infra: Spine Switches

This section describes how to configure spine switches in each site for Cisco Multi-Site. When you configure the spine switches, you are effectively establishing the underlay connectivity between the sites in your Multi-Site domain by configuring connectivity between the spines in each site and the ISN.

Before Release 3.5(1), underlay connectivity was establishing using OSPF protocol. In this release however, you can choose to use OSPF, BGP (IPv4 only), or a mixture of protocols, with some sites using OSPF and some using BGP for intersite underlay connectivity. We recommend configuring either OSPF or BGP and not both, however if you configure both protocols, BGP will take precedence and OSPF will not be installed in the route table.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Config > Site To Site Connectivity**.

3. In the top right of the main pane, click **Configure**.
4. In the left pane, under **Sites**, select the specific on-premises site.
5. In the main pane, select a spine switch within a pod.
6. In the right **<Spine> Settings** pane, click **+Add Port**.
7. In the **Add Port** window, provide the underlay connectivity information.

   Any port that is already configured directly in APIC for IPN connectivity will be imported and shown in the list. For any new ports you want to configure from NDO, use the following the steps:

   a. Provide general information:

      - In the **Ethernet Port ID** field, enter the port ID, for example 1/29.

        This is the interface which will be used to connect to the IPN.

      - In the **IP Address** field, enter the IP address/netmask.

        The Orchestrator creates a subinterface with VLAN 4 with the specified IP ADDRESS under the specified PORT.

      - In the **MTU** field, enter the MTU. You can specify either inherit, which would configure an MTU of 9150B, or choose a value between 576 and 9216.

        MTU of the spine port should match MTU on IPN side.

8. Choose the underlay protocol.

   a. Enable **OSPF** if you want to use OSPF protocol for underlay connectivity.

      If you want to use BGP protocol for underlay connectivity instead, skip this part and provide the information that is required in the next substep.

      - Set **OSPF** to Enabled.

        The OSPF settings become available.

      - From the **OSPF Policy** drop-down, select the OSPF policy for the switch that you have configured in Configuring Infra: On-Premises Site Settings.

        OSPF settings in the OSPF policy you choose should match on IPN side.

      - For **OSPF Authentication**, you can pick either none or one of the following:
        - MD5
        - Simple
      - Set **BGP** to Disabled.

   b. Enable **BGP** if you want to use BGP protocol for underlay connectivity.
   If you're using OSPF protocol for underlay connectivity and have already configured it in the previous substep, skip this part.

      BGP IPv4 underlay is not supported in the following cases:

- If your Multi-Site domain contains one or more Cloud Network Controller sites, in which case you must use the OSPF protocol for intersite underlay connectivity for both On-Prem to On-Prem and On-Prem to cloud sites.
- If you are using GOLF (Layer 3 EVPN services for fabric WAN) for WAN connectivity in any of your fabrics.

In the above cases, you must use OSPF in the Infra L3Out deployed on the spines.

- Set **OSPF** to Disabled.

  We recommend configuring either OSPF or BGP and not both, however if you configure both protocols, BGP will take precedence and OSPF routes will not be installed in the route table because only EBGP adjacencies with the ISN devices are supported.

- Set **BGP** to Enabled.

  The BGP settings become available.

- In the **Peer IP** field, provide the IP address of this port's BGP neighbor.

  Only IPv4 IP addresses are supported for BGP underlay connectivity.

- In the **Peer AS Number** field, provide the Autonomous System (AS) number of the BGP neighbor.

  This release supports only EBGP adjacencies with the ISN devices.

- In the **BGP Password** field, provide the BGP peer password.
- Specify any additional options as required:
  - Bidirectional Forwarding Detection-Enables Bidirectional Forwarding Detection (BFD) protocol to detect faults on the physical link this port and the IPN device.
  - Admin State-Sets the admin state on the port to enabled.

9. Repeat the procedure for every spine switch and port that connects to the IPN.

Configuring Infra for Cisco Cloud Network Controller Sites

Refreshing Cloud Site Connectivity Information

Any infrastructure changes, such as CSR and Region addition or removal, require a multi-site fabric connectivity site Refresh. This section describes how to pull up-to-date connectivity information directly from each site's APIC.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Config > Site To Site Connectivity**.
3. In the top right of the main pane, click **Configure**.
4. In the left pane, under **Sites**, select a specific site.
5. In the main window, click the **Refresh** button to discover any new or changed CSRs and regions.
6. Finally, click **Yes** to confirm and load the connectivity information.

   This discovers any new or removed CSRs and regions.
7. Click **Deploy** to propagate the cloud site changes to other sites that have connectivity to it.

   After you Refresh a cloud site's connectivity and CSRs or regions are added or removed, you must deploy infra configuration so other sites that have underlay connectivity to that cloud site get updated configuration.

Configuring Infra: Cloud Site Settings

This section describes how to configure site-specific Infra settings for Cloud Network Controller sites.

1. Log in to the Cisco Nexus Dashboard Orchestrator GUI.
2. In the left navigation menu, select **Config > Site To Site Connectivity**.
3. In the top right of the main pane, click **Configure**.
4. In the left pane, under **Sites**, select a specific cloud site.
5. Click **View Details** to load site settings.

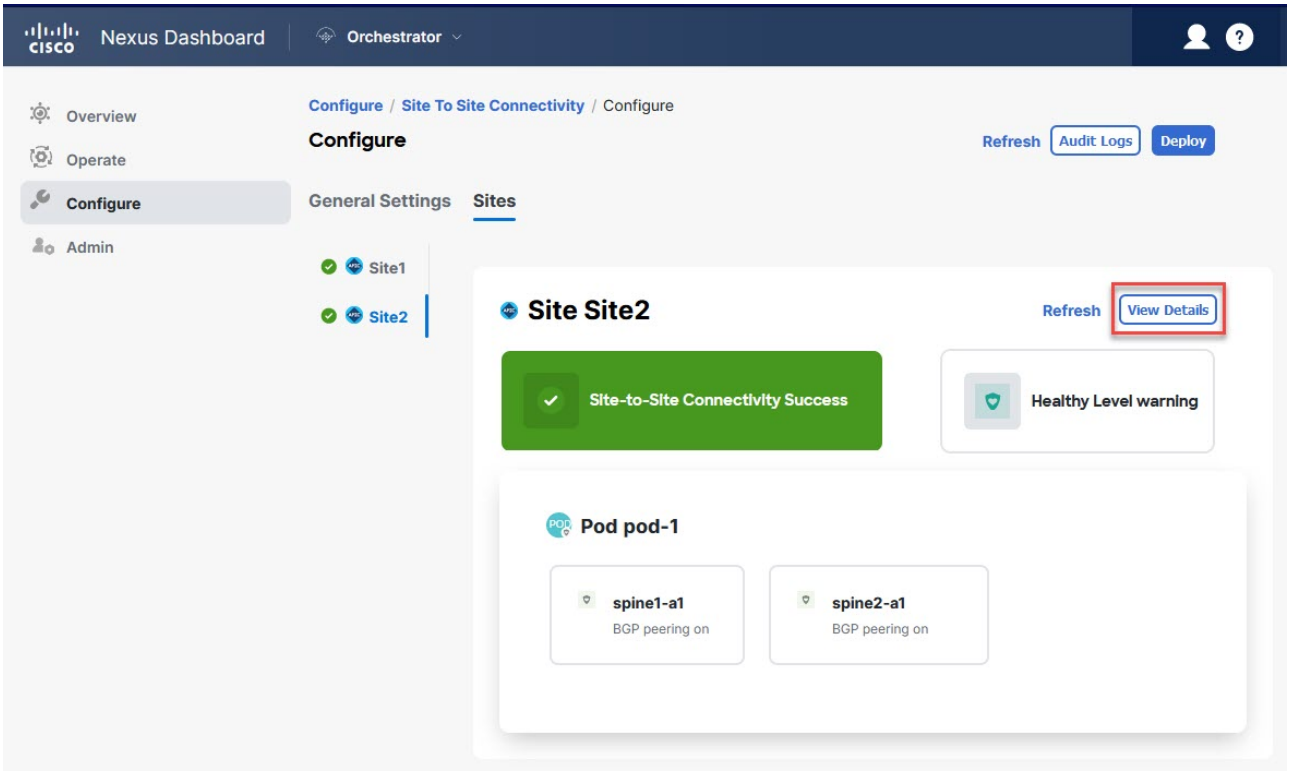


Figure 5. Configure > Site to Site Connectivity > Site > View Details

6. Provide the general **Inter-Site Connectivity** information.
   a. In the right **<Site> Settings** pane, select the **Inter-Site Connectivity** tab.
   b. Enable the **Multi-Site** knob.

      This defines whether the overlay connectivity is established between this site and other sites.

      The overlay configuration will not be pushed to sites which do not have the underlay intersite connectivity that is established as described in the next step.

   c. (Optional) Specify the **BGP Password**.
7. Provide site-specific **Inter-Site Connectivity** information.
   a. In the right properties sidebar for the cloud site, click **Add Site**.

      The **Add Site** window opens.

   b. Under **Connected to Site**, click **Select a Site** and select the site (for example, Site2) to which you want to establish connectivity from the site you are configuring (for example, Site1) .

      When you select the remote site, the **Add Site** window updates to reflect both directions of connectivity: **Site1 > Site2** and **Site2 > Site1**.

   c. In the **Site1 > Site2** area, from the **Connection Type** drop-down, choose the type of connection between the sites.

      The following options are available:

      - Public Internet-Connectivity between the two sites is established through the Internet.

        This type is supported between any two cloud sites or between a cloud site and an on-premises site.

- Private Connection-Connectivity is established using a private connection between the two sites.

  This type is supported between a cloud site and an on-premises site.

- Cloud Backbone-Connectivity is established using cloud backbone.

  This type is supported between two cloud sites of the same type, such as Azure-to-Azure or AWS-to-AWS.

If you have multiple types of sites (on-premises, AWS, and Azure), different pairs of site can use different connection type.

d. Choose the **Protocol** that you want to use for connectivity between these two sites.

   If using **BGP-EVPN** connectivity, you can optionally enable **IPSec** and choose which version of the Internet Key Exchange (IKE) protocol to use: IKEv1 (Version 1) or IKEv2 (Version 1) depending on your configuration.

   - For Public Internet connectivity, IPsec is always enabled.
   - For Cloud Backbone connectivity, IPsec is always disabled.
   - For Private Connection, you can choose to enable or disable IPsec.

   If using **BGP-IPv4** connectivity instead, you must provide an external VRF which will be used for route leaking configuration from the cloud site you are configuring.

   After **Site1 > Site2** connectivity information is provided, the **Site2 > Site1** area will reflect the connectivity information in the opposite direction.

e. Click **Save** to save the intersite connectivity configuration.

   When you save connectivity information from Site1 to Site2, the reverse connectivity is automatically created from Site2 to Site1, which you can see by selecting the other site and checking the **Inter-site Connectivity** information in the right sidebar.

f. Repeat this step to add intersite connectivity for other sites.

   When you establish underlay connectivity from Site1 to Site2, the reverse connectivity is done automatically for you.

   However, if you also want to establish intersite connectivity from Site1 to Site3, you must repeat this step for that site as well.

8. Provide **External Connectivity** information.

   If you do not plan to configure connectivity to external sites or devices that are not managed by NDO, you can skip this step.

   Detailed description of an external connectivity use case is available in the *Configuring External Connectivity from Cloud CSRs Using Nexus Dashboard Orchestrator* document.

   a. In the right **<Site> Settings** pane, select the **External Connectivity** tab.
   b. Click **Add External Connection**.

The **Add External Connectivity** dialog opens.

c. From the **VRF** drop-down, select the VRF you want to use for external connectivity.

   This is the VRF which will be used to leak the cloud routes. The **Regions** section displays the cloud regions that contain the CSRs to which this configuration be applied.

d. From the **Name** drop-down in the **External Devices** section, select the external device.

   This is the external device that you added in the **General Settings > External Devices** list during general infra configuration and must already be defined as described in Configuring Infra: General Settings.

e. From the **Tunnel IKE Version** drop-down, pick the IKE version that will be used to establish the IPsec tunnel between the cloud site's CSRs and the external device.

f. (Optional) From the **Tunnel Subnet Pool** drop-down, choose one of the named subnet pools.

   Named subnet pools are used to allocate IP addresses for IPsec tunnels between cloud site CSRs and external devices. If you do not provide any **named** subnet pools here, the **external** subnet pool will be used for IP allocation.

   Providing a dedicated subnet pool for external device connectivity is useful for cases where a specific subnet is already being used to allocate IP addresses to the external router and you want to continue to use those subnets for IPsec tunnels for NDO and cloud sites.

   If you want to provide a specific subnet pool for this connectivity, it must already be created as described in Configuring Infra: General Settings.

g. (Optional) In the **Pre-Shared Key** field, provide the custom keys that you want to use to establish the tunnel.

h. If necessary, repeat the previous substeps for any additional external devices you want to add for the same external connection (same VRF).

i. If necessary, repeat this step for any additional external connections (different VRFs).

   There's a one-to-one relationship for tunnel endpoints between CSRs and external devices, so while you can create extra external connectivity using different VRFs, you cannot create extra connectivity to the same external devices.

What to do next:

While you have configured all the required intersite connectivity information, it has not been pushed to the sites yet. You must deploy the configuration as described in Deploying Infra Configuration.

Recovering from Cloud Network Controller Site Downtime

When Cloud Network Controller (formerly Cloud APIC) instance/VM goes down for any reason while still being managed by NDO, you may be unable to undeploy or delete any existing templates associated with that cloud site. In this case, attempting to forcefully unmanage the site in NDO can cause stale configuration and deployment errors even if the site recovers.

To recover from this:

1. Bring up the new Cloud Network Controller sites and reregister the cloud sites.

    a. Log in to NDO.

    b. Open the admin console.

    c. Navigate to the **Operate > Sites** page.

    d. From the action **(...)** menu next to the site you redeployed, choose **Edit Site**.

    e. Check the " Reregister site" check box.

    f. Provide the new site details.

    You must provide the new public IP address of site and sign-in credentials.

    g. Click *Save*to reregister the site.

    When the connectivity status of the site shows UP, the site IPs in NDO are also updated and the new sites are in 'managed' state.

2. Undeploy the previously deployed templates for each schema.

    a. Log in to NDO.

    b. Navigate to **Configure** and select **Tenant Template > Applications**.

    c. Click a schema with the deployed templates.

    d. From the **Actions** menu next to the **Template Properties**, choose **Undeploy Template** and wait until the template is successfully undeployed.

3. Refresh the site's infra configuration to ensure that the new Cisco Catalyst 8000V switches are added in NDO.

    a. Navigate to **Configure** and select **Site To Site Connectivity**.

    b. Click **Configure** at the top right of the screen.

    c. Select the cloud site under the **Sites** panel and click **Refresh.**

    d. Click **Deploy** on the top right of the screen and wait until all sites are successfully deployed.

4. Redeploy all templates associated with this Cloud Network Controller site.

    a. Navigate to **Configure > Tenant Templates** under the **Applications** tab.

    b. Click a schema with the templates undeployed earlier.

    c. Click **Deploy to Sites and** wait until the template is deployed.

Deploying Infra Configuration for ACI Sites

Deploying Infra Configuration

This section describes how to deploy the Infra configuration to each APIC site.

1. In the top right of the main pane, click **Deploy** and choose the appropriate option to deploy the configuration.

   If you have configured only on-premises or only cloud sites, simply click **Deploy** to deploy the Infra configuration.

   However, if you have both, on-premises and cloud site, the following additional options may be available:

   - **Deploy & Download IPN Device Config files:** Pushes the configuration to both the on-premises APIC site and the Cloud Network Controller site and enables the end-to-end interconnect between the on-premises and the cloud sites.

     In addition, this option downloads a zip file that contains configuration information that you will use to enable connectivity from the IPN devices to Cisco Cloud Services Router (CSR). A followup screen appears that allows you to select all or some of the configuration files to download.

   - **Deploy & Download External Device Config files:** Pushes the configuration to both the Cloud Network Controller sites and enables the end-to-end interconnect between the cloud sites and external devices.

     In addition, this option downloads a zip file that contains configuration information that you will use to enable connectivity from external devices to the Cisco Cloud Services Router (CSR) deployed in your cloud sites. A followup screen appears that allows you to select all or some of the configuration files to download.

   - **Download IPN Device Config files only:** Downloads a zip file that contains configuration information that you will use to enable connectivity from the IPN devices to Cisco Cloud Services Router (CSR) without deploying the configuration.
   - **Download External Device Config files only:** Downloads a zip file that contains configuration information that you will use to enable connectivity from external devices to Cisco Cloud Services Router (CSR) without deploying the configuration.
2. In the confirmation window, click **Yes**.

   The Deployment started, refer to left menu for individual site deployment status message will indicate that Infra configuration deployment began and you can verify each site's progress by the icon displayed next to the site's name in the left pane.

What to do next:

The Infra overlay and underlay configuration settings are now deployed to all sites' controllers and cloud CSRs. The last remaining step is to configure your IPN devices with the tunnels for cloud CSRs as descrbied in Refreshing Site Connectivity Information.

Enabling Connectivity Between On-Premises and Cloud Sites

If you have only on-premises or only cloud sites, you can skip this section.

This section describes how to enable connectivity between on-premises APIC sites and Cloud Network Controller sites.

By default, the Cisco Cloud Network Controller will deploy a pair of redundant Cisco Cloud Services Router 1000vs. The procedures in this section creates two tunnels, one IPsec tunnel from the on-premises IPsec device to each of these Cisco Cloud Services Router 1000vs. If you have multiple on-premises IPsec devices, you will need to configure the same tunnels to the CSRs on each of the on-premises devices.

The following information provides commands for Cisco Cloud Services Router 1000v as your on-premises IPsec termination device. Use similar commands if you are using a different device or platform.

1. Gather the necessary information that you will need to enable connectivity between the CSRs deployed in the cloud site and the on-premises IPsec termination device.

   You can get the required configuration details using either the **Deploy & Download IPN Device config files** or the **Download IPN Device config files only** option in Nexus Dashboard Orchestrator as part of the procedures provided in Deploying Infra Configuration.

2. Log into the on-premises IPsec device.
3. Configure the tunnel for the *first* CSR.

   Details for the first CSR are available in the configuration files for the ISN devices you downloaded from the Nexus Dashboard Orchestrator, but the following fields describe the important values for your specific deployment:

   - *<first-csr-tunnel-ID>*-unique tunnel ID that you assign to this tunnel.
   - *<first-csr-ip-address>*-public IP address of the third network interface of the first CSR.

     The destination of the tunnel depends on the type of underlay connectivity:

     - The destination of the tunnel is the public IP of the cloud router interface if the underlay is via public internet
     - The destination of the tunnel is the private IP of the cloud router interface if the underlay is via private connectivity, such as DX on AWS or ER on Azure
   - *<first-csr-preshared-key>*-preshared key of the first CSR.
   - *<onprem-device-interface>*-interface that is used for connecting to the Cisco Cloud Services Router 1000v deployed in Amazon Web Services.
   - *<onprem-device-ip-address>*-IP address for the *<interface>* interface that is used for connecting to the Cisco Cloud Services Router 1000v deployed in Amazon Web Services.
   - *<peer-tunnel-for-onprem-IPsec-to-first-CSR>*-peer tunnel IP address for the on-premises IPsec device to the first cloud CSR.
   - *<process-id>*-OSPF process ID.

- *<area-id>*-OSPF area ID.

The following example shows intersite connectivity configuration using the IKEv2 protocol supported starting with Nexus Dashboard Orchestrator, Release 3.3(1) and Cloud Network Controller, Release 5.2(1). If you are using IKEv1, the IPN configuration file you downloaded form NDO may look slightly differently, but the principle remains the same.

+

```
crypto ikev2 proposal ikev2-proposal-default
   encryption aes-cbc-256 aes-cbc-192 aes-cbc-128
   integrity sha512 sha384 sha256 sha1
   group 24 21 20 19 16 15 14 2
exit

crypto ikev2 policy ikev2-policy-default
   proposal ikev2-proposal-default
exit

crypto ikev2 keyring key-ikev2-infra:overlay-1-__<first-csr-tunnel-id>__
   peer peer-ikev2-keyring
      address __<first-csr-ip-address>__
      pre-shared-key __<first-csr-preshared-key>__
   exit
exit

crypto ikev2 profile ikev2-infra:overlay-1-__<first-csr-tunnel-id>__
   match address local interface __<onprem-device-interface>__
   match identity remote address __<first-csr-ip-address>__ 255.255.255.255
   identity local address __<onprem-device-ip-address>__
   authentication remote pre-share
   authentication local pre-share
   keyring local key-ikev2-infra:overlay-1-__<first-csr-tunnel-id>__
   lifetime 3600
   dpd 10 5 on-demand
exit

crypto ipsec transform-set infra:overlay-1-__<first-csr-tunnel-id>__ esp-gcm 256
   mode tunnel
exit

crypto ipsec profile infra:overlay-1-__<first-csr-tunnel-id>__
   set pfs group14
   set ikev2-profile ikev2-infra:overlay-1-__<first-csr-tunnel-id>__
   set transform-set infra:overlay-1-__<first-csr-tunnel-id>__
exit
```

```
interface tunnel 2001
   ip address <peer-tunnel-for-onprem-IPsec-to-first-CSR> 255.255.255.252
   ip virtual-reassembly
   tunnel source __<onprem-device-interface>__
   tunnel destination __<first-csr-ip-address>__
   tunnel mode ipsec ipv4
   tunnel protection ipsec profile infra:overlay-1-__<first-csr-tunnel-id>__
   ip mtu 1400
   ip tcp adjust-mss 1400
   ip ospf __<process-id>__ area __<area-id>__
   no shut
exit
```

+

```
crypto ikev2 proposal ikev2-proposal-default
   encryption aes-cbc-256 aes-cbc-192 aes-cbc-128
   integrity sha512 sha384 sha256 sha1
   group 24 21 20 19 16 15 14 2
exit

crypto ikev2 policy ikev2-policy-default
   proposal ikev2-proposal-default
exit

crypto ikev2 keyring key-ikev2-infra:overlay-1-2001
   peer peer-ikev2-keyring
      address 52.12.232.0
      pre-shared-key 144904725321902286651389219409672714611O
   exit
exit

crypto ikev2 profile ikev2-infra:overlay-1-2001
   ! Please change GigabitEthernet1 to the appropriate interface
   match address local interface GigabitEthernet1
   match identity remote address 52.12.232.0 255.255.255.255
   identity local address 128.107.72.62
   authentication remote pre-share
   authentication local pre-share
   keyring local key-ikev2-infra:overlay-1-2001
   lifetime 3600
   dpd 10 5 on-demand
exit
```

```
crypto ipsec transform-set infra:overlay-1-2001 esp-gcm 256
   mode tunnel
exit

crypto ipsec profile infra:overlay-1-2001
   set pfs group14
   set ikev2-profile ikev2-infra:overlay-1-2001
   set transform-set infra:overlay-1-2001
exit

! These tunnel interfaces establish point-to-point connectivity between the on-prem
device and the cloud Routers
! The destination of the tunnel depends on the type of underlay connectivity:
! 1) The destination of the tunnel is the public IP of the cloud Router interface if the
underlay is via internet
! 2) The destination of the tunnel is the private IP of the cloud Router interface if the
underlay is via private
    connectivity like DX on AWS or ER on Azure

interface tunnel 2001
   ip address 5.5.1.26 255.255.255.252
   ip virtual-reassembly
   ! Please change GigabitEthernet1 to the appropriate interface
   tunnel source GigabitEthernet1
   tunnel destination 52.12.232.0
   tunnel mode ipsec ipv4
   tunnel protection ipsec profile infra:overlay-1-2001
   ip mtu 1400
   ip tcp adjust-mss 1400
   ! Please update process ID according with your configuration
   ip ospf 1 area 0.0.0.1
   no shut
exit
```

4. Repeat the previous step for the 2nd and any additional CSRs that you need to configure.
5. Verify that the tunnels are up on your on-premises IPsec device.

   Use the following command to display the status. If you do not see that both tunnels are shown as up, verify the information that you entered in the steps in this section to determine where you might have an issue. Do not proceed to the next section until you see that both tunnels are shown as up.

```
ISN_CSR# show ip interface brief | include Tunnel
Interface              IP-Address      OK? Method Status                Protocol
```

```
Tunnel1000          30.29.1.2       YES manual up                    *up*
Tunnel1001          30.29.1.4       YES manual up                    *up*
```

Upgrading Sites

Overview

This feature is supported for Cisco APIC sites only. It is not supported for Cisco Cloud Network Controller or Cisco NDFC fabrics.

When you deployed Cisco Multi-Site, each site's APIC clusters and switch nodes software had to be managed individually at the site level. As the number of sites in your Multi-Site domain grew, the release life cycle and upgrades could become complicated as they had to be manually coordinated and managed for release and feature compatibility.

Cisco Nexus Dashboard Orchestrator provides a workflow that allows you to manage all sites' software upgrades from a single point eliminating the need for multiple site administrators to manually coordinate software upgrades and giving you insight into any potential issues that could affect the upgrades.

You can access the site upgrades screen by navigating to **Admin > Software Management**. The page contains four tabs, which are described in this and following sections.

The **Overview** tab displays information about the sites in your Multi-Site domain and the firmware versions that are deployed or ready to be deployed. The Sites Firmware service polls the sites every 5 minutes for new or changed data such as the latest status of any of the upgrade policies. You can manually trigger a Refresh by clicking the **Refresh** button in the upper right corner of the main pane.

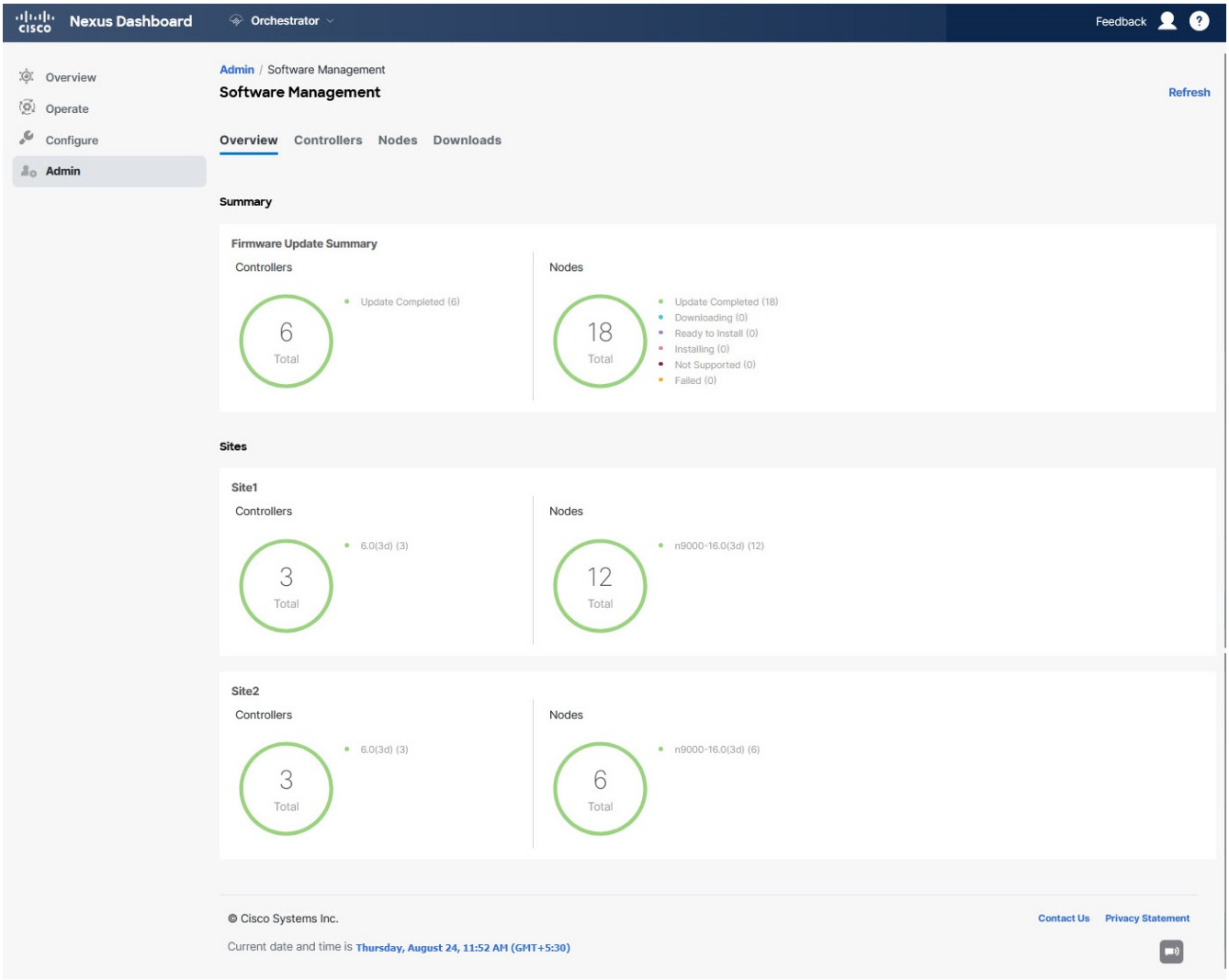


Figure 6. Sites Firmware Overview

The page is divided into the following areas:

- **Firmware Update Summary**–Provides overall summary of the firmware images that are present across all sites in your Multi-Site domain, including the Cisco APIC and the switch firmware.

  For each type of image, the specific information includes the number of images in each state:

  - Completed–The image is currently deployed to the controllers or the switches.
  - Downloading (for switch nodes only)–The image is being downloaded to the switch nodes.
  - Ready to Install (for switch nodes only)–The image was successfully downloaded to the switch nodes and is ready to be installed.
  - Installing–The images currently in the process of being deployed to the controllers or the switch nodes.
  - Not Supported–The images that do not support remote firmware upgrades, such as releases before Release 4.2(5).
- **Site-specific information**–Extra sections of the page display information about individual sites, which includes the version of the currently deployed software and the number of controllers or nodes.

Guidelines and Limitations

When performing fabric upgrades from the Cisco Nexus Dashboard Orchestrator, the following restrictions apply:

- You must review and follow the guidelines, recommendations, and limitations specific to the Cisco APIC upgrade process described in the Upgrading and Downgrading the Cisco APIC and Switch Software of the *Cisco APIC Installation, Upgrade, and Downgrade Guide*.
- Your Cisco Nexus Dashboard Orchestrator must be deployed in Cisco Nexus Dashboard.

  The site upgrade feature is not available for NDO deployments in VMware ESX and you must follow the standard upgrade procedures that are described in *Cisco APIC Installation, Upgrade, and Downgrade Guide*

- The fabrics must be running Cisco APIC, Release 4.2(5) or later.

  Fabrics running earlier APIC releases will not be available for selection during the upgrade workflow. Follow the standard upgrade procedures described in *Cisco APIC Installation, Upgrade, and Downgrade Guide*.

- We recommend coordinating the site upgrades with the site administrators managing those fabrics. You may need access to the controllers or switch nodes to troubleshoot any potential issues should they arise.
- If a fabric switch node goes into an inactive state in the middle of the upgrade process, for example due to hardware or power failure, the process is unable to complete. You will not be able to remove or modify the node upgrade policy from NDO during this time as NDO is unable to differentiate whether the node went down or is simply in the middle of a reboot for the upgrade.

  To resolve this issue, you must manually decommission the inactive node from the APIC, at which point the NDO upgrade policy recognizes the change and return a failed status. Then you can update the upgrade policy on the NDO to remove the switch and rerun the upgrade.

Downloading Controller and Switch Node Firmware to Sites

You must download the controller and switch software to all the site controllers in your fabrics before performing the upgrade. After you complete the following steps, you will be able to start the upgrade process later using the downloaded images.

1. Log in to your Cisco Nexus Dashboard Orchestrator.
2. Set up firmware download.

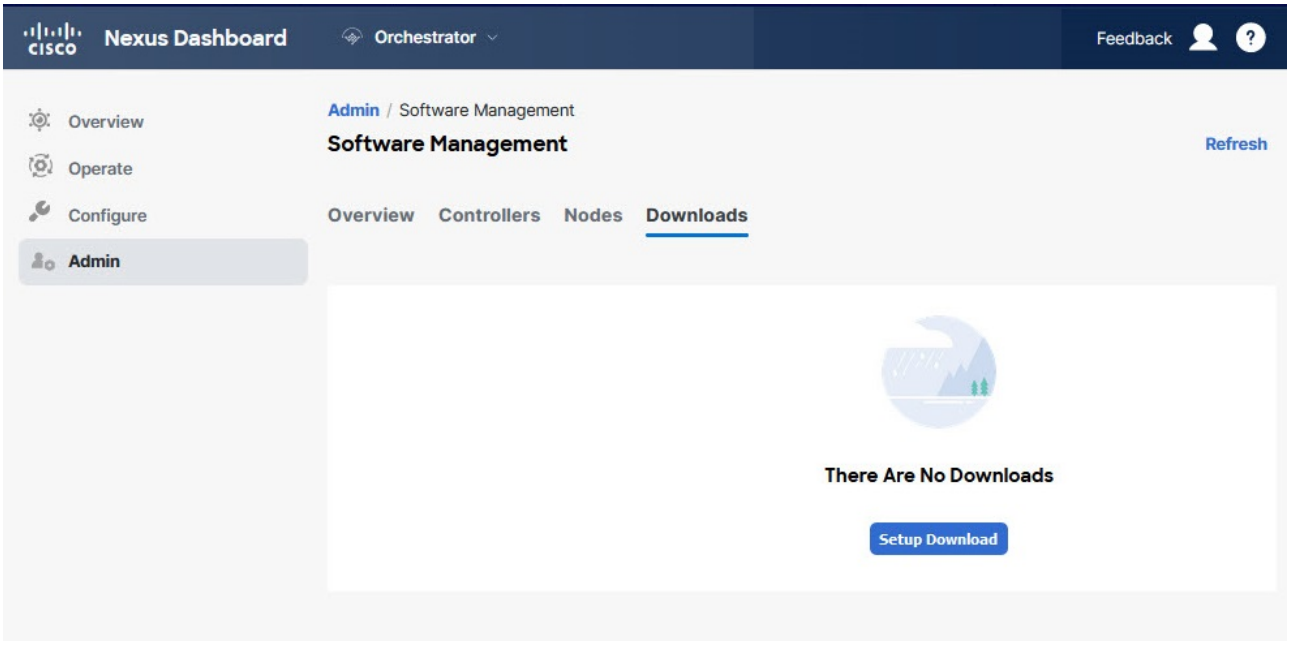


Figure 7. Site firmware update

a. From the left navigation pane, select **Admin > Software Management**.

b. In the main window, select the **Downloads** tab.

c. Click **Setup Downloads** tab.

   If you have previously set up one or more downloads, click the **Setup Downloads** button in the top right of the main pane instead.

   The **Download Image to APIC** screen opens.

3. Select the sites.

   The image will be downloaded to the Cisco APICs of all the sites you select here.

   a. Click **Select Sites**.

   b. In the **Select Sites** window, check one or more sites and click **Add and Close**.

   c. Click **Next** to proceed.

4. Provide the download details.

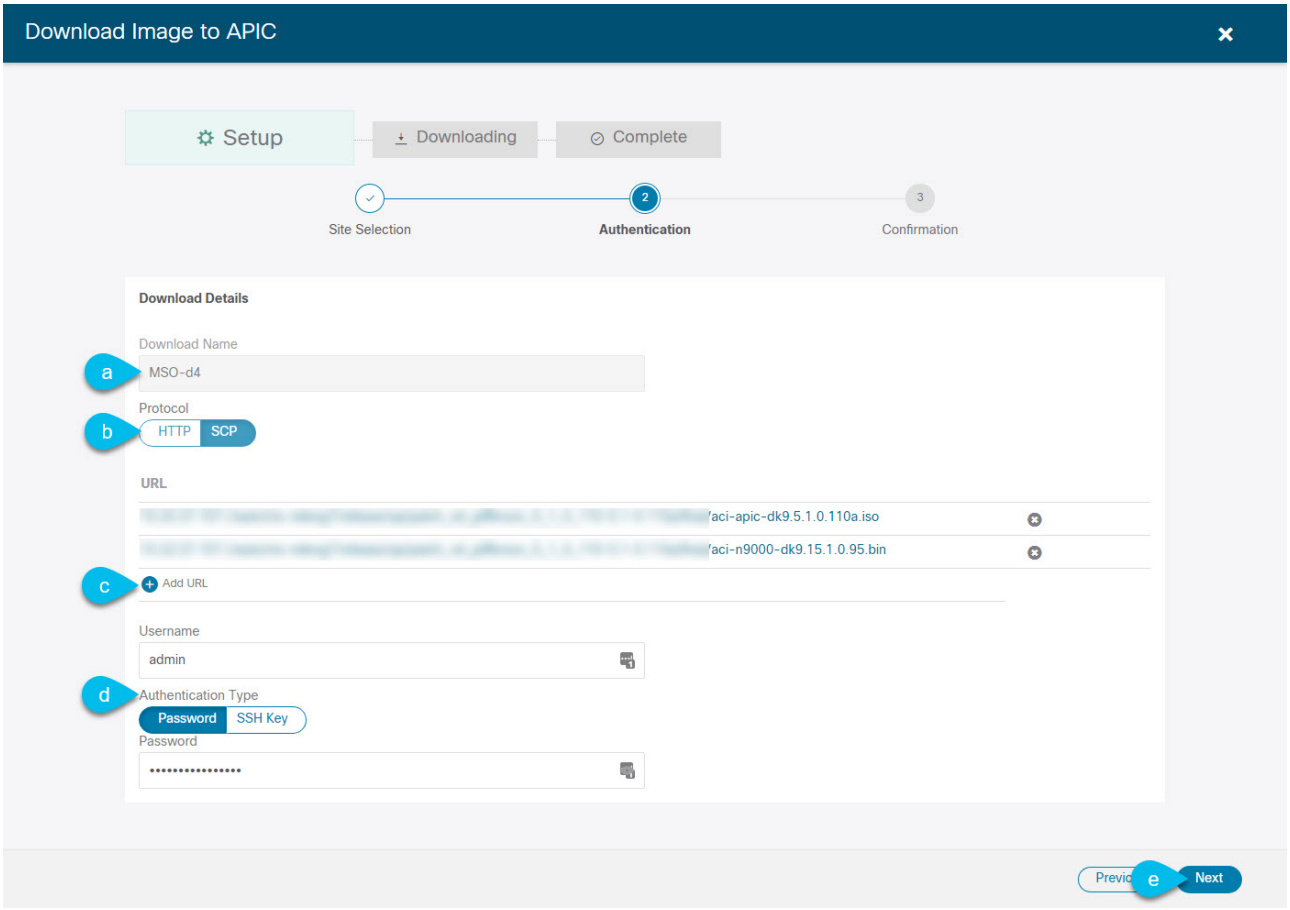


Figure 8. Details

a. Provide the **Name**.

   You can provide a descriptive name for tracking the download.

b. Choose the protocol.

   You can choose to download the image through HTTP or SCP.

c. Click **+ Add URL** to provide location of one or more images.

   You can provide both, the APIC and the switch firmware images.

d. If you selected **SCP**, provide the authentication information.

   You must provide the sign-in **Username**, for example admin.

   Then choose the **Authentication Type**:

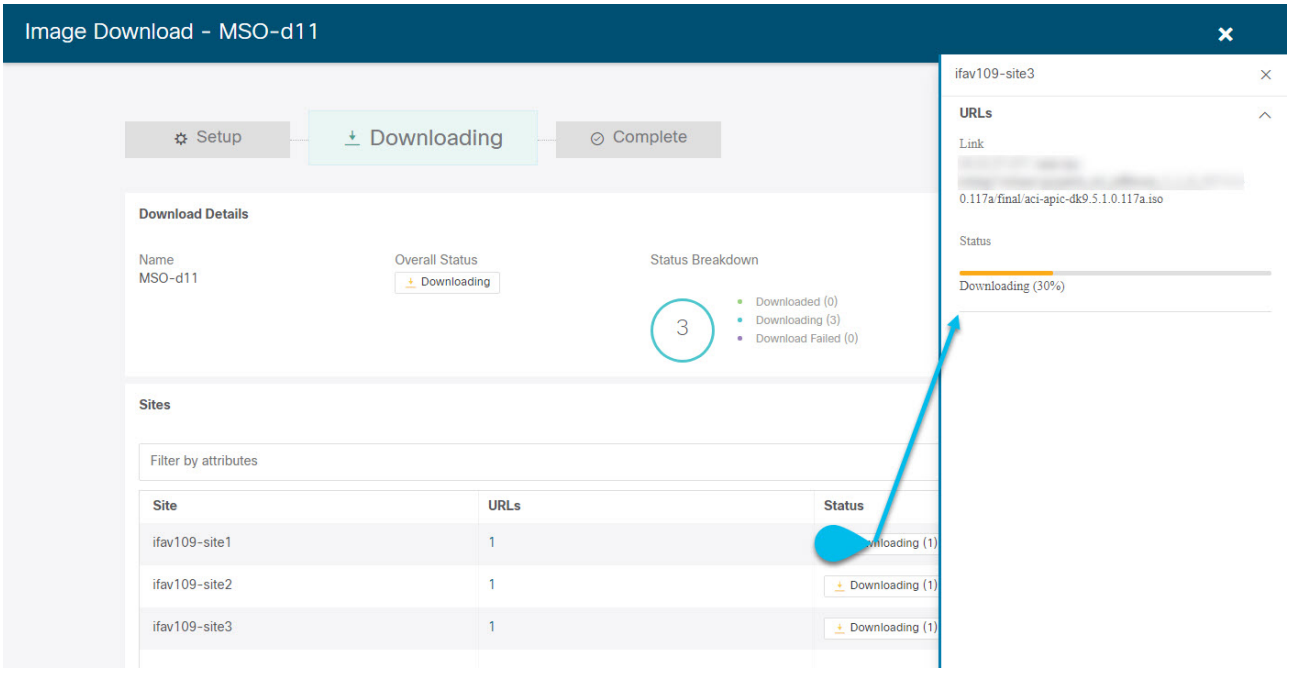
   - For **Password** authentication, simply enter the password for the username you provided earlier.
   - For **SSH Key** authentication, you must enter the **SSH Key** and the **SSH Key Passphrase**.

e. Click **Next** to proceed.

5. In the confirmation screen, review the information and click **Submit** to proceed.

In the **Downloading** screen that opens, you can view the status of the image download.

You can also click the status, to see extra details about the progress.



After all downloads complete, you will transition to the **Completed** screen. You do not have to wait at the **Downloading** screen, you can always navigate back to it from the **Downloads** tab by clicking the download name that you provided in a previous step.

Upgrading Controllers

This section describes how to set up a software upgrade for your sites' APIC clusters.

1. Log in to your Cisco Nexus Dashboard Orchestrator.
2. Set up APIC cluster upgrade.

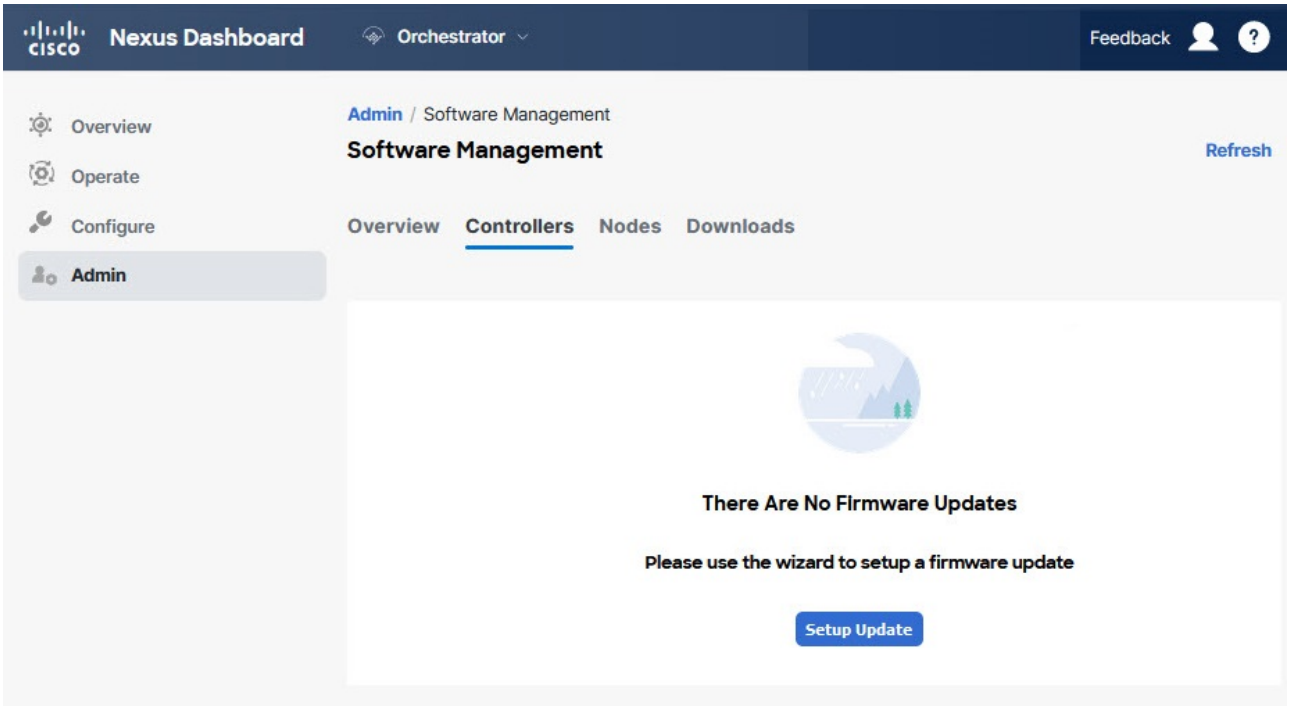


Figure 9. Upgrading Controllers

a. From the left navigation pane, select **Admin > Software Management**.

b. In the main window, select the **Controllers** tab.

c. Click **Setup Update** tab.

   If you have previously set up one or more updates, click the **Setup Update** button in the top right of the main pane instead.

   The **Setup Site Firmware Update** screen opens.

3. Provide the upgrade details.

   a. Provide the **Name**.

      This is the controller upgrade policy name that you will be able to use to track the upgrade progress at any time.

   b. Click **Select Sites**.

      The **Select Sites** window opens.

   c. In the **Select Sites** window, check one or more sites and click **Add and Close**.

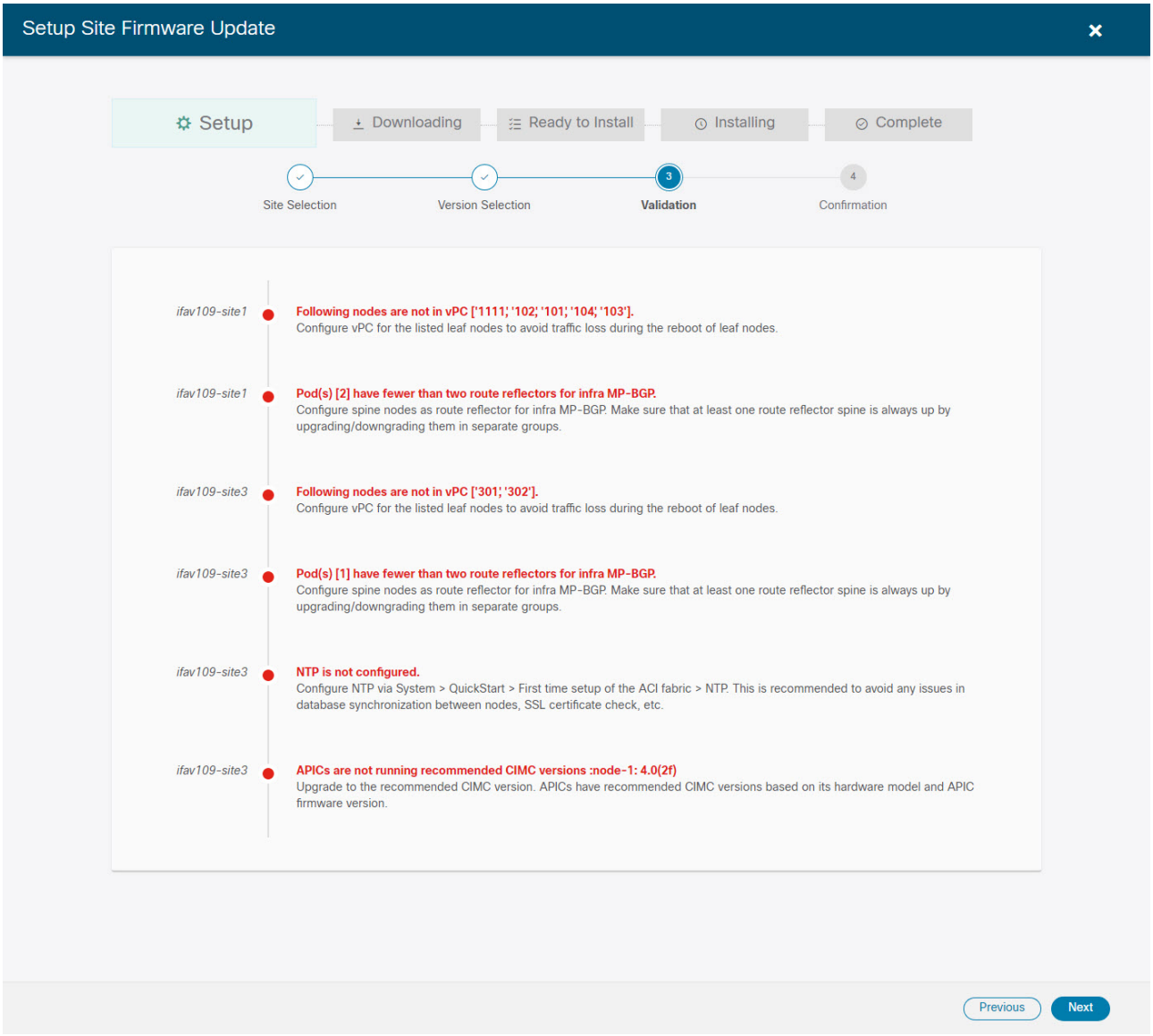
   d. Click **Next** to proceed.

4. In the **Version Selection** screen, select the firmware version and click **Next**.

   The firmware must be downloaded to the sites before it becomes available here. If the download you set up in previous section has completed successfully but the image is still not available here, close the **Setup Site Firmware Update** screen, navigate back to **Admin > Software Management > Overview** tab, and click the **Refresh** button to reload the latest information available for the sites; then restart the upgrade steps.

5. In the **Validation** screen, review the information, then click **Next**.

   Ensure that there are no faults and review any additional information that may affect your upgrade:



6. In the **Confirmation** screen, review the information and click **Submit** to start the upgrade.
7. In the **Ready to Install** screen, click **Install** to start the upgrade.

   If NDO to site connectivity is lost during the upgrade process, the GUI displays the last known status of the upgrade before loss of connectivity. When connectivity is reestablished, the upgrade status will be refreshed. You can perform a manual Refresh after connectivity loss by clicking the **Refresh** button in the top right of the main pane.

Upgrading Nodes

This section describes how to set up a software upgrade for your sites' switch nodes.

1. Log in to your Cisco Nexus Dashboard Orchestrator.
2. Set up switch nodes upgrade.

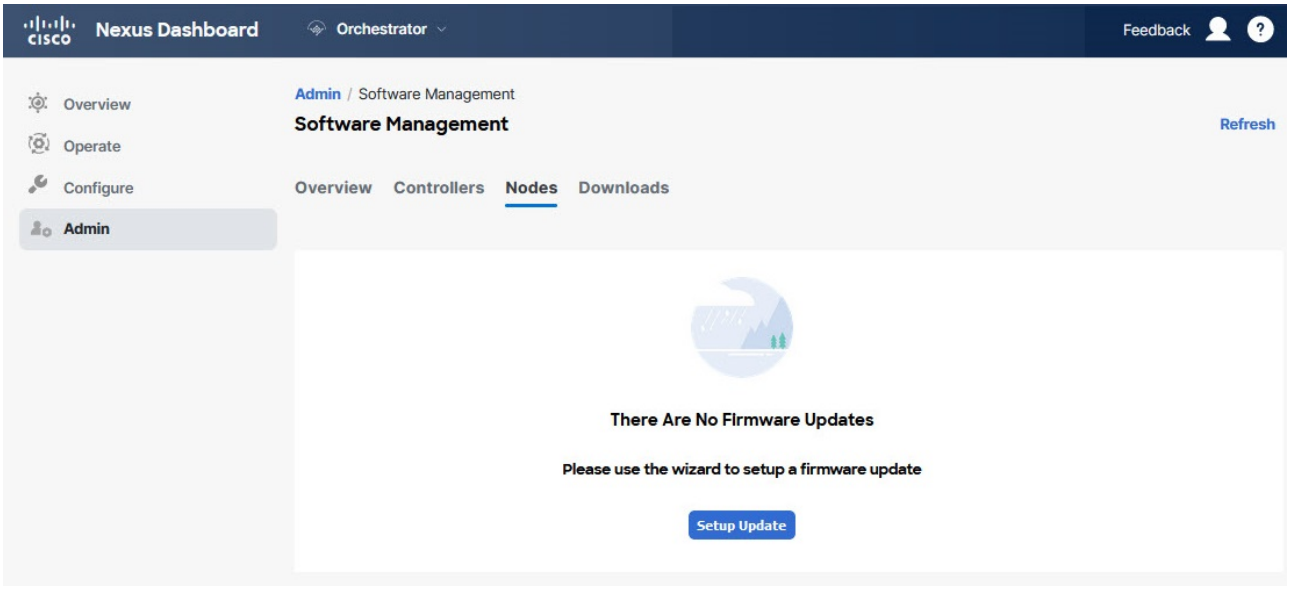


Figure 10. Switch nodes upgrade

a. From the left navigation pane, select **AdminSoftware Management**.

b. In the main window, select the **Nodes** tab.

c. Click **Setup Update** tab.

   If you have previously set up one or more updates, click the **Setup Update** button in the top right of the main pane instead.

   The **Setup Node Firmware Update** screen opens.

3. Provide the upgrade details.

   a. Provide the **Name**.

      This is the upgrade policy name that you are able to use to track the upgrade progress at any time.

   b. Click **Select Nodes**.

      The **Select Nodes** window opens.

   c. Select a site, then select the switch nodes in that site and click **Add and Close**.

      You can add switch nodes from a single site at a time. You repeat this step if you want to add switches from other sites. image::503324.jpg[,width=720]

   d. Repeat the previous substep for nodes in other sites.

   e. Click **Next** to proceed.

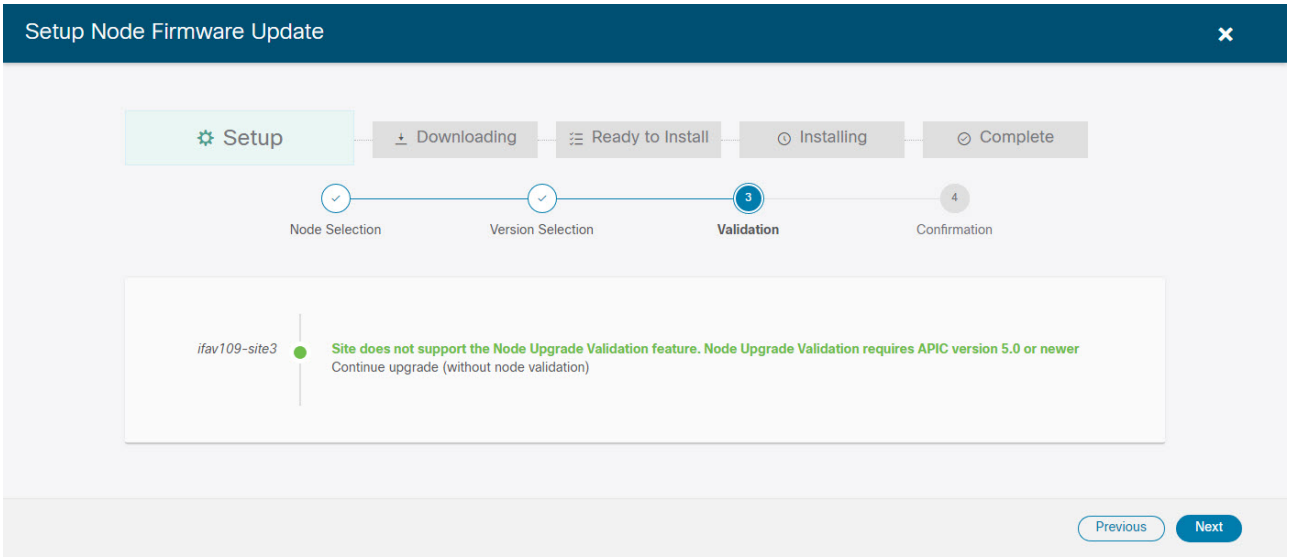
4. In the **Version Selection** screen, select the firmware version and click **Next**.

   The firmware must be downloaded to the sites before it becomes available here. If the download you set up in previous section has completed successfully but the image is still not available here, close the **Setup Site Firmware Update** screen, navigate back to **Admin > Software Management > Nodes** tab, and click the **Refresh** button to reload the latest information available for the sites; then restart the upgrade steps.

5. In the **Validation** screen, ensure that there are no faults raised, then click **Next**.

   Ensure that there are no faults and review any additional information that may affect your upgrade:

   > Sites running releases before Release 5.0(1) do not support node validation, so we recommend checking for any switch node faults in the site's APIC before starting the upgrade from NDO.



6. In the **Confirmation** screen, review the information and click **Submit**.

   This triggers image to be predownloaded to all the nodes you have selected. After the download completes, the screen will transition to **Ready to Install** and you can proceed to the next step.

7. (Optional) Change **Advanced Settings**.

   > Review the guidelines, recommendations, and limitations for the Cisco APIC upgrade process described in the Upgrading and Downgrading the Cisco APIC and Switch Software of the *Cisco APIC Installation, Upgrade, and Downgrade Guide* before making changes to the advanced options.

   In the **Ready to Install** screen, you can open the **Advanced Settings** menu for extra options:

   - **Ignore Compatibility Check**-By default, the option is set to No and compatibility check is enabled and verifies if an upgrade path from the currently running version of the system to a specified newer version is supported.

     If you choose to ignore the compatibility check feature, you run the risk of making an unsupported upgrade to your system, which could result in your system going to an unavailable state.

   - **Graceful Check**-By default, the option is set to No and the upgrade process will not put any of the switches into Graceful Insertion and Removal (GIR) mode before performing the upgrade.

     You can choose to enable this option to bring down the node gracefully (using GIR) while performing the upgrade so that the upgrade has reduced traffic loss.

- **Run Mode**–By default, the option is set to Continue on Failure and if a node upgrade fails, the process proceeds to the next node. Alternatively, you can set this option to Pause on Failure to halt upgrade process if any one of the node upgrades fails.

8. Remove any nodes that are marked as Failed from the upgrade.

   The upgrade cannot proceed if the upgrade policy contains one or more nodes that failed to download the firmware. You can mouse over the Failed status for more information and reason for failure.

   To remove the nodes from the upgrade, click **Edit Update Details** link in the **Ready to Install** screen.

9. Click **Install** to start the upgrade.

   If NDO to site connectivity is lost during the upgrade process, the GUI displays the last known status of the upgrade before loss of connectivity. When connectivity is reestablished, the upgrade status will be refreshed. You can perform a manual Refresh after connectivity loss by clicking the **Refresh** button in the top right of the main pane.

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