Provision Fabric Networks

About Fabric Networks

A fabric network is a logical group of devices that is managed as a single entity in one or multiple locations. Having a fabric network in place enables several capabilities, such as the creation of virtual networks and user and device groups, and advanced reporting. Other capabilities include intelligent services for application recognition, traffic analytics, traffic prioritization, and steering for optimum performance and operational effectiveness.

Cisco DNA Center allows you to add devices to a fabric network. These devices can be configured to act as control plane, border, or edge devices within the fabric network.

Fabric Sites

A fabric site is an independent fabric area with a unique set of network devices: control plane, border, edge, wireless controller, ISE PSN. Different levels of redundancy and scale can be designed per site by including local resources: DHCP, AAA, DNS, Internet, and so on.

A fabric site can cover a single physical location, multiple locations, or only a subset of a location:

- Single location: branch, campus, or metro campus
- Multiple locations: metro campus + multiple branches
- Subset of a location: building or area within a campus

A Software-Defined Access fabric network may comprise multiple sites. Each site has the benefits of scale, resiliency, survivability, and mobility. The overall aggregation of fabric sites accommodates a large number of endpoints and scales modularly or horizontally. Multiple fabric sites are interconnected using a transit site.

Transit Sites

A transit site is a site that interconnects two or more fabric sites or connects the fabric site with external networks (Internet, data center, and so on). There are two types of transit networks:

- IP transit: Uses a regular IP network to connect to an external network or to connect two or more fabric sites. It leverages a traditional IP-based (VRF-LITE, MPLS) network, which requires remapping of VRFs and SGTs between sites.
- SD-Access transit: Uses LISP/VxLAN encapsulation to connect two fabric sites. The SD-Access transit area may be defined as a portion of the fabric that has its own control plane nodes, but does not have edge or border nodes. However, it can work with a fabric that has an external border. With an SD-Access transit, an end-to-end policy plane is maintained using SGT group tags.

Fabric Readiness and Compliance Checks

Fabric Readiness Checks

Fabric readiness checks are a set of preprovisioning checks done on a device to ensure that the device is ready to be added to the fabric. Fabric readiness checks are now done automatically when the device is provisioned. Interface VLAN and Multi VRF configuration checks are not done as part of fabric readiness checks.

Fabric readiness checks include the following:

- Connectivity checks: Checks for the necessary connectivity between devices; for example, connectivity from the edge node to map server, from edge node to border, and so on.
- Existing configuration check (brownfield check): Checks for any configuration on the device that conflicts with the configuration that is pushed through SD-Access and can result in a failure later.
- Hardware version: Checks if the hardware version of the device is supported.
- Image type: Checks if the device is running with a supported image type (IOS-XE, IOS, NXOS, Cisco Controller).
- Loopback interface: Checks for the loopback interface configuration on the device. A device must have a loopback interface configured on it to work with the SDA application.
- Software license: Checks if the device is running with an appropriate software license.
- Software version: Checks if the device is running with an appropriate software image.

For more information on the software versions supported, see the Cisco SD-Access Hardware and Software Compatibility Matrix.

If an error is detected during any of the fabric readiness checks, an error notification is displayed on the topology area. You can correct the problem and continue with the provisioning workflow for the device.

Fabric Compliance Checks

Fabric compliance is a state of a device to operate according to the user intent configured during the fabric provisioning. Fabric compliance checks are triggered based on the following:

- Every 24 hours for wired devices and every six hours for wireless devices.
- When there is a configuration change on the wired device.

  A configuration change on the wired device triggers an SNMP trap, which in turn triggers the compliance check. Ensure that you have configured the Cisco DNA Center server as an SNMP server.

The following compliance checks are done to ensure that the device is fabric compliant:

- Virtual Network: Checks whether the necessary VRFs are configured on the device to comply with the current state of user intent for the VN on Cisco DNA Center.
- Fabric Role: Checks whether the configuration on the device is compliant with the user intent for a fabric role on Cisco DNA Center.
- Segment: Checks the VLAN and SVI configuration for segments.
- Port Assignment: Checks the interface configuration for VLAN and Authentication profile.

Add a Fabric Site

Before you begin

You can create a new fabric site only if IP Device Tracking (IPDT) is already configured for the site. This means that you should have enabled **Monitor wired clients** while configuring Telemetry settings for the site.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (☰) and choose **Provision** > **SD ACCESS** > **Fabric Sites**.

Step 2 In the **Fabric Sites** tab, click **Add fabric site**.

Alternatively, instead of the first two steps, in the Cisco DNA Center GUI, click the Menu icon and choose **Workflow** > **Create a Fabric Site and Fabric Zones**.

Follow the workflow wizard.

Step 3 In the **Create a Fabric Site** window, click **Let's Do it**.

Step 4 Select an area, building, or floor to add as a fabric site and click **Next**.

Step 5 (Optional) To designate fabric zones and create scoped subnets, select **Yes Setup Zones**.

To enable a fabric zone, select a fabric site from the network hierarchy displayed.

Step 6 Click **Next**.

Step 7 Review the fabric site settings on the **Summary** window.

You can edit any of the fabric site or zone settings here.

Step 8 Click **Create**.

It takes a few seconds for the site and zones to be provisioned. Upon successful creation of the site, a **Success! Your fabric site is created** message is displayed.

Add a Device to a Fabric

After you have created a fabric site, you can add devices to the fabric site. You can also specify whether the device should act as a control plane node, an edge node, or a border node.

You can add a new device to the fabric site only if IP Device Tracking (IPDT) is configured for the fabric site.

A device which is assigned the Access role and has been provisioned before enabling IPDT on the site can’t be added to the fabric. Reprovision such devices before adding them to the fabric site. Check the Provision workflow to confirm the status of **Deployment of IPDT** on the device.

Note

- It’s optional to designate the devices in a fabric site as control plane nodes or border nodes. You might have devices that don’t occupy these roles. However, every fabric site must have at least one control plane node device and one border node device. In the current release for wired fabric, you can add up to six control plane nodes for redundancy.
- Currently, the Cisco Wireless Controller communicates only with two control plane nodes.

Before you begin

Provision the device if you haven’t already provisioned it:

1. In the Cisco DNA Center GUI, click the **Menu** icon (☰) and choose **Provision** > **Network Devices** > **Inventory**.
2. The **Inventory** window displays the discovered devices.
3. The topology view shows a device in gray color if it has passed the fabric readiness checks and is ready to be provisioned.
4. If an error is detected during any of the fabric readiness checks, an error notification is displayed on the topology area. Click **See more details** to check the problem area listed in the resulting window. Correct the problem and click **Re-check** to ensure that the problem is resolved.
5. If you update the device configuration as part of problem resolution, ensure that you resynchronize the device information by performing an **Inventory** > **Resync** for the device.

Note You can continue to provision a device that has failed the fabric readiness checks.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**. The Fabric Sites tab in the resulting window displays all the provisioned sites.

Step 2 Select the fabric site to add a device.

The resulting topology view displays all devices in the network that have been inventoried. In the topology view, any device that is added to the fabric is shown in blue.

Step 3 Click a device. A slide-in pane displays the following **Fabric** options:

Option	Description
Edge	Toggle the button next to this option to enable the selected device as an edge node.
Border	Toggle the button next to this option to enable the selected device as a border node.
Control Plane	Toggle the button next to this option to enable the selected device as a control plane node.

To configure a device as a fabric-in-a-box, select the **Control Plane**, **Border**, and **Edge** options.

To configure the device as a control plane and a border node, select both **Control Plane** and **Border**.

Step 4 Click **Add**.

What to do next

After a device is added to the fabric, fabric compliance checks are automatically performed to ensure that the device is fabric-compliant. The topology displays a device that has failed the fabric compliance check in blue color with a cross-mark beside it. Click **See more details** on the error notification to identify the problem area and correct it.

Add a Device as a Border Node

When you are adding a device to a fabric, you can add it in various combinations to act as a control plane, border node, or edge node as explained in Add a Device to a Fabric, on page 4.

To add a device as a border node:

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**. The **Fabric Sites** tab in the resulting window displays all the provisioned sites.

Step 2 Select the fabric site to add a border node.
The resulting topology view displays all devices in the network that have been inventoried. In the topology view, any device that is added to the fabric is shown in blue.

Step 3 Click a device.

Step 4 In the slide-in window that appears, click the **Border** toggle button.

Step 5 In the resulting window, click the **Layer 3 Handoff** tab.

Step 6 Check the **Enable Layer-3 Handoff** check box.

Step 7 Enter the **Local Autonomous Number** for the device.

If the Local Autonomous Number is already configured on the device, this field displays the configured number and is disabled. You cannot change the Local Autonomous Number if it is already configured on the device.

Step 8 From the **Select IP Pool** drop-down list, choose an IP address pool.

Select an IP pool only if you want to add an IP transit network.

Step 9 Choose a transit network that is enabled on the border device:

a) To enable SDA transit on the border, choose a user-created SDA transit domain from the **Select Transit/Peer Network** drop-down list.

Click **Add**.

b) To enable IP transit on the border, choose a user-created IP transit domain from the **Select Transit/Peer Network** drop-down list.

Click **Add**.

Do the following steps in the resulting window:

1. Choose an IP pool from Design Hierarchy. The selected pool is used to automate IP routing between the border node and the IP peer.
2. Click **Add Interface** to enter interface details on the next screen.
3. Choose **External Interface** from the drop-down list.
4. Enter a custom description for the interface at **Interface Description**.
5. Enter the **Remote AS Number**.
6. Check the **Virtual Network** from the list. This virtual network is advertised by the border to the remote peer. You can select one, multiple, or all virtual networks.
7. Click **Save**.

Step 10 By default, a border is designated as an external border, wherein it acts as a gateway to all unknown traffic, without importing any external routes. A border can be configured to be an internal border, wherein it acts as a gateway to known traffic and imports specific external routes. A border can also have a combined role of internal and external borders.

- Check both **Default to all Virtual Networks** and **Do not Import External Routes** check boxes to designate the border as an external border, providing connectivity to unknown networks.
- Do not check both **Default to all Virtual Networks** and **Do not Import External Routes** check boxes to designate the border as an internal border, operating as a gateway for specific network addresses.
- Check the **Default to all Virtual Networks** check box to designate this border node as an internal and external border. It acts as a gateway to all known and unknown traffic sent from the edge nodes. (Do not check the **Do not Import External Routes** check box.)

Step 11 (Optional) Perform this step only if you are connecting a nonfabric network to the fabric network or you are migrating from a traditional network to an SDA network. Click the **Layer 2 Handoff** tab. A list of virtual networks and the count of IP pools in each virtual network is displayed.

a) Click a virtual network that is to be handed off.

After you select a virtual network, a list of IP address pools that are present in the virtual network appears. A list of interfaces through which you can connect nonfabric devices is also displayed.

b) Select an **External Interface**.

In Cisco DNA Center Release 2.1.2.6, you can select more than one interface on which you can do a Layer 2 handoff.

c) Enter the **Interface Description**.

d) Enter the **External VLAN** number into which the fabric must be extended.

In releases earlier than Cisco DNA Center 2.1.2.6, a virtual network can only be handed off on a single interface. The same virtual network cannot be handed off through multiple interfaces.

In Cisco DNA Center Release 2.1.2.6 and later releases, a virtual network can be handed off on a single interface or on multiple interfaces. Layer 2 handoff for a segment can also be done on two different devices. In both cases, ensure that there are no loops formed in the network.

e) Click **Save**.

Step 12 Click **Add**.

Configure LISP Pub/Sub

You can configure LISP Pub/Sub on a fabric site only when you add the first control plane to your fabric.

Before you begin

Ensure that the fabric devices operate on Cisco IOS XE 17.6.1 or later releases.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under SD ACCESS.

Step 2 In the **Fabric Sites** tab, click the site to be configured with LISP Pub/Sub.

The **SITE** window displays a summary of the site elements.

Step 3 Click the device that is to be configured as a control plane.

Step 4 In the slide-in pane that appears, click the **Control Plane** toggle button to configure this plane.

Step 5 In the **Configure Control Plane** window, choose **LISP PubSub** route distribution protocol and click **Add**.

Step 6 Click **Deploy**.

Step 7 In the **Modify Fabric** window, schedule the operation and click **Apply**.

To verify the configuration of LISP Pub/Sub in the fabric site, see the LISP Pub/Sub status on the **SITE SUMMARY** window.

Create an IP Transit Network

To add a new IP transit network:

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Transits & Peer Networks** under **SD ACCESS**.

Step 2 In the **Transits and Peer Networks** window, click **Add Transit**.

Step 3 In the **Transit/Peer Network** slide-in window, enter a name for the transit network.

Step 4 Enter a transit name for the network.

Step 5 Choose **IP-Based Transit/Peer Network Type**.
The routing protocol is set to BGP by default.

Step 6 Enter the Autonomous System Number (ASN) for the transit network.

Step 7 Click **Save**.

Create an SDA Transit Network

To add a new SDA transit network:

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **SD Access** > **Transits & Peer Networks**.

Step 2 In the **Transits and Peer Networks** window, click **Add Transit**.

Step 3 In the **Transit/Peer Network** slide-in window, enter a name for the transit network.

Step 4 Choose an SD-Access **Transit/Peer Network Type**.

To configure a transit for fabric sites that do not have LISP Pub/Sub control plane, choose **SD-Access (LISP/BGP)**.

To configure a transit for fabric sites that have LISP Pub/Sub control plane, choose **SD-Access (LISP PubSub)**.

To share the **SD-Access (LISP PubSub)** transit with other Cisco DNA Center, choose **Yes, Share**. Otherwise, choose **No, keep it local**.

Note You can share an SD-Access (LISP Pub/Sub) Transit only with four other Cisco DNA Center nodes.

Step 5 Select a **Site for the Transit Control Plane** from the drop-down list. Choose at least one transit map server.

Step 6 Select a **Transit Control Plane** for the transit network from the drop-down list.

Step 7 Repeat Step 5 and Step 6 to add a second map server.

Step 8 Click **Save**.

After creating the transit network, the **Transits and Peer Networks** window displays the newly created transit and its attributes.

Note You cannot add an **SD-Access (LISP/BGP)** transit to a fabric site that uses LISP/BGP control plane and similarly you cannot add **SD-Access (LISP/BGP)** transit to a fabric site that uses LISP Pub/Sub control plane.

What to do next

To interconnect the fabric sites with an SDA transit, add the transit to the border node.

Configure Host Onboarding

The **Host Onboarding** tab lets you configure settings for the various kinds of devices or hosts that can access the fabric network.

The **Host Onboarding** tab has the following subtabs:

- **Authentication** tab: Select an authentication template for the fabric. An Authentication template is a predefined set of configurations that are retrieved from Cisco ISE. After selecting the authentication template, click **Save**.
- **Wireless SSIDs** tab: Specify wireless SSIDs within the network that hosts can access. You can select the guest or enterprise SSIDs and assign address pools, and click **Save**.
- **Port Assignment** tab: Apply specific configurations to each port, depending on the type of device that connects to the fabric site. To do this, select the ports that need a specific assignment, click **Assign**, and choose the port type from the drop-down list.

  Note the following constraints:

  - Cisco SD-Access deployments support only APs, extended nodes, user devices (such as a single computer or a single computer plus phone), and devices that need trunk ports like single servers.
  - Servers with internal switches or virtual switches aren’t supported.
  - Other networking equipments (such as hubs, routers, or switches) aren’t supported.

Select the Authentication Template

You can select the authentication template that applies to all devices in the fabric site.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**. The **Fabric Sites** tab in the resulting window displays all the provisioned sites.

Step 2 In the **Fabric Sites** window, select a fabric site.

Step 3 Click the **Host Onboarding** tab.

Step 4 In the **Authentication** tab, choose an authentication template for the site:

- **Closed Authentication**: Any traffic prior to authentication is dropped, including DHCP, DNS, and ARP.
- **Low Impact**: Security is added by applying an ACL to the switch port, to allow very limited network access prior to authentication. After a host has been successfully authenticated, additional network access is granted.
- **No Authentication**
- **Open Authentication**: A host is allowed network access without having to go through 802.1X authentication.

You can edit the settings of the selected authentication template to address site-specific authentication requirements.

Before you change the site-level authentication, you must resychronize any fabric devices where APs were onboarded through macros or autoconf and haven't yet undergone the periodic resynch.

Step 5 (Optional) To edit the settings of the chosen authentication method, click **Edit**.

The slide-in window displays the parameters of the selected authentication method: **First Authentication Order**, **802.1x to MAB Fallback**, **Wake on LAN**, and **Number of hosts**.

Note **Number of hosts** specifies the number of data hosts that can be connected to a port. With **Single**, you can have only one data client on the port. With **Unlimited**, you can have multiple data clients and one voice client on the port.

Make the required changes and click **Save**.

The edit window closes. The saved modifications apply only to the site for which the authentication template is edited.

Step 6 Click **Deploy**.
The Hitless Authentication Change feature lets you switch from one authentication method to another without removing the devices from the fabric.

Configure Ports Within the Fabric Site

The **Port Assignment** tab lets you configure each access device in the fabric site. You can specify network behavior settings for each port on a device.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**.

Step 2 In the resulting **Fabric Sites** window, click a fabric site.

Step 3 In the **Host Onboarding** tab, click the **Port Assignment** tab.

Step 4 From the list of fabric devices displayed in the left pane, choose the device that you want to configure.
The ports available on the device are displayed in the right pane.

Step 5 Select the ports of the device and click **Assign**.

Step 6 In the **Port Assignment** slide-in window, select the **Connected Device Type** from the following options in the drop-down list:

Option	Description
Trunk	Configure the port as trunk port.
Access Point(AP)	Configures the port to connect to an access point.
User Devices (IP phone, computer, laptop)	Configures the port to connect to a host device.

a) To connect a trunk port, select **Trunk** and provide a **Description** for this port.

b) To connect an access point, select **Access Point(AP)** and do the following:

1. Select the VLAN and IP address from the **VLAN Name / IP Address Pool (Data)** drop-down list.
2. Select the **Authentication** type from the drop-down list.
3. Provide a **Description** about the connected device.

c) To connect host devices, select **User Devices (IP phone, computer, laptop)** and do the following:

1. Select the IP address pool for data from the **VLAN Name / IP Address Pool (Data)** drop-down list.

2. Select the **Scalable Group**s, which are the groups you have provisioned.

   Scalable groups are supported only with No Authentication profile.

3. Select the IP address pool for voice from the **VLAN Name / IP Address Pool (Voice)** drop-down list.
4. Select the authentication template from the **Authentication** drop-down list.
5. Enter a **Description** for the connected device.

d) Click **Update**.

Step 7 After completing all port assignments, click **Deploy**.

Configure Wireless SSIDs for Fabric Networks

Step 1 From the **Wireless SSID** section, specify the wireless SSIDs within the network that the hosts can access.

Step 2 Click **Choose Pool** and select an IP pool reserve for the SSID.

Step 3 From the **Assign SGT** drop-down list, choose a scalable group for the SSID.

Step 4 Check the **Enable Wireless Multicast** check box to enable wireless multicast on the SSIDs.

Virtual Networks

Virtual networks are overlays that are used to segment traffic within a common physical network infrastructure; this is also known as macro-segmentation. Layer 2 Virtual Networks segment switched traffic and Layer 3 Virtual Networks segment routed traffic. Each endpoint that is connected to a Cisco SD-Access fabric is assigned to a specific virtual network based on the static edge port configurations or the dynamic policy from Identity Service Engine. Within a virtual network, endpoints can communicate with each other unless explicitly blocked by micro-segmentation policy. Endpoints across different virtual networks cannot communicate with each other by default. Inter-virtual network traffic requires connectivity policy to be implemented outside of the Cisco SD-Access fabric, such as on a fusion device.

A typical use case for virtual networks is an office building containing both corporate endpoints and building management systems. The corporate endpoints need to be segmented from building systems, such as lighting, heating, ventilation, and air conditioning. In this case a network administrator could macro-segment the corporate endpoints and the building systems using two or more virtual networks to block unauthorized access between the building systems and corporate endpoints.

A Layer 3 virtual network may span multiple fabric sites and across network domains (wireless LAN, campus LAN, and WAN). A Layer 2 virtual network resides within a single fabric site.

Create a Layer 3 Virtual Network

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (☰) and choose **Workflows** > **Create Layer 3 Virtual Network**.

Alternatively, you can navigate to the **Layer 3 VNs** tab of **Provision** > **Virtual Networks** under **SD ACCESS** and click **Create Layer 3 VN**.

Step 2 In the **Add Virtual Network** workflow window, click **Let's Do it**.

Step 3 In the **Create Layer 3 Virtual Networks** window, enter the number of Layer 3 virtual networks that you wish to create.

Step 4 Click **Next**.

Step 5 Enter the name of the Layer 3 virtual network and click **Next**.

Step 6 To associate the Layer 3 virtual networks to fabric sites and fabric zones, select the Layer 3 virtual network from the drop-down list and select a fabric site from the corresponding drop-down list. You can assign a virtual network to multiple fabric sites. Repeat this association for all the Layer 3 virtual networks that you created.

Alternatively, in the **By Fabric Site** tab, you can assign multiple virtual networks to a fabric site.

Step 7 Click **Next**.

Step 8 Configure the exit behavior of the traffic when this virtual network is associated with multiple fabric sites.

a) By default, **Local Exit** is selected. This allows the traffic to exit through the local border of each associated fabric site.

b) To anchor a virtual network and enable the traffic to exit at a designated border, choose **Remote Exit**.

From the list of associated fabric sites, choose a site whose border will serve as an exit for all traffic in this virtual network. The other associated fabric sites will inherit the virtual network.

Step 9 Click **Next**.

Step 10 Review the virtual network settings on the **Summary** window before configuring the virtual networks.

Step 11 To create the context of the virtual network, click **Create**.

Step 12 To assign the virtual network to the selected sites, click **Deploy**.

Step 13 To verify the virtual network creation, click **View All Virtual Networks**.

Step 14 The **Virtual Networks** window displays the details of all the Layer 3 virtual networks in the fabric.

Create a Layer 2 Virtual Network

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Workflows** > **Create Layer 2 Virtual Network**.

Alternatively, you can navigate to the **Layer 2 VNs** tab of **Provision** > **Virtual Networks** under **SD ACCESS** and click **Create Layer 2 VN**.

Step 2 In the **Create L2 Virtual Network** window, click **Let’s Do it**.

Step 3 Enter the number of VLANs that you want to connect to the fabric.

Step 4 Click **Next**.

Step 5 In the **Configure VLANs** window, do the following:

a) Enter a **VLAN Name** and optional **VLAN ID** for each of the VLANs.

b) From the **Traffic Type** drop-down list, choose **Data** or **Voice**.
Flooding is enabled by default for a Layer 2 virtual network.

c) Click **Next**.

Step 6 In the **Select your CPs for each L2VN** window, choose a fabric site and Layer 3 virtual network for each Layer 2 virtual network created.

If a Layer 2 virtual network is deployed to more than one fabric site, Cisco DNA Center stretches the subnet with a common pool.

Step 7 Click **Next**.

Step 8 In the **Summary** window, review your Layer 2 virtual network settings. Click **Create**.

Step 9 To confirm the provisioning of the Layer 2 virtual network, click **Submit**.

After the Layer 2 virtual network is provisioned, a success message is displayed.

Step 10 To verify the creation of the Layer 2 virtual network, click **Virtual Network overview**. In the **Virtual Networks** window, the **Layer 2** tab displays the details of all the Layer 2 virtual networks in the fabric.

Associate a Layer 3 Virtual Network to a Fabric Site

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (☰) and choose **Provision** > **Virtual Networks** under **SD ACCESS**.

Step 2 In the **Virtual Networks** window, under **SEGMENTS**, click the number that indicates the count of **Layer 3 Virtual Networks**.

The resulting window displays all the Layer 3 virtual networks at the global level.

Step 3 In the **Layer 3** tab, for a desired Layer 3 virtual network, click **Actions (…)** > **Add to fabric site**.

Step 4 In the **Select Fabric Site** slide-in window, select a site and click **Select**.

Follow these steps to add this virtual network to another fabric site.

Add a Gateway to a Layer 3 Virtual Network

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (☰) and choose **Provision** > **Virtual Networks** under **SD ACCESS**.

Step 2 In the **Virtual Networks** window, under **SEGMENTS**, click the number that indicates the count of **Layer 3 Virtual Networks**.

The resulting window displays all the Layer 3 virtual networks at the global level.

Step 3 In the **Layer 3** tab, for a desired Layer 3 virtual network, click **Actions (…)** > **Add gateways**.

The **Add Pools to an L3VN** window displays all the sites to which the selected Layer 3 virtual network is assigned.

Step 4 In the left pane of the **Add Pools to an L3VN** window, select the Layer 3 virtual network for which the gateway is to be created and do the following:

a) Choose an **IP Pool** from the drop-down list.

> **Note** You can only choose from those IP pools that are reserved at the same site level as the fabric site. You can reserve IP address pools when you design your network settings.

b) Enter a valid **VLAN Name** or select **Auto generate VLAN name**.

c) Enter a custom **VLAN ID** for the virtual network.

Note the following about VLAN IDs:

- VLAN IDs 1, 1002-1005, 2046, and 4095 are reserved and can’t be used.
- If you don’t provide a custom VLAN ID, Cisco DNA Center generates a VLAN ID in the range of 1021 to 2020.

d) Choose **Data** or **Voice** from the **Traffic Type** drop-down list.

e) Choose a **Scalable Group** from the drop-down list.

f) To enable Layer 2 flooding, click the **Flooding** toggle button on.

Note Layer 2 flooding requires underlay multicast, which is configured during LAN automation. If you do not provision the underlay through LAN automation, configure underlay multicast manually.

g) To include this IP pool in the critical IP address pool, click the **Critical VLAN** toggle button on.

A critical pool is used for closed authentication profile when an authentication server is not available. A critical VLAN is assigned to the critical pool and all unauthenticated hosts are placed in the critical VLAN in the absence of an authentication server.

h) To enable this IP pool as a wireless IP address pool, click the **Wireless** toggle button on.

i) To enable the IP-Directed Broadcast feature, click the **Directed Broadcast** toggle button on.

Note

- Enable Layer 2 flooding before enabling IP-Directed Broadcast.
- Routers and Nexus 7000 Series Switches do not support IP-Directed Broadcast.
- Before enabling IP-Directed Broadcast, ensure that underlay multicast is enabled.

j) To associate more IP pools, click the ⊕ icon and repeat the steps.

k) Click **Next**.

Step 5 Review the endpoint connectivity settings in the **Summary** window.

Step 6 In the **Provisions in progress** window, click **Submit**.

Step 7 To verify the gateway creation after you see a success message, click **Virtual Network overview**.

Step 8 In the **Virtual Networks** window, the **Layer 2 VNs** tab under **Segments** displays all the Layer 2 virtual networks and their details.

Configure a Fabric Zone

A fabric site (parent site) can be divided into fabric zones with smaller subnets to help you manage the network easily. A fabric zone can have its own edge nodes and extended nodes, but it connects to the parent site for a control plane and border. If you migrated from an earlier release of Cisco DNA Center, you can create a fabric zone on the existing fabric site. This fabric zone inherits all the properties of its parent site.

Before you begin

- Ensure that your network hierarchy is created under the Global site.
- Select a parent site that is not at the lowest level in the hierarchy.

The following is the broad workflow to configure a fabric zone.

1. Create a fabric zone in either of the following ways:
   - Create a fabric site and its zones using the **Create a Fabric Site and Fabric Zones** workflow. For more information, see Create a Fabric Site and Its Fabric Zones, on page 15.
   - Edit an existing fabric site to add fabric zones to it. For more information, see Create a Fabric Zone on an Existing Fabric Site, on page 16.
2. Add edge nodes and extended nodes to the fabric zone. For more information, see Add a Device to a Fabric, on page 4.
3. Assign Layer 3 virtual networks and segments to the fabric zone. Note that only the virtual networks and segments of the parent site are available to the fabric zone. For more information, see Add Virtual Networks to a Fabric Zone, on page 16.

Note After a segment is added to a fabric zone, it cannot be updated in the parent site.

You cannot edit edge nodes and extended nodes of a fabric zone in its parent site.

You can configure the edge node of a fabric zone as a control plane or a border of the parent site.

Create a Fabric Site and Its Fabric Zones

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**.

Step 2 In the **Fabric Sites** tab, click **Add Fabric Site**.

Alternatively, instead of following the first two steps, in the Cisco DNA Center GUI, click the Menu icon and choose **Workflow** > **Create a Fabric Site and Fabric Zones**.

Follow the workflow wizard.

Step 3 In the **Create a Fabric Site** window, click **Let’s Do it**.

Step 4 Select an area, building, or floor to add as a fabric site and click **Next**.

Step 5 To designate fabric zones and create scoped subnets, choose **Yes Setup Zones**.

To enable a fabric zone, choose a fabric site from the network hierarchy displayed.

Step 6 Click **Next**.

Step 7 On the **Summary** window, review the fabric site settings.

You can edit any of the fabric site or zone settings here.

Step 8 Click **Create**.

It takes several seconds for the site and zones to be provisioned. A **Success! Your fabric site is created** message is displayed.

The newly created fabric zone is tagged with an “FZ” in the site hierarchy pane.

Create a Fabric Zone on an Existing Fabric Site

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**.

Step 2 In the **Fabric Sites** tab, select a fabric site.

In the **Site** window, click **More Actions** > **Edit Fabric Zone**.

Step 3 In the **Designate fabric zones** window, choose an area, building, or floor to add as a fabric zone.

Step 4 Click **Next**.

Step 5 In the **Summary** window, review the fabric site settings.

You can edit any of the fabric site or zone settings here.

Step 6 Click **Create**.

It takes several seconds for the site and zones to be provisioned. A **Success! Your fabric site is created** message is displayed.

The newly created fabric zone is tagged with an “FZ” in the site hierarchy pane.

What to do next

- Add only edge and extended node devices to the newly created fabric zone.

  Devices assigned to a fabric zone cannot be assigned to the parent site. However, an edge device assigned to a fabric zone can still be configured as a control plane or a border in the parent site.

- Assign IP pools and virtual networks to the fabric zone.

Add Virtual Networks to a Fabric Zone

Before you begin

Ensure that the fabric zone is created.

Note that you can add only the virtual networks of a parent site to a fabric zone.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Virtual Networks** under **SD ACCESS**.

Step 2 In the **Virtual Networks** window, under **SEGMENTS**, click the number that indicates the count of **Layer 3 Virtual Networks**.

The resulting window displays all the Layer 3 virtual networks at a global level.

Step 3 Click Fabric Site: **Global**.

Step 4 In the **Select Fabric Site** slide-in pane, choose a fabric zone.

Step 5 In the **Layer 3** tab, click **Add Layer 3 VN**.

Step 6 In the **Add Virtual Network** slide-in pane, choose the virtual networks to add to the fabric zone. Click **Update**.

Add Layer 2 Virtual Networks to a Fabric Zone

Before you begin

Note that the gateways added to the fabric zone cannot be updated at the parent site.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Virtual Networks** under **SD ACCESS**.

Step 2 In the **Virtual Networks** window, click the number that indicates the count of **Layer 2 Virtual Networks**.

The resulting window displays all the Layer 2 virtual networks at a global level.

Step 3 Click Fabric Site: **Global**.

Step 4 In the **Select Fabric Site** slide-in pane, choose a fabric zone.

Step 5 In the **Layer 2** tab, click **Add Layer 2/ Gateways**.

Step 6 In the **Select L2VNs/Gateway(s)** slide-in pane, choose the Layer 3 virtual networks of the fabric zone to configure the gateways.

Step 7 Click **Next**.

Step 8 From the **L2VNs/Gateway(s)** drop-down list, choose the desired gateways.

Step 9 Click **Add**.

Configure an Extended Node Device

Extended nodes are those devices that run in Layer 2 switch mode and do not support fabric technology natively. An extended node is configured by an automated workflow. After configuration, the extended node device is displayed on the fabric topology view. **Port Assignment** on the extended nodes is done on the **Host Onboarding** window.

Note Extended Nodes cannot be onboarded through the User Interface-based provisioning workflows. Extended nodes are onboarded only through the SD-Access automated workflow after resetting the device configuration to factory default and powering on the device.

Extended node devices support multicast traffic.

Policy extended nodes are extended nodes that support security policy within the virtual network. You can select a **Group** during port assignment for the policy extended node.

Cisco Catalyst Industrial Ethernet (IE) 3400, IE 3400 Heavy Duty series switches, and Cisco Catalyst 9000 series switches that run Cisco IOS XE 17.1.1s or later releases of the software are policy extended node devices.

Cisco Digital Building series switches, Cisco Catalyst 3560-CX switches, and Cisco Industrial Ethernet 4000, 4010, and 5000 series switches are not policy extended node devices. They do not support Cisco TrustSec and **Group** selection during port assignment.

Steps to Configure an Extended Node

When configured as a fabric edge, Cisco Catalyst 9300, Cisco Catalyst 9400, and Cisco Catalyst 9500 series switches support extended nodes.

The minimum supported software version on the edge nodes that support policy extended nodes is Cisco IOS XE 17.1.1s.

Note Cisco Catalyst 9200 series switches that are configured as fabric edge nodes do not support extended node devices.

The following are the minimum supported software versions on the extended nodes:

- Cisco Industrial Ethernet 4000, 4010, 5000 series switches: 15.2(7)E0s with LAN base license enabled.

  If you have an IP services license, you must change the Switch Database Management (SDM) template to `dual-ipv4-and-ipv6 default` manually.

- Cisco Catalyst IE 3400, 3400 Heavy Duty (X-coded and D-coded) series switches: IOS XE 17.1.1s.
- Cisco Catalyst IE 3300 series switches: IOS XE 16.12.1s.
- Cisco Digital Building series switches, Cisco Catalyst 3560-CX switches: 15.2(7)E0s.

Ensure the following before configuring a policy extended node:

- The minimum software version required on a policy extended node device and on the edge device supporting the policy extended node is Cisco IOS XE 17.1.1s.
- Both the policy extended node and the edge node supporting it must have the Network Advantage and DNA Advantage license levels enabled.

Step 1 Configure a network range for the extended node. See Configure IP Address Pools. This comprises adding an IP address pool and reserving the IP pool at the site level. Ensure that the CLI and SNMP credentials are configured.

Step 2 Assign the extended IP address pool to INFRA_VN. See Add a Gateway to a Layer 3 Virtual Network, on page 13. Choose **Extended** as the **Pool Type**.

Cisco DNA Center configures the extended IP address pool and VLAN on the supported fabric edge device. This enables the onboarding of extended nodes.

Step 3 Configure the DHCP server with the extended IP address pool and Option 43. Ensure that the extended IP address pool is reachable from Cisco DNA Center.

Note For a detailed description of Option 43, see DHCP Controller Discovery.

Step 4 Connect the extended node device to the fabric edge device. You can have multiple links from the extended node device to the fabric edge.

Step 5 Create a port channel on the fabric edge node connected to the extended node. For a subsequent extended node in a ring or daisy chain, create the port channel on the previous extended node it connects to.

Note Complete this step only if the global authentication mode for the fabric is **Open**, **Low Impact**, or **Closed**. If the fabric site is set to **No Authentication** mode, the port channel is automatically created during the onboarding of the extended nodes using Plug and Play provisioning.

To create a port channel, complete the following steps:

a) Go to **Provision** > **Fabric Sites** > **Fabric Infrastructure** and select a fabric edge node (or an extended node, depending on the connection). A window with the device name as the title slides in.
b) In the **Port Channel** tab, click **Create Port Channel**.
c) Fill in all the fields:

- Select **Extended Node** from the **Connected Device Type** drop-down list.
- Select **Port Aggregation Protocol (PAgP)**.

  Starting with Cisco IOS XE Release 17.1.1s, IE 3300 and IE 3400 devices support PAgP.
- Select **On** for IE 3300 and IE 3400 devices if they are running versions earlier than Cisco IOS XE 17.1.1s.
- Note that Link Aggregation Control Protocol (LACP) does not work for extended node onboarding.
- Select the ports to be bundled as a port channel.

d) Click **Done**.

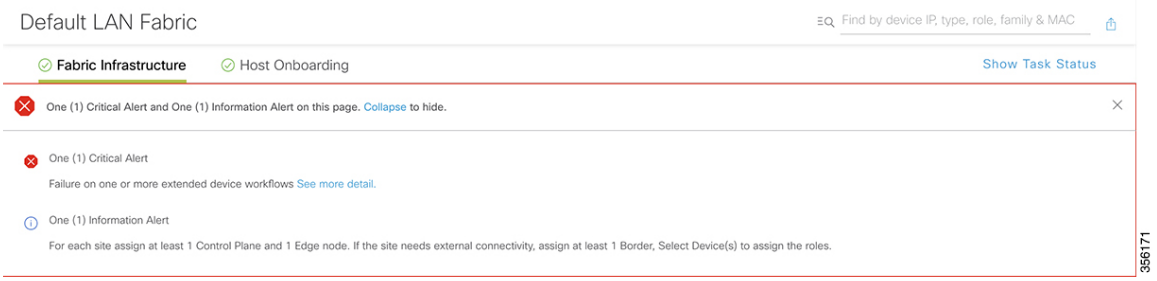
This creates a port channel on the fabric edge node (or the extended node) to onboard an extended device.

Step 6 Power up the extended node device if it has no previous configuration. If the extended node device has configurations, write-erase the previous configurations and reload the extended node device.

Cisco DNA Center adds the extended node device to the Inventory and assigns the same site as the fabric edge. The extended node device is then added to the fabric. Now the extended node device is onboarded and ready to be managed.

After the configuration is complete, the extended node appears in the fabric topology with a tag (X) to indicate that it is an extended node.

If there are errors in the workflow while configuring an extended node, an error notification is displayed as a banner on the topology window.



Default LAN Fabric

One (1) Critical Alert and One (1) Information Alert on this page. Collapse to hide.

One (1) Critical Alert

Failure on one or more extended device workflows See more detail.

One (1) Information Alert

For each site assign at least 1 Control Plane and 1 Edge node. If the site needs external connectivity, assign at least 1 Border, Select Device(s) to assign the roles.

Click **See more details** to see the error.

A Task Monitor window slides in, displaying the status of the extended node configuration task.

Click **See Details** to see the cause of error and possible solution.

Configure a Port Channel

A group of ports bundled together to act as a single entity is called a port channel. Port channels between a fabric edge and its remotely connected devices like extended nodes or servers increase the connection resiliency and bandwidth.

Create a Port Channel

Do the following steps only when authentication is Closed Authentication. Note that the following steps are automated for other authentication modes.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**.

Step 2 In the resulting **Fabric Sites** window, click a fabric site.

Step 3 The **Fabric Infrastructure** tab displays all fabric devices.

Step 4 Click a fabric edge node.

A window with the device name as the title slides in.

Step 5 In the **Port Channel** tab, click **Create Port Channel**.

Step 6 From the **Connected Device Type** drop-down, select the type of connected device.

- To create a port channel between a fabric edge node and an extended node or between two extended nodes, choose **Extended Node**.
- To create a port channel with a fabric edge node or extended node on one side and a third party device or a server port on the other side, choose **Trunk**.

Step 7 Enter a suitable **Description** for the new port channel.

Step 8 Select an appropriate protocol:

- For the extended nodes that run Cisco IOS XE Release 16.12.1s and earlier releases, select **On** as the protocol.
- For the extended nodes that run Cisco IOS XE Release 17.1.1s and later releases, select **Port Aggregation Protocol (PAgP)** as the protocol.
- Do not select **Link Aggregation Control Protocol (LACP)** as the protocol for extended nodes. You can only connect the trunk ports or the server ports in the LACP mode.

Step 9 From the list of ports displayed, choose the ports to be bundled.

Note You cannot have more than 16 members in a port channel that is connected in the LACP mode.

You cannot have a more than eight members in a port channel that is connected in the PAgP mode.

Step 10 Click **Done**.

A new port channel that is created is displayed in the window.

Update a Port Channel

Before you begin

Ensure that at least one member interface exists before you update a port channel.

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**.

Step 2 In the resulting **Fabric Sites** window, click a fabric site.

Step 3 In the **Fabric Infrastructure** tab, click a fabric edge node..

A slide-in window displays all details of the device.

Step 4 Select the **Port Channel** tab.

Step 5 From the list of port channels displayed, select the port channel to be updated.

The resulting window displays all the interfaces and the status of the selected port channel.

Step 6 Do the desired update on the port channel.

You can either add interfaces to the port channel or delete existing interfaces on the port channel.

Step 7 Click **Done**.

Delete a Port Channel

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (≡) and choose **Provision** > **Fabric Sites** under **SD ACCESS**.

Step 2 In the resulting **Fabric Sites** window, click a fabric site.

Step 3 In the **Fabric Infrastructure** tab, click the device whose port channel you want to delete.

Step 4 In the slide-in window, click the **Port Channel** tab.

The resulting **Port Channel** view lists all the existing port channels.

Step 5 Select the port channel and click **Delete**.

Step 6 At the prompt, click **Yes**.

Multicast

Multicast traffic is forwarded in different ways:

- Through shared trees by using a rendezvous point. PIM SM is used in this case.
- Through shortest path trees (SPT). PIM source-specific multicast (SSM) uses only SPT. PIM SM switches to SPT after the source is known on the edge router that the receiver is connected to.

See IP Multicast Technology Overview.

Configure Multicast

Cisco DNA Center provides a workflow that helps enable group communication or multicast traffic in the virtual networks. The workflow also allows you to choose multicast implementation in the network: native multicast or headend replication.

Note In Cisco DNA Center Release 2.2.2.4 and later, you can enable multicast on a virtual network whose border serves as a multisite remote border. Configuring multicast on such a virtual network configures multicast on the devices in the inherited virtual network too, provided the inherited virtual network already contains a segment. If the inherited virtual network doesn't have a segment, multicast is deployed only after the first segment is created. Ensure that a virtual network and its inherited networks deploy the same type of multicast implementation. The edge devices of an inherited virtual network cannot be configured as rendezvous point (RP).

Step 1 In the Cisco DNA Center GUI, click the **Menu** icon (☰) and choose **Workflows**.
The **Workflows** window displays all workflows offered by Cisco DNA Center.

Step 2 Click **Configure Multicast**.

A configuration wizard comes up.

Step 3 Click **Let's do it** in the multicast configuration wizard.

Step 4 Select a **Site** from the drop-down list and click **Next**.

Step 5 In the **Enabling Multicast** window, choose the method of multicast implementation for the network: **Native Multicast** or **Head-end replication**. Click **Next**.

Step 6 In the **Virtual Networks** window, select the virtual network on which you want to set up multicast. Click **Next**.

Note You can't select an inherited virtual network to set up multicast.

Step 7 In the **Multicast pool mapping** window, select an IP address pool from the **IP Pools** drop-down list. The selected IP address pool is associated with the chosen virtual network. Click **Next**.

Step 8 From the **Select multicast type** window, choose the type of multicast to implement, and click **Next**:

- **SSM** (Source Specific Multicast)
- **ASM** (Any Specific Multicast)

Step 9 Do the following:

a) On selecting **SSM**, configure the SSM list by adding an IP group range for each virtual network. You can add multiple IP group ranges for a virtual network.

1. Choose an IP group range from 225.0.0.0 to 239.255.255.255.
2. Enter the **Wildcard Mask** for the IP group.
3. Click **Next**.

b) On selecting **ASM**, choose the type of rendezvous point (RP):

- **Internal RP**

- **External RP**

Click **Next**.

Step 10 To configure a rendezvous point, do the following:

If you choose to configure an internal rendezvous point:

a) Select the devices that you need configured as internal rendezvous points. The second rendezvous point that you select is the redundant rendezvous point. Click **Next**.
b) Assign internal rendezvous points to each of the listed virtual networks. Click **Next**.

If you choose to configure an external rendezvous point.:

a) In the **Setup your External RP** window, enter the IPv4 or IPv6 address of the external rendezvous point.

   (Optional) You can enter a second set of IPv4 or IPv6 addresses.

   Click **Next**.

b) In the **Select which RP IP Address(es) to utilize** window, select an IP address for each Virtual Network.

   Click **Next**.

Step 11 Review the multicast settings displayed in the **Summary** window and modify, if required, before submitting the configuration.

Click **Finish** to complete the multicast configuration.