Provision a LAN Underlay

LAN automation

Catalyst Center provides LAN automation as an alternative for manual deployment of new networks. This automation allows you to simplify network operations and create a standard error-free network. LAN automation uses the IS-IS routing protocol to deploy a Layer 3 routed access design.

LAN Automation provides these capabilities:

- Provision your network through LAN automation
- View the history of LAN automation sessions
- View the summary of LAN automated devices

From the main menu, choose **Provision** > **LAN Automation** to view this window.

- **Start LAN Automation**: Use this option to initiate LAN automation sessions on your network.
- **Overview**: Expand this section to view the prerequisites and more information about provisioning your network through LAN automation.
- **Sessions**: This section consists of the **History** of LAN automation sessions, and the list of **LAN Automated Devices**.

Day-Zero Operation

On day zero, click **Start LAN Automation** to start provisioning your network through LAN automation. For more information, see Provision a network through LAN automation, on page 3.

For day zero, Catalyst Center doesn't display any data in the **Sessions** section.

Day-*n* Operation

On day *n*, you can click **Start LAN Automation** to initiate more LAN automation sessions. You can run up to five LAN automation sessions simultaneously across sites. For more information, see Provision a network through LAN automation, on page 3.

When a LAN automation session is in progress, Catalyst Center displays a tile for the session on the **LAN Automation** window. To view the details of the session, click **See Session Details** in the tile. To stop LAN automation for the session, click **Stop LAN Automation** in the tile.

The **History** tab displays the history of LAN automation sessions in your network. You can use the **Search** field to search for specific text. To view the session details, click the hyperlinked date. To view the logs for a session, in the session details window, click **View Session Logs**.

The **LAN Automated Devices** tab displays the details of the LAN automated devices. You can use the search field to filter the data based on specific text. Click one of these toggle buttons to filter the data:

- **Seed Devices**: Displays the data for seed devices
- **Discovered**: Displays the data for discovered devices
- **Provisioned**: Displays the data for provisioned devices
- **Error**: Displays the data for devices with errors

In the **LAN Automated Devices** tab, you can also do these tasks:

- Click the device name hyperlink to view the device details.
- Provision interfaces between two devices by clicking **Add Link**. For more information, see Create a link between interfaces, on page 11.
- Delete the interface between two devices by clicking **Delete Link**. For more information, see Delete a link between interfaces, on page 11.
- Customize the hostname and loopback IP address of a device using the **Edit Device** option. For more information, see Edit hostname and loopback IP address of LAN automated devices, on page 12.

Note

- To edit the hostname and loopback IP address of a device on Day-*n*, the device must be in the **Managed** state in the Inventory.
- You can edit the loopback IP addresses of a maximum of 25 devices in a single Day-*n* workflow.

Prerequisites for provisioning a network through LAN automation

Before provisioning a network through LAN automation, ensure these prerequisites are met:

- Configure your network hierarchy. (See Create the network hierarchy.)
- Define these global network settings:
  - Network servers, such as the AAA, DHCP, and DNS servers. (See Configure global network servers.)
  - Device credentials, such as the CLI, SNMP, HTTP, and HTTPS credentials. (See Add global CLI credentials, Add global SNMPv2c credentials, Add global SNMPv3 credentials, and Add global HTTPS credentials.)

Note SNMPv2 write credentials are not required and if configured, it won't be pushed to the device during LAN automation.

  - IP address pools. (See Configure IP address pools.)
- Ensure you have at least one device in your inventory. If not, discover devices using the Discovery feature. (See Do Discovery and Assign an unprovisioned device to a site.)

Note LAN automation is blocked if the discovered site is configured with "cisco" in the username of your CLI credentials.

- If you have a Cisco Catalyst 9400 Switch configured in the network, these operations must be completed on the switch for LAN automation to automatically enable the 40G port:
  - The day-zero configuration is performed on the switch.

    For more information, see “Initial Configuration for the Switch” in the *Cisco Catalyst 9400 Series Switches Hardware Installation Guide*.
  - A 40G Quad Small Form-Factor Pluggable (QSFP) transceiver is inserted in either port 9 or port 10 of the Supervisor, and the ports numbered 1 to 8 on the Supervisor do not have a 10G or 1G Small Form-Factor Pluggable (SFP) transceiver that is inserted in them. If there are dual supervisor engines, ensure that the 40G QSFP is inserted in port 9.

    For more information on the Catalyst 9400 Series Supervisor, see the “Uplink Ports” topic in the *Cisco Catalyst 9400 Series Supervisor Module Installation Note*.
- See *Cisco Catalyst Center SD-Access LAN Automation Deployment Guide* for more information on LAN automation prerequisites.

Provision a network through LAN automation

Before you begin

Make sure that the prerequisites have been met. For more information, see Prerequisites for provisioning a network through LAN automation, on page 2.

Procedure

Step 1 Reserve an IP address pool for the site that you are provisioning.

Note
The size of the LAN automation IP address pool must be at least 25 bits of netmask or larger.

a) From the main menu, choose **Design** > **Network Settings** > **IP Address Pools**.
b) From the left hierarchy tree, select the required site.
c) Click the **Reserve IP Pool** link.
d) In the **Reserve IP Pool** slide-in pane, complete these fields to reserve all or part of an available global IP address pool for the selected site:

- **IP Address Pool Name**: Unique name for the reserved IP address pool.
- **Type**—Type of IP address pool:
  - **LAN**: Assigns IP addresses to LAN interfaces for applicable underlays. Choose this option for LAN automation.
  - **Management**: Assigns IP addresses to management interfaces.
  - **Service**: Assigns IP addresses to service interfaces.
  - **WAN**: Assigns IP addresses to WAN interfaces.
  - **Generic**: Used for all other network types. This is the default option.
- **IP Address Space**: Select either the **IPv4** or the **IPv6** check box to create an address pool. To create a dual-stack pool, select both the **IPv4** and **IPv6** check boxes.
- **Global IP Pool**: IPv4 address pool from which you want to reserve all or some of the IP addresses. You can enter text in the search field to filter the drop-down list's results.

  Note
  LAN automation uses only the IPv4 subnet.

- **Prefix length / Number of IP Addresses**—Specify how to choose the IP addresses you want to reserve:

If you want to ...	Then ...
reserve the addresses with a particular IP route prefix,	**1.** Click the **Prefix length** radio button. **2.** Choose the appropriate prefix length value from the drop-down list. **3.** In the **IPv4 Subnet** field, enter the subnet address you want to use.
reserve a specific number of addresses,	**1.** Click the **Number of IP Addresses** radio button. **2.** In the **Total host** field, enter the number of IP addresses you want to reserve.

- **Gateway**: Gateway IP address. This field is displayed only when the **Prefix length** radio button is selected.
- **Overlapping**: Specify whether you want to enable Classless Interdomain Routing (CIDR) overlapping:

If you ...	Then ...
don't want to enable the placement of IP pools in multiple parallel IPv4 and IPv6 address spaces,	ensure that the **Off** radio button is already selected, as this is the default setting.
want to enable CIDR overlapping,	**1.** Click the **On** radio button. **2.** Specify the address space identifier that you want to use. Either click the **Create new** radio button and enter an identifier or click the **Select existing** radio button and select an identifier from the drop-down list. **Important** Take care when you enter the name for a new address space identifier. You will not be able to change the name later.

- **DHCP Server(s)**: IP address of the DHCP servers used by your Catalyst Center deployment.
- **DNS Server(s)**: IP address of the DNS servers used by your Catalyst Center deployment.

e) Click **Reserve**.

Step 2 To initiate the discovery and provisioning of the devices:

a) From the main menu, choose **Provision** > **LAN Automation**.

b) In the **LAN Automation** window, click **Start LAN Automation**.

The workflow guides you through the configuration process.

c) In the **Seed Devices** window, select the site for the seed device and configure the attributes described in the table, as required.

Attribute	Description
Primary Seed Device	Select the primary device that Catalyst Center uses as the starting point to discover and provision new devices. **Select interfaces** for the device.
Secondary Seed Device	Select the secondary seed device. **Select interfaces** for the device.
Discovery Depth	Devices are LAN automated up to the specified level under the primary seed device. The default value for Discovery Depth is 2, and the maximum value is 5.

d) In the **Sessions Attributes** window, do these steps:

1. Choose the site to which all the newly discovered devices are assigned. This site can be different from the primary and peer sites.

2. Configure the session attributes described in the table, as required.

Attribute	Description
Principal IP Address Pool	The IP address pool that is reserved for LAN automation. Choose the IP address pool from the drop-down list.
Link Overlapping IP Pool	The IP address pool that is shared with other sites and is used to configure the /31 IP addresses on point-to-point links in the underlay. • A link that overlaps IP pool can be a subpool that is inherited from a parent site or a subpool that is defined in any other site. • A link that overlaps IP pool allows you to overlap /31 IP addresses in a multisite deployment. Hosts in different sites will be able to reuse the IP addresses on the /31 links. • If you decide to define a link that overlaps IP pool, the addresses that are defined in the **Principal IP Pool** field are used for management IPs, such as loopback address, VLAN address, and so on. **Note** For an IPv6 address pool, use the **Point-to-point IPv6 Link-Local addressing** check box to configure point-to-point links.
Point-to-point IPv6 Link-Local addressing	This option is displayed when you select an IPv6 address pool. Select the check box to enable link-local addressing for point-to-point links in the underlay.
IS-IS Domain Password	Enter the IS-IS password for LAN automation. If the password already exists on the seed device, it will be reused and not overwritten. If you do not enter a password and the device does not have one, the default domain password is used. Ensure the domain passwords on both the primary and secondary seed devices match.
Session Timeout	Specify a timeout value for the LAN automation session. LAN automation stops automatically when the specified time limit is reached. The value is specified in minutes and the valid range is 20 through 10080.

Attribute	Description
Advertise LAN Automation Summary Route into BGP	Select this check box if you want LAN automation to advertise the principal IP pool into BGP on the primary and peer seed device. LAN automation advertises the summary route on the seed devices only if BGP is configured on them. The check box is disabled by default. It is enabled only if the primary or the peer seed device has an autonomous system (AS) number configured.
Enable Multicast	Check this check box to enable underlay native multicast. LAN automation creates a multicast tree with seed devices as RPs and discovered devices as subscribers.

Choose a File	You can either select a hostname map file from the **Choose a File** drop-down, or upload the CSV file from a storage device.
	User-provided names are configured for discovered devices using the chosen CSV file that contains a mapping between serial numbers and hostnames. If the discovered device is a stack, all the serial numbers of the stack are provided in the CSV file. Optionally, it can also have a customized loopback IP address for each device. The LAN automation process assigns the specified loopback IP address for the corresponding device. If the CSV file does not contain the loopback IP address information, a random IP address from the IP pool is assigned to the device.
	Note
	The loopback IP address for a device can be an address from any IP address pool in the same site as the device.
	For strict mode of device matching, the CSV file must contain the site name as well.
	A sample CSV file is as follows:
	`standalone-switch,FCW2212L0NF,10.1.1.4`
	`stack-switch,"FCW2212E00Y,FCW2212L0GV"`

Discovered Devices Hostname Prefix	Name prefix for the devices being provisioned. When Catalyst Center provisions each device, it prefixes the device with the text that you provide and adds a unique number at the end. For example, if you input "Access" as the name prefix, each consecutive device that is provisioned is named Access-1, Access-2, Access-3, and so on.

Attribute	Description
Device Matching	Select an option for device discovery: • **Relaxed**: Hostname and loopback IP is assigned to the discovered device if the device's serial number matches the uploaded device list. • **Strict**: Device discovery is restricted to the list of devices provided. You can discover a maximum of 50 devices. To add or edit devices, see Manage devices in strict discovery mode, on page 13.

e) In the **Review** window, look through all the LAN automation session settings. To make any changes, click **Edit**.

Step 3 In the **Review** window, click **Start**.

Catalyst Center begins to discover and provision the new devices.

LAN automation configures an IP address on the seed device of VLAN 1. If this VLAN 1 IP address of the seed device is not reachable from Catalyst Center, an error message is displayed on the **LAN Automation Status** window. Hover your cursor over the **See Details** link on this window to see the error details and possible remedial actions.

Step 4 Monitor and review the progress of the devices being provisioned.

In the **LAN Automation** window, click **See Session Details** on the status pane.

You can filter the status display and see the details of the discovered devices, or the provisioned devices, or error messages. Click **View Session Logs** to display the session logs. To view device details and logs, click the device hyperlink.

Note
The provisioning of new devices may take several minutes.

Step 5 Stop the LAN automation session after all the devices have been discovered and added to the inventory. Ensure that devices are reachable and in managed state.

a) In the **LAN Automation Status** window, click **Stop LAN Automation**.

When you stop LAN automation, a **Review LAN Automation Session** workflow is triggered. This workflow allows you to review the devices that are discovered during the LAN automation session and make changes before deployment.

b) In the **Review Discovered Devices** window, you can edit the loopback IP address (Management IP address) of a device.

c) Click **Validate** to verify the edited IP address.

d) If the validation succeeds, click **Apply** to deploy the LAN automation configurations.

Step 6 (Optional) You can have multiple LAN automation sessions, with up to five sessions running in parallel. Details for each session appear on separate tiles in the **LAN Automation** window.

Consider these aspects before you start simultaneous LAN automation sessions:

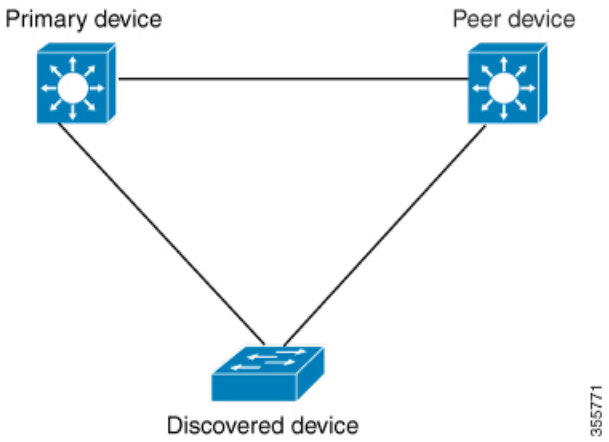
- You cannot use the same seed device for more than one session.
- You cannot use the same site for parallel sessions.
- You cannot use the same IP pool for parallel sessions.

Step 7 (Optional) You can check the status of completed LAN automation sessions under the **History** tab and see the list of discovered devices under the **LAN Automated Devices** tab.

Peer Device in LAN automation use case

Provision a dual-homed switch

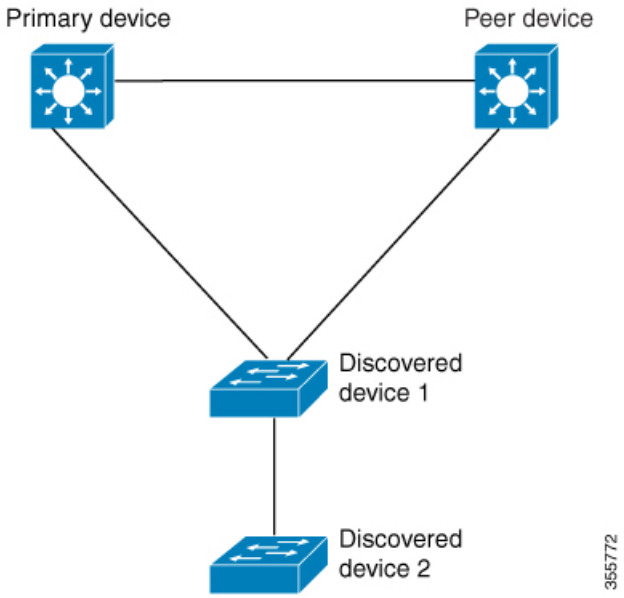
You must always select a peer device to provision the dual-homed switch.



Catalyst Center configures the DHCP server on the primary device. Because Catalyst Center understands that the discovered device is connected to both the primary and peer devices, it configures two Layer 3 point-to-point connections when the LAN automation task is stopped. One connection is established between the discovered device and the primary device; the other connection is established between the discovered device and the peer device.

Note If the link between the primary and the peer device is not configured before the LAN automation job is executed, you must select the interface of the primary device that connects to the peer device as part of the LAN automation configuration in Catalyst Center.

LAN automation two-hop limitation



For the preceding topology, Catalyst Center configures these links:

- A point-to-point Layer 3 routed connection from *Discovered device 1* to *Primary device*
- A point-to-point Layer 3 routed connection from *Discovered device 1* to *Peer device*
- A point-to-point Layer 3 routed connection from *Discovered device 1* to *Discovered device 2*

Consider the scenario where a device—named *Discovered device 3*—is directly connected below *Discovered device 2*. The connection between *Discovered device 2* and *Discovered device 3* is not configured as part of the LAN automation job because it is more than two hops away from *Primary device*.

Check the LAN automation status

View the ongoing LAN automation session status and history of completed sessions, along with their logs.

Procedure

Step 1 From the main menu, choose **Provision** > **LAN Automation**.

The **LAN Automation** window displays the status pane for ongoing sessions, the history of past sessions, and LAN automated devices.

Step 2 In the status pane, click **See Session Details** to view the overall status of LAN automation (In Progress or Completed) and the session logs.

Step 3 To view the history of completed sessions, select the **History** tab. Click the session hyperlink to see details and logs.

Step 4 To review LAN automated devices, select the **LAN Automated Devices** tab. Click the device name to view device-specific logs and configuration.

Create a link between interfaces

To add a link between interfaces through LAN automation:

Procedure

Step 1 From the main menu, choose **Provision** > **LAN Automation**.

Step 2 On the **LAN Automation** window, in the **LAN Automated Devices** tab, click **Add Link**.

Alternatively, you can create a link from **Workflows** > **Add Link**.

Step 3 Follow these steps in the **Add Link** workflow:

a) Select the site.
b) Choose the two devices to establish the link.
c) Choose an IP address pool within the LAN.

Ensure that the IP address pool is reachable from Catalyst Center.

For IPv6, you can select the **Point-to-point IPv6 Link-Local addressing** check box to configure point-to-point links using link-local addressing.

d) Choose the interfaces on both the devices between which you want to establish a connection.
e) Click **Now** or **Later** to indicate when you want to provision the link.
f) Enter a name for the task in the field provided.
g) In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
h) Click **Start Add Link**.

The **Link Configuration Started Successfully** window displays.

Step 4 (Optional) To view the status of the configuration, click **View Status in Activities**.

You can also view the status under **Activities** > **Task**.

Delete a link between interfaces

Use this procedure to delete the interface links that were created during LAN automation or by doing an Add Link operation.

Procedure

Step 1 From the main menu, choose **Provision** > **LAN Automation**.

Step 2 On the **LAN Automation** window, in the **LAN Automated Devices** tab, click **Delete Link**.

Alternatively, you can delete a link from **Workflows** > **Delete Link**.

Step 3 Follow the steps in the **Delete Link** workflow:

a) Select the site and two devices.
b) Select the interfaces on both these devices between which you want to delete the link.
c) Click **Now** or **Later** to indicate when you want to start the delete process.
d) Enter a name for the task in the field provided.
e) In the **Summary** window, review the configuration settings. To make any changes, click **Edit**.
f) Click **Start Delete Link**.

The **LAN Automation configuration has been removed from the selected interfaces** window displays.

Step 4 (Optional) To view the status of the delete link task, click **View Status in Activities**.

You can also view the status under **Activities** > **Task**.

Edit hostname and loopback IP address of LAN automated devices

You can customize the hostname and loopback IP address of devices that are discovered through LAN automation using the reserved IP address pools of the type **LAN**.

Note

- To edit the hostname and loopback IP address of a device on Day-*n*, the device must be in the **Managed** state in the Inventory.
- You can edit the loopback IP addresses of a maximum of 25 devices in a single Day-*n* workflow.

Before you begin

- Discover the devices through LAN automation. For more information, see Provision a network through LAN automation, on page 3.
- Reserve the required IP address pools of the type **LAN**. For more information, see Reserve an IP address pool.

Procedure

Step 1 From the main menu, choose **Provision** > **LAN Automation**.

Step 2 In the **LAN Automated Devices** tab of the **LAN Automation** window, check the check box next to the devices that you want to edit.

Step 3 Click **Edit Device**.

Step 4 In the **Edit Devices** window, do these steps:

a) In the **Device Name** field, enter the hostname for the device.

b) From the **IP Address Pool** drop-down list, choose an IP address pool.

c) In the **IP Address** field, enter an IPv4 address without a subnet mask.

Note
The IP address must be within the range of the selected IP address pool.

d) Use the **Reset** or **Reset All** option to revert the changes, if required.

e) Repeat Step 4.a, on page 13, Step 4.b, on page 13, and Step 4.c, on page 13 for each device.

f) Click **Validate**.

If the specified IP address isn't available for allocation, Catalyst Center displays an error message. Enter a valid IPv4 address in the corresponding **IP Address** field.

g) Click **Next**.

Step 5 In the **Schedule Edit Device Deployment** window, do one of these tasks:

- Click the **Now** radio button, name the task, and click **Apply**.
- Click the **Later** radio button; name the task; specify the start date, start time, and time zone; and click **Apply**.

Manage devices in strict discovery mode

With Catalyst Center Release 2.3.7.5 and later, you can choose either **Relaxed** mode or **Strict** mode for device matching during discovery. **Strict** mode limits device discovery to a defined list. Follow these steps to add, edit, or delete devices in the discovery list.

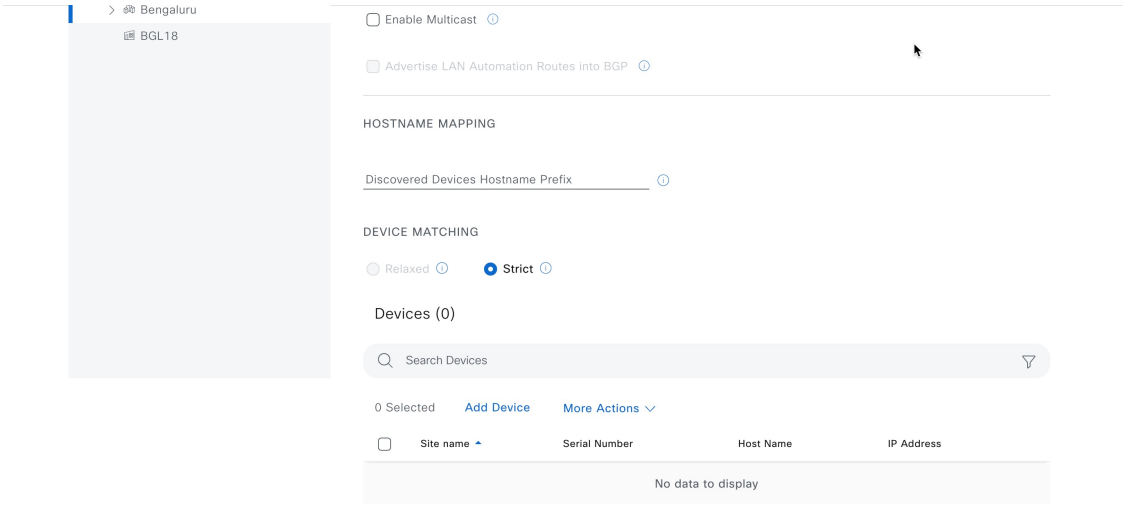
Procedure

Step 1 In the **LAN Automation** window, click **Start LAN Automation**.

Step 2 Add the seed devices and click **Next**.

Step 3 In the **Session Attributes** window, in the left pane, select a building or a floor.

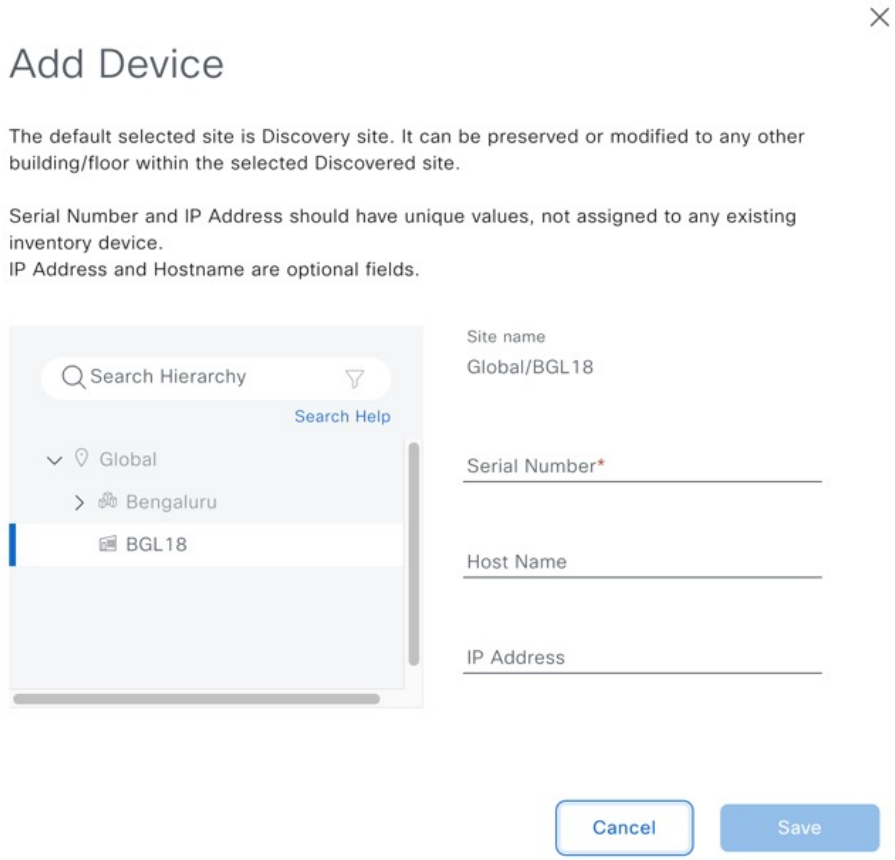
Step 4 Under **Device Matching**, select the **Strict** option.



Note
If you select an area as the site, you must add a device list. In this case, the **Strict** mode is chosen automatically, and the **Relaxed** mode is disabled.

Step 5 Add devices using one of these options for your discovery list:

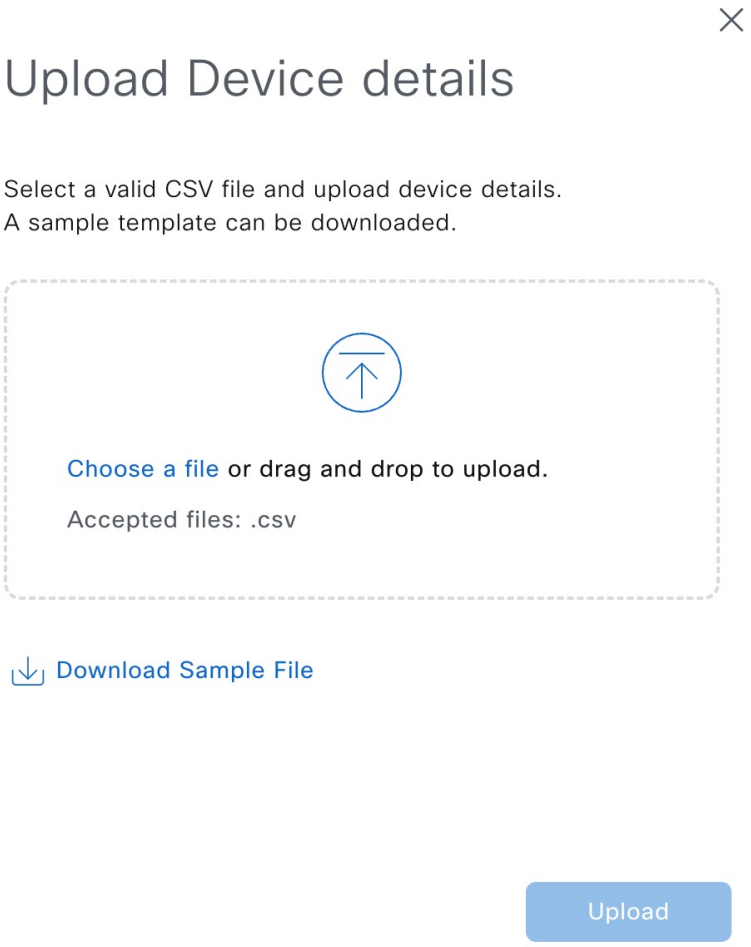
- **Add Device**: Use this option to add a single device.
  - In the **Devices** table, click **Add Device** and follow these steps:
    a. If you've chosen an area, select a building or a floor as the site.
    b. Enter a **Serial Number** for the device.
    c. (Optional) Enter the **Host Name** and **IP Address** for your device.
    d. Click **Save**.



- **Upload Device**: Use this option to add devices from a CSV file.
  a. In the **Devices** table, click **More Actions** and choose the option to upload the device CSV file.
  b. Upload the CSV file.

     Drag and drop the CSV file into the boxed area or click **Choose a file** and browse to the CSV file.

     You can also download a sample template.



Step 6 Follow these steps to edit a device from the discovery list:

a) Check the check box next to the device that you want to edit and choose **More Actions** > **Edit Device**.

b) Edit the device details as needed

You can edit only one device at a time.

c) Click **Save**.

Step 7 Follow these steps to delete a device from the discovery list:

a) Check the check box next to the device that you want to delete and choose **More Actions** > **Delete Device**.

You can select multiple devices to delete.

b) Click the **Delete** icon and confirm the delete action.