Managing Hub Sites

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Setting Up a Hub Site

From the IWAN App home page, use the **Configure Hub Site & Settings** option to set up a hub site. The Network Wide Settings page opens, with tabs for configuration tasks, as described below.

Tutorial Video

IWAN App Hub Provisioning

Table 4-1 Network Wide Settings Page—Tasks

Tab	Task	See:
System	Configure system settings, including: • Server addresses for NetFlow collector • DNS servers • Syslog server • AAA server • NAT/Proxy addresses • SNMP • DHCP	Configuring System Settings, page 4-2
Certified IOS Releases	Upload Cisco IOS software images to load onto new greenfield branch devices.	Uploading Certified Cisco IOS Software Images for Branch Devices, page 4-6
Service Providers	Configure service providers: • Identifying label for each service provider • Type of connection for each service provider	Configuring Service Providers, page 4-9
IP Address Pools	Configure IP address pools to allocate IP addresses for: • Service providers (overlay) • Loopback • Branch sites	Configuring IP Address Pools, page 4-12
IWAN Aggregation Site	Configure the IWAN aggregation site(s): • Master controller • Hub sites • Hub devices: LAN, WAN, and MC configurations	Configuring the IWAN Aggregation Site, page 4-17

Configuring System Settings

Use this procedure to configure system settings such as Netflow Collector, DNS, AAA, Syslog, SNMP, and DHCP.

Click **Show More** or **Show Less** to display or hide settings.

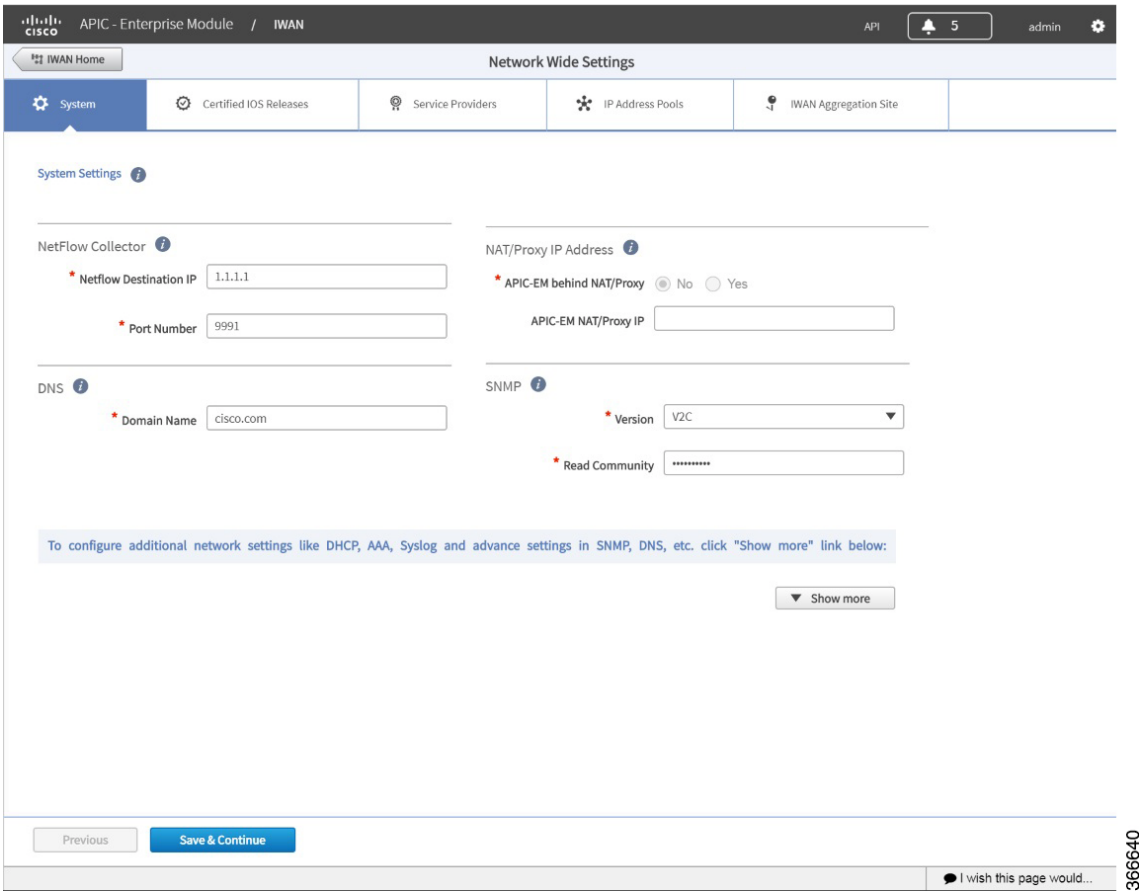
Procedure

Step 1 If logging in for the first time, specify the global settings in the CLI Credentials dialog box. Enter a user name and password, then click **Add**.

Step 2 From the left navigation pane, click **IWAN**. The Cisco IWAN home page opens.

Step 3 From the Cisco IWAN home page, click **Configure Hub Site & Settings**. The Settings tab opens by default and the System Settings page displays as shown in the following figure:

Figure 4-1 System Settings Tab



Step 4 In the **Netflow Collector** area, enter the following properties:

Field	Description
NetFlow Destination IP	IP address of the NetFlow collector (server). Traffic stats are sent from the network devices to the NetFlow collector.
Port Number	Port number of the NetFlow collector (server).

Step 5 In the **DNS** area, enter the following properties:

Field	Description
Domain name	DNS domain name.
Primary Server	(Optional) IP address of the primary DNS server.
Secondary Server	(Optional) IP address of the secondary DNS server.

Step 6 In the **Authorization, Authentication, Accounting** area, enter the following properties:

Field	Description
IP Address	(Optional) IP address of the Authentication, Authorization, and Accounting (AAA) server. TACACS is the only supported centralized AAA service for Cisco IWAN. When a TACACS server is provided, the devices use TACACS for management access to the spoke devices (SSH & HTTPS). Whether or not TACACS is provided, a local AAA user database is created on the spoke device, which is used when the TACACS server is not available. One of the following default values are used for the local AAA user credentials: • Cisco APIC-EM global credentials. • Username and password specified in the global device credentials for branch routers. • Username and password entered while provisioning the hub.
Key	(Optional) Key for accessing the AAA server.

Step 7 In the **Syslog** area, enter the following:

Field	Description
Server IP	(Optional) Destination IP address of the syslog server. Syslog messages from all routers are sent to this server.

Step 8 In the **NAT/Proxy IP Address** area, configure the following:

Field	Description
APIC-EM Behind NAT/Proxy	Select **Yes** if the APIC-EM controller is located behind a NAT router.
APIC-EM NAT/Proxy IP	Public NAT public IP address of the APIC-EM controller.

Step 9 In the **SNMP** area, choose the version number in the Version field. Depending on the SNMP version number you choose, V2C or V3, different properties display.

- For SNMP version V2C, enter the following properties:

Field	Description
Version	SNMP software version. Value: V2C.
Read Community	SNMP V2C read community string.
Write Community	(Optional) SNMP V2C write community string.
Retries	Number of retries. Default: 3
Timeout (secs)	Displayed for SNMP V2C only. Timeout period. Default: 10
Trap Destination IP	(Optional) IP address of the SNMP server. **Note** If you do not enter an IP address, the Cisco IWAN app is used as an SNMP server. The APIC-EM controller can serve as the SNMP manager for managed network devices or a separate SNMP server can be specified to handle SNMP traps. SNMP settings determine the inventory from hub and remote site devices and these values are reflected in the configuration.

- For SNMP version V3, enter the following properties:

Field	Description
Version	SNMP software version. Value: V3.
Mode	Select the mode from the drop-down list. Options are: • Authentication and Encryption • No Authentication and No Encryption • Authentication and No Encryption
Auth. Type	Displayed if you chose Authentication and Encryption; or Authentication and No Encryption in the Mode field. Select the authentication type from the drop-down list. Options are: • HMAC-SHA • HMAC-MDS
Username	The authentication username.
Auth. Password	Displayed if you chose Authentication and Encryption; or Authentication and No Encryption in the Mode field. The password for the authentication username.
Encryption Type	Displayed if you chose Authentication and Encryption in the Mode field. The encryption username.
Encryption Password	Displayed if you chose Authentication and Encryption in the Mode field. The password for the encryption username.
Retries	Number of retries. Default: 3

Field	Description
Timeout (secs)	Displayed for SNMP V2C only. Timeout period. Default: 10
Trap Destination IP	(Optional) IP address of the SNMP server. **Note** If you do not enter an IP address, the Cisco IWAN app is used as an SNMP server. The APIC-EM controller can serve as the SNMP manager for managed network devices or a separate SNMP server can be specified to handle SNMP traps. SNMP settings determine the inventory from hub and remote site devices and these values are reflected in the configuration.

Step 10 In the **DHCP** area, enter the following properties:

Field	Description
External DHCP IP	(Optional) Destination IP address of the DHCP server. The DHCP server that provides client computers and other TCP/IP-based network devices with valid IP addresses. To add an additional DHCP server, click the **+** icon next to the IP address field, and then enter the IP address. **Note** You can add a maximum of five DHCP servers. To remove a DHCP server, click the **-** icon next to the IP address field that you want to remove.

Step 11 Click **Save and Continue**.

After updating existing values in the Systems tab, the Network Wide Settings Summary dialog box opens, indicating changes. Do one of the following:

- Click the **Apply Now** radio button, and then click **Continue**.
- Click the **Schedule** radio button, specify a date and time to apply the changes, and then click **Submit**.

Uploading Certified Cisco IOS Software Images for Branch Devices

Note This step applies to greenfield branch devices only.

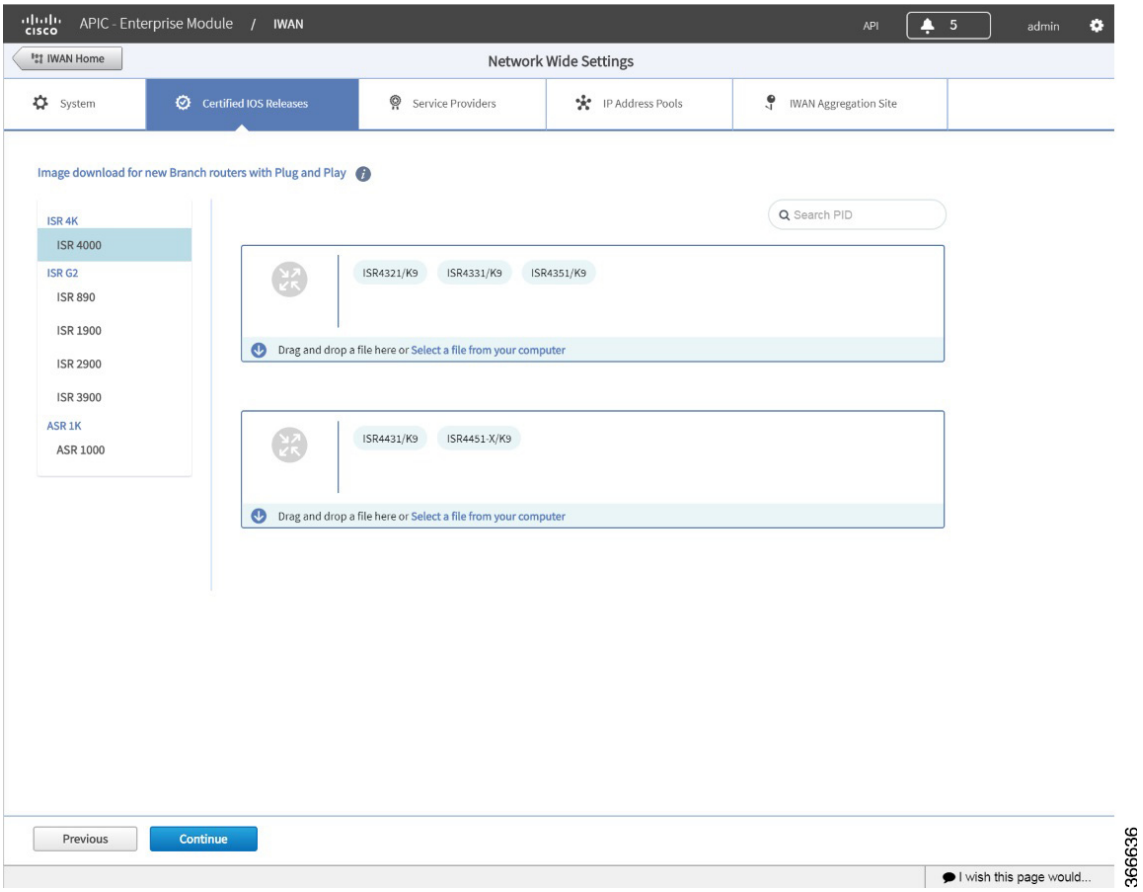
You can upload certified Cisco IOS images from your computer into the Cisco IWAN app. When a greenfield device comes up, the Plug-n-Play agent interacts with the Plug-n-Play server in Cisco APIC-EM, downloads the appropriate Cisco IOS software image to the device, and reloads the device with that image.

Note If the appropriate software image is already installed on any new greenfield routers, you can skip this step.

Procedure

Step 1 Click the **Certified IOS Releases** tab. The Cisco IOS Releases for Sites page opens as shown in the following figure:

Figure 4-2 Certified IOS Releases Tab



Step 2 From the left pane, choose the router type.

Step 3 Do one of the following:

- Drag and drop the Cisco IOS software image file from your computer into the GUI.
- Browse to the location where you have saved the Cisco IOS software image file and upload it into the system.

Step 4 Click **Continue**.

Deleting an Uploaded Cisco IOS Software Image

Before deleting a Cisco IOS software image, it is necessary to disassociate the image from any platform models configured to use the image by default. To delete an image, do the following:

Step 1 Open the "Network Plug and Play" app by clicking its icon in the left panel of APIC-EM.

Step 2 Click the "Images" tab at the top of the page to display uploaded images.

Step 3 Click an image name of an image to be deleted to open the "Image Info" dialog box.

Step 4 In the "Use this Image as Default" column, de-select any selected boxes to disassociate the image from the various platform types. (**Tip**: Click the **All** box two times to clear all boxes in the column.)

Step 5 Click the **Save** button in the dialog box.

Step 6 Repeat for all the images need to be deleted.

Step 7 In the "Images" tab, select the image(s) to delete and click the **Delete** button at the top-left.

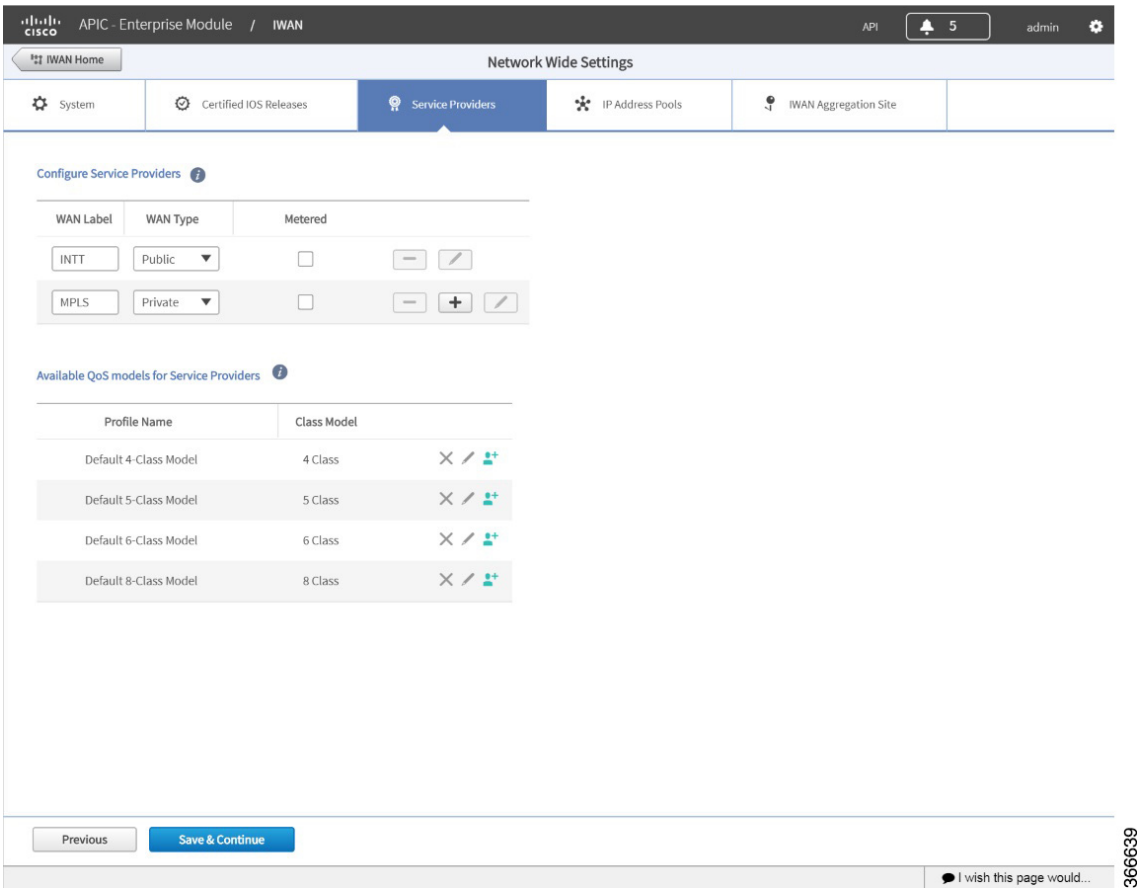
Configuring Service Providers

Use the Service Providers tab to define the type of links and the number of service providers.

Procedure

Step 1 Select the **Service Providers** tab. The Configure Service Providers Page opens as shown in the following figure:

Figure 4-3 Service Providers Tab



Step 2 In the **Configure Service Providers** area, click the **+** icon and configure the properties shown in the table below.

Note You can specify a maximum of four service providers.

Field	Description
WAN Label	WAN transport type. Can be a maximum of seven characters.
WAN Type	Can be one of the following: • Private • Public
Metered	Select this option if the WAN is metered. **Note** The Metered option is available only when the number of service providers is greater than two. You cannot choose one of the link as a metered link if there are only two service providers. **Note** Only one link can be metered. **Note** Only one link is permitted on a public cloud.
Available QoS Models for Service Providers	
Profile Name	Lists the names of all available service profiles.
Class Model	Lists the class models that correspond to the respective service profiles: • 4 Class • 5 Class • 6 Class • 8 Class

Step 3 (Optional) If you require a custom class model than the default ones that are provided, click the **Available QoS Models for Service Providers** area, and then click the **+** icon next to the profile that most closely matches the service provider Service Level Agreement (SLA). The Add Service Profile dialog box opens as shown in the following figure:

Figure 4-4 Add Service Profile Dialog Box

Step 4 Enter the following profile information, and click **Save**.

Note For the Private WAN interface, a set of predefined service provider profiles are available. Egress QoS queuing is applied on the WAN Egress to fulfill the service provider SLA.

Field	Description
Profile Name	Name of the new service profile.
Class Model	Displays the type of class model. Can be one of the following: • 4 Class • 5 Class • 6 Class • 8 Class
Class Name	Displays the data class name.
DSCP	Displays the Differentiated Services Code Point (DSCP) values for each class. Once saved, it appears as a new profile. You cannot edit this value after it is saved.
Priority Bandwidth (%)	Percent bandwidth allocated to the priority class, such as Voice.
Remaining Bandwidth (%)	Percent bandwidth allocated to other classes, such as streaming video, critical class, and so on. **Note** Enter a value greater than 0. The total value for all the data classes in the Remaining Bandwidth column cannot exceed 100%.

Note After you add the profile information, the profile details appear in the Available QoS Models for Service Providers area.

Step 5 Click **Continue**. The IWAN Aggregation Site tab opens. See Configuring the IWAN Aggregation Site, page 4-17.

Configuring IP Address Pools

Use the IP Address Pools tab to define IP address pools. For general information about IP Address Pools, see Understanding IP Address Pools, page 4-27.

Note When planning IP address pools, consider any future requirements, such as future growth of the IWAN network, and remote sites that might be deployed in the future. After hub site(s) provisioning, the IP address pool settings cannot be changed.

Note Earlier versions of the IWAN App referred to generic IP address pools. Beginning with the 1.5.0 release, the IWAN App refers to Service Provider Address Pool, Global Address Pool, and Site Specific Address Pools.

Overview of Address Pool Configuration in the IWAN App

Generic pool

A generic pool is used to assign IP addresses for DMVPN tunnels, management loopback addresses for Cisco Performance Routing (PfR), and LAN interfaces for greenfield remote sites.

Ensure that the address range allocated for a generic pool is not used elsewhere in the network.

Enter the number of remote sites used in the IWAN network. This corresponds to the number of DMVPN overlays. Click **IP Pool Calculator** to display the subnet mask required for the Generic pool.

Loopback pool

A Loopback pool is used to assign IP addresses for management loopback addresses for Cisco Performance Routing (PfR).

Ensure that the address range allocated for a loopback pool is not used elsewhere in the network.

Enter the number of remote sites used in the IWAN network. This corresponds to the number of DMVPN overlays. Click **IP Pool Calculator** to display the subnet mask required for the Loopback pool.

LAN Greenfield pool

If not allocating addresses for greenfield remote site LANs from the generic pool, there are two options:

1. Create a separate LAN greenfield pool. This will be single IP pool for all remote branches. Calculate the subnet length required for this single IP pool by entering the number of VLANs and number of devices per VLAN by clicking the **IP Pool Calculator** button.

2. To assign specific addresses for the remote site VLAN at every site, use a site-specific pool.

Verify that the address range allocated for the LAN greenfield pool is not used anywhere else in the network.

LAN Brownfield pool

To create a summary routing entry for all existing LAN subnets across all brownfield sites, use the LAN Brownfield pool option. This will help in advertising only the summary route from the hub representing all of the branch LAN prefixes. Without this entry, the IWAN app uses specific entries for the branch LAN prefixes.

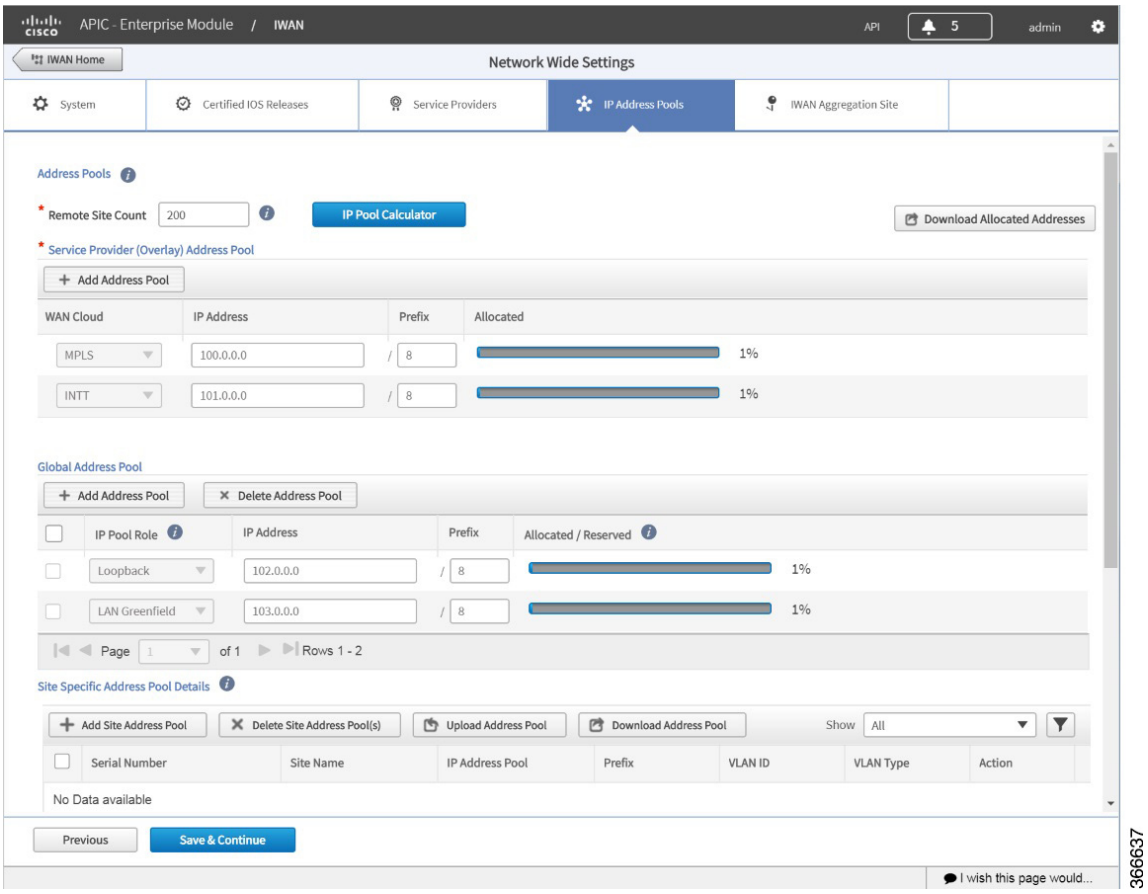
Note The LAN Greenfield and LAN Brownfield pools are used in defining the enterprise prefix lists in Cisco Performance Routing (PfR).

Configuring Address Pools

Procedure

Step 1 Select the **IP Address Pools** tab. The Address Pools page opens as shown in the following figure:

Figure 4-5 IP Address Pools Tab



Step 2 In the **Remote Site Count field**, enter the maximum number of remote sites to deploy.

If you are an existing customer with Cisco IWAN release 1.2.x, you can increase the remote site count by upgrading to Cisco IWAN release 1.3.x. Based on the availability of internal IP addresses in pre-reserved subnets (which are created during initial provisioning) you can specify a higher number of remote site count.

Step 3 Click the **IP Pool Calculator** button.

The Proposed IP Range dialog box opens, providing:

- Recommended minimum prefix length values for IP pools
- Recommended values for number of IP addresses per VLAN, and number of VLANs.

Step 4 Click **OK** or **Get IP Range**.

Step 5 To configure a service provider address pool: In the Service Provider (Overlay) Address Pool section, click **+ Add Address Pool**.

Configure a maximum of one service provider address pool per service provider. IP addresses from this pool will be used for overlay IP address needs.

Field	Description
WAN Cloud	Select a service provider name. **Note** Configuring service provider IP address pools changed in IWAN App releases 1.5.x. If the IWAN App is installed as an upgrade from a release earlier than 1.5.x, to support an existing legacy configuration, IWAN App provides WAN Cloud labels automatically for existing service providers in this step. The WAN label configured for the service provider in the earlier release is used for the WAN Cloud label on this page. Examples: “INET1,” “MPLS”
IP Address	IP Address for the IP address pool. This pool is for service provider overlay address needs.
Prefix	CIDR prefix. (The Classless InterDomain Routing (CIDR) prefix notation defines the subnet mask.)
Allocated	Displays the percentage of addresses in the pool that are used.

Step 6 To configure a global address pool: In the Global Address Pool section, click **+ Add Address Pool**.

Field	Description
IP Pool Role	Select a role: • **Loopback**: Used to assign IP address for management loopback addresses for Cisco Performance Routing (PFR). • **LAN Greenfield**: Choose this option to define the LAN IP address pool for new greenfield branch devices. You can have any number of LAN greenfield IP address pools. • **LAN Brownfield**: Choose this option to define the LAN IP address pool for brownfield branch devices (devices with an existing configuration). You can have any number of LAN brownfield IP address pools. **Note** To support legacy configurations, the IWAN App provides “Generic” as a role if installed as an upgrade from a previous version of the IWAN App.
IP Address	IP Address for the IP address pool.
Prefix	CIDR prefix. (The Classless InterDomain Routing (CIDR) prefix notation defines the subnet mask.)
Allocated	Displays the percentage of addresses in the pool that are used.

Step 7 To configure site specific LAN IP address pools:

a. Click **+ Add Site Address Pool**. The Add Site Address Pool dialog box opens.

b. Enter the properties as shown in the table below, then click **OK**. The newly configured information appears in the table.

By default, greenfield branch site IP addresses assignment is as follows:

- If there is a LAN greenfield IP address pool, greenfield branch sites use this address pool.
- If there is no LAN greenfield IP address pool, greenfield branch sites use the generic IP address pool (applicable only for upgrade deployments—upgraded from an IWAN app release prior to 1.5.0 to releases 1.5.x).

To provision a new greenfield branch site using custom IP address pools for its VLANs, define the VLANs and custom IP address pools before you provision the site. (Doing this prevents the VLANs from using the LAN greenfield IP address pools or generic IP address pools, by default. In this case, the generic IP address pool option applies only to deployments upgraded from an IWAN app release prior to 1.5.0 to releases 1.5.x.)

Note After a site is provisioned, you cannot move back-and-forth between site-specific IP address pool with VLANs and site-specific IP address pool without VLANs. Plan carefully before provisioning the site.

Note Typically, for greenfield branch sites, the LAN Greenfield pool is required. It is optional only if:

- The greenfield branch site has a site-specific pool defined, and
- It is a single-router branch site.

Field	Description
Serial Number	Serial number(s) of the site device(s). If a site has more than one device, include all serial numbers separated by a semi-colon.
Site Name	Name of the site.
IP Address Pool	IP address pool to be used for hosts in this VLAN.
Prefix	CIDR prefix. (The Classless InterDomain Routing (CIDR) prefix notation defines the subnet mask.) Range of values (single serial number): 16 to 30 Range of values (more than one serial number): 16 to 29
VLAN ID	Range of values: 1 to 4094 **Note** The VLAN ID 99 is reserved for the transit VLAN, therefore you cannot use this ID for other VLANs.
VLAN Type	Enter a VLAN type or select it from the drop-down list. Values: Data, Guest, Voice and Video, Wireless. **Note** The following restrictions apply when you enter a VLAN type of your choice: – The VLAN type value should not be more than 200 characters in length. – The VLAN type should not include the ? character. – For site-specific address pools, you can enter a maximum of 20 entries per site.

Step 8 To upload a large number of site specific address pools:

a. In the Site Specific Address Pool Details section, click **Download Address Pool** to download a template CSV file called:
Controller_Profile_DD-MM-YYYY.csv

b. Create a CSV file containing all of the required information.

c. Click **Upload Address Pool**, and then upload the CSV file.

Step 9 Click **Save & Continue**.

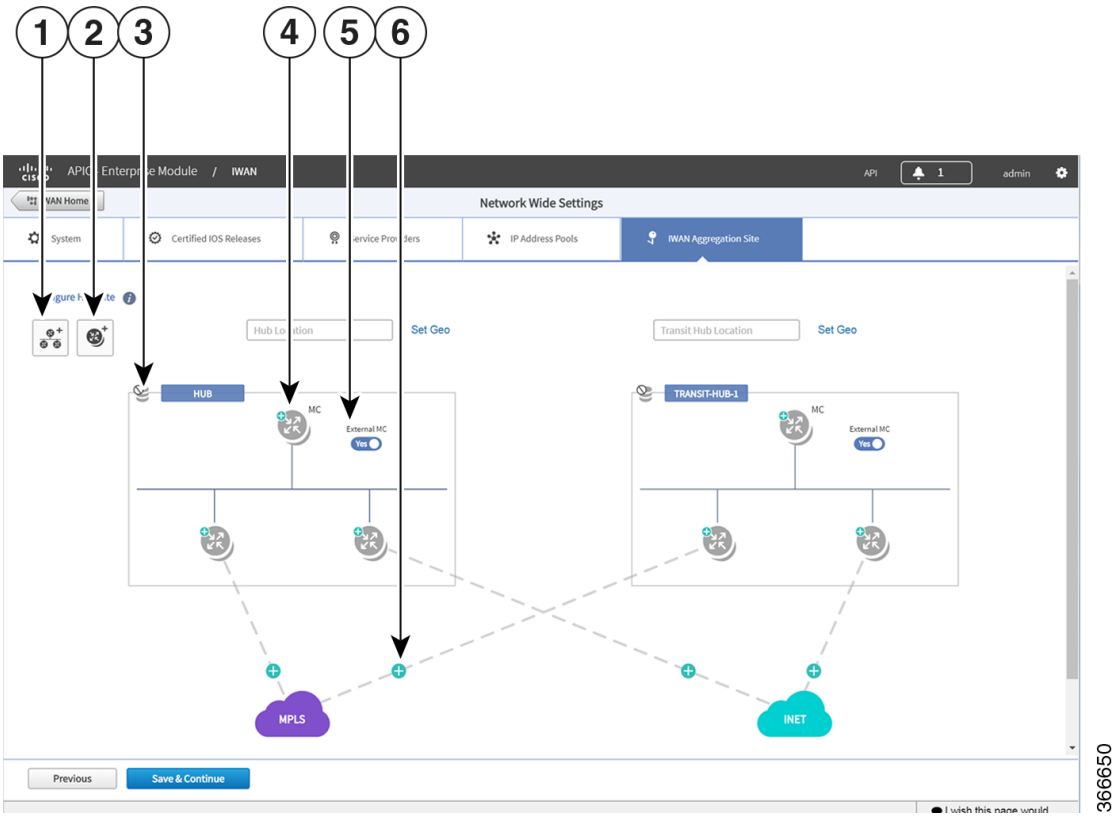
Configuring the IWAN Aggregation Site

Use this procedure to do the following:

1. Discover hub devices.
2. Configure LANs.
3. Configure WANs.
4. Configure the external master controller.

Refer to the following figure to understand the procedure that follows:

Figure 4-6 IWAN Aggregation Site Tab



1	Add POP	**4**	Configure External MC Router
2	Add Border Router	**5**	External MC Toggle Button
3	Configure LAN	**6**	Configure WAN Link

Procedure

Step 1 Discover hub devices. Do the following:

a. Select the **IWAN Aggregation Site** tab. The Configure Hub Site page opens and displays all of the defined service providers and the respective hub border routers.

b. Do one of the following:

- (Recommended) Click the **External MC** button (see # 5 in Figure 4-6) to toggle to **Yes**. A new router is added as a standalone master controller (MC).
- Click the **External MC** button to toggle to **No**. One of the border routers is designated as an MC.

c. To add an additional hub, click the **Add POP** icon ((see # 1 in Figure 4-6). A transit hub is added next to the primary hub (see TRANSIT-HUB-1 in the above figure).

Note You can specify a maximum of two hub sites during provisioning. You can add or delete routers after hub provisioning.

d. (Optional) To rename the new TRANSIT-HUB-1 to another name, click the name of the hub, and then add a different name.

Note You can only change the name of the hub during initial configuration, before routers are added to it.

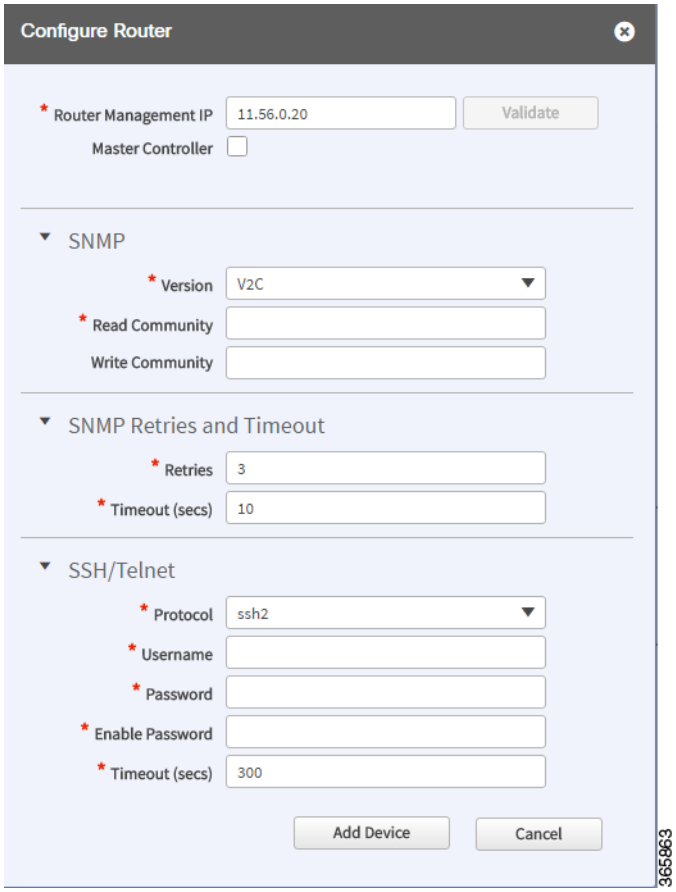
e. To add a border router to a hub, hover over the **Add Border Router** icon (see # 2 in Figure 4-6) the **Add to POP** options appear. Choose one of the two available hubs. A new border router is added in the appropriate hub.

Note You can have a maximum of four border routers in a hub site.

f. To configure the newly added border router, click on the **+** icon on top of the router, the Configure Router dialog box opens.

g. From the Configure Router dialog box, do the following:

- In the **Router Management IP** field, enter the management IP address of the hub router.
- Click **Validate**. The Configure Router dialog box opens again with additional fields as shown in the following figure:



Field	Description
Router Management IP	Hub router management IP address.
Master Controller	Check this option to choose this device as the Master Controller.
SNMP	
Version	SNMP version number. Depending on the version number you choose, different properties display.
Read Community (Displayed if you chose SNMP V2C.)	SNMP V2C read community string.
Write Community (Displayed if you chose SNMP V2C.)	(Optional) SNMP V2C write community string.
Mode (Displayed if you chose SNMP V3.)	Choose the mode from the drop-down list. Options are: • Authentication and Encryption • No Authentication and No Encryption • Authentication and No Encryption

Field	Description
Auth. Type (Displayed if you chose SNMP V3.)	Displayed if you chose Authentication and Encryption; or Authentication and No Encryption in the Mode field. Choose the authentication type from the drop-down list. Options are: • HMAC-SHA • HMAC-MDS
Username (Displayed if you chose SNMP V3.)	Displayed if you chose SNMP V3. The authentication username.
Auth. Password (Displayed if you chose SNMP V3.)	Displayed if you chose Authentication and Encryption; or Authentication and No Encryption in the Mode field. The password for the authentication username.
Encryption Type (Displayed if you chose SNMP V3.)	Displayed if you chose Authentication and Encryption in the Mode field. The encryption username.
Encryption Password (Displayed if you chose SNMP V3.)	Displayed if you chose Authentication and Encryption in the Mode field. The password for the encryption username.
SNMP Retries and Timeout	
Retries	Number of SNMP retries. Default: 3
Timeout (secs)	Number of seconds to wait before the system considers an SNMP request to have timed out. Default: 10
SSH/Telnet	
Protocol	Protocol used to communicate to the host (SSH or Telnet).
Username	SSH or Telnet username.
Password	SSH or Telnet password.
Enable Password	Enable password for the username.
Timeout (secs)	Number of seconds to wait before the system considers an SSH or Telnet request to have timed out.

– Enter the properties as shown in the table above.

Note These credentials can be entered only once. The values are automatically populated to the remaining hub devices in the system.

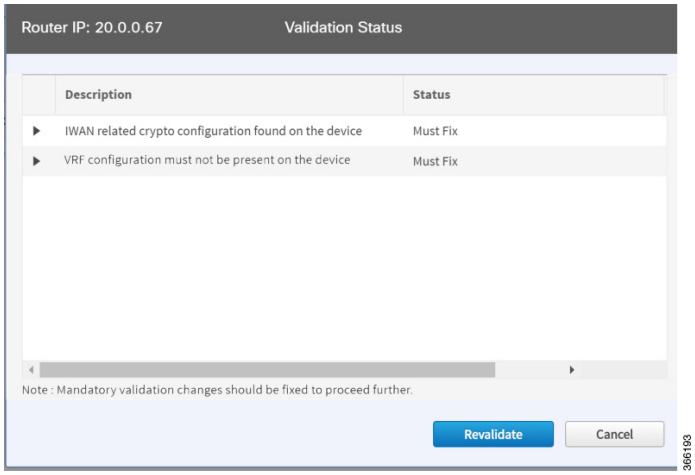
– Click **Add Device**.

The device is verified in the background to determine if the device is suitable for provisioning. The following occurs:

The Cisco IWAN app accesses the router and checks its configuration to determine if it has any configuration that might conflict with the Cisco IWAN app. This is called Brownfield Validation.

If the router does not have conflicting configurations, an orange icon appears on top of the device and the Configure Router Dialog opens.

If the router has conflicting configurations, the Validation Status dialog opens listing all the validation failures, as shown in the following figure:



h. The validation status could be either Warning or Must Fix. Do the following:

– If the validation status is Warning, you can fix it or ignore it.

– If the validation status is Must Fix, remove the configurations suggested by the description, and click **Revalidate**.

For information about the messages displayed in the Validation Status dialog box, see Appendix A, "Brownfield Validation Messages."

After the router is successfully validated (it does not have any Must Fix errors), the Configure Router dialog box opens.

i. From the Configure Router dialog box, select the appropriate **LAN IP-Interface** check box(es), and click **Save**.

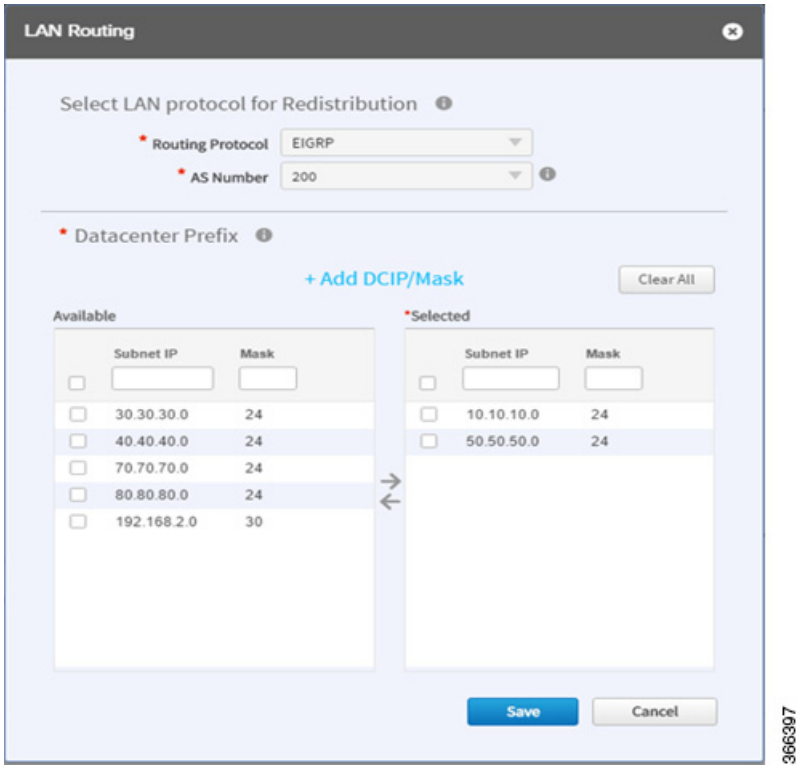
Note You can choose more than one LAN IP-Interface.

j. To connect the border router to the cloud, click on the router and drag it to the cloud.

k. Configure the other border routers using the above steps.

Step 2 Configure LANs. Do the following:

a. Click the icon on the top-left corner of the primary hub (see # 3 in Figure 4-6). The LAN Routing dialog box opens.



The Routing Protocol, AS Number, and Datacenter prefixes are collected from the devices and auto-populated for ease of configuration. The common (matching) AS numbers between the devices are displayed for each routing protocol. You can change the AS numbers on the device, but this is not recommended.

Field	Description
Select LAN Protocol for Redistribution	
Routing Protocol	Default routing protocol running on the hub routers. Example: EIGRP, OSPF, BGP
AS Number	AS number or area number, depending on the routing protocol. **Note** If the LAN routing protocol is BGP, and there are no matching AS numbers from the other hub device, this field is grayed out. You must manually modify the LAN side routing in the device. **Note** BGP with different AS numbers is not supported.
Datacenter Prefix	
Available (table)	Automatically populated list of hub site IP addresses.
Selected (table)	IP addresses selected from the Available table.

b. Select one or more IP addresses from the Available table and click an arrow to move the addresses to the Selected table. Only selected IP addresses (prefixes) will be configured on the hub.

   To remove an address from the Selected table, hover over the address and click the red X.

   (Optional) Use the Add DCIP/Mask link to filter IP addresses.

c. Click **Save**.

Step 3 Configure WANs. Do the following:

a. Click the **+** icon on the link that connects the router and cloud (see # 6 in Figure 4-6). The Configure Link dialog box opens.

   The dialog boxes that appear depend on the WAN type that you specified while configuring the Service Provider—for example, Private or Public.

b. For Public WAN, the Configure Link dialog box opens. Enter the following information for each link in the network:

Table 4-2 Configure Link Dialog Box—Public WAN

Field	Description
WAN IP-Address	IP address of the WAN interface.
Default Gateway	IP address of the default gateway.
NAT Enabled	Check this option if NAT IP address is used.
NAT IP Address	Public IP address.
Bandwidth (Mbps)	Symmetrical bandwidth for upload and download.
Service Profile	Choose a service profile from the drop-down list. The drop-down list includes default and custom 8 Class service profiles that were configured in the Service Providers tab.

c. For Private WAN, the Configure Link dialog box opens. Enter the following information for each link in the network:

Table 4-3 Configure Link Dialog Box—Private WAN

Field	Description
WAN IP-Address	IP address of the WAN interface.
Default Gateway	IP address of the default gateway.
Use Loopback for DMVPN Tunnel	Check this option to enable communication between non-IWAN sites and the newly enabled IWAN POP (Hub) and spoke sites for staged migration of the network. See Understanding the Coexistence of IWAN Sites and Non-IWAN Sites, page 4-25.

Table 4-3 Configure Link Dialog Box—Private WAN

Field	Description
Loopback IP-Interface	Choose a pre-provisioned loopback IP address from the drop-down list. This enables Cisco IWAN application to form a route between the existing sites and the new IWAN sites. **Note** The loopback interface must be configured on a private (MPLS) router. The loopback interface is required to support coexistence between the IWAN and non-IWAN sites and must be configured before adding the device to Cisco APIC-EM. It is recommended that you specify a loopback IP address in the same subnet as the WAN interface.
Bandwidth (Mbps)	Symmetrical bandwidth for upload and download.
Service Profile	Choose a service profile from the drop-down list. The drop-down list includes all default and custom service profiles (4 Class, 5 Class, 6 Class, and 8 Class) that were configured in the Service Providers tab.

d. Click **Save**.

Step 4 Configure the external master controller.

During initial hub and router setup, if you clicked the **External MC** button to toggle to **Yes**, a new router was added as a standalone MC. Do the following:

a. Click the **+** icon on top of the External MC router (see # 4 in Figure 4-6). The Configure Router dialog box opens.

For a dedicated master controller, the device must be greenfield validated. No conflicting configuration with IWAN or dynamic routing protocols are supported for LAN and WAN.

b. In the **Router Management IP** field, enter the management IP address of the hub router.

c. Click **Validate**. The Configure Router dialog box opens.

d. Enter the Router Management IP address, SNMP, SSH or Telnet protocol information, and click **Save**.

Modifying the Configuration of Hub Sites

After you have completed all of the configuration steps in the Hub Site and Settings area, you can go back and modify the properties at a later time. Fields that are grayed out, cannot be modified.

Effective with Cisco IWAN Release 2.0, you can perform the following for a provisioned site:

- Add WAN clouds and service providers.
- Add a maximum of two links of any type (Private or Public). The new links do not affect the existing device priority nor do they change the path preference.
- Connect different hub sites to different service providers (the maximum number of service providers is four).

Understanding the Coexistence of IWAN Sites and Non-IWAN Sites

The coexistence of IWAN and non-IWAN sites feature allows communication between the newly enabled IWAN POP (Hub) and spoke sites and the non-IWAN sites for staged migration of the network. The benefit of this feature is:

- You can deploy Cisco IWAN on a few sites prior to full scale deployment.
- Non-IWAN sites can continue to communicate with the hub and spoke routers that are IWAN enabled and vice-versa

Prerequisites for Enabling Support of Non-IWAN Sites Along With IWAN Solution

The following configurations must be completed before starting the Cisco IWAN app on APIC-EM workflows:

- Define the Cisco IWAN hub private (MPLS) border router.
- On the hub router:
  - A loopback interface must be enabled on the border router. It is recommended that you specify a loopback IP address in the same subnet as the WAN interface.
  - A static route must be added with the existing MPLS-CE as the default gateway (before provisioning the hub with Cisco IWAN application workflows).
- On the existing MPLS-CE router:
  - The loopback IP address on the IWAN MPLS border router must be advertised through BGP (or another routing protocol used for peering with MPLS provider) on the MPLS-CE router. The loopback IP must be reachable from all remote sites.

Effective with Cisco IWAN Release 1.1.0, you can have two hubs, two clouds and add more devices to the cloud, thereby enabling a multilink network. In other words, a multilink network can have two datacenters and each datacenter can have four devices with four links.

Homogeneous and Heterogeneous Topologies

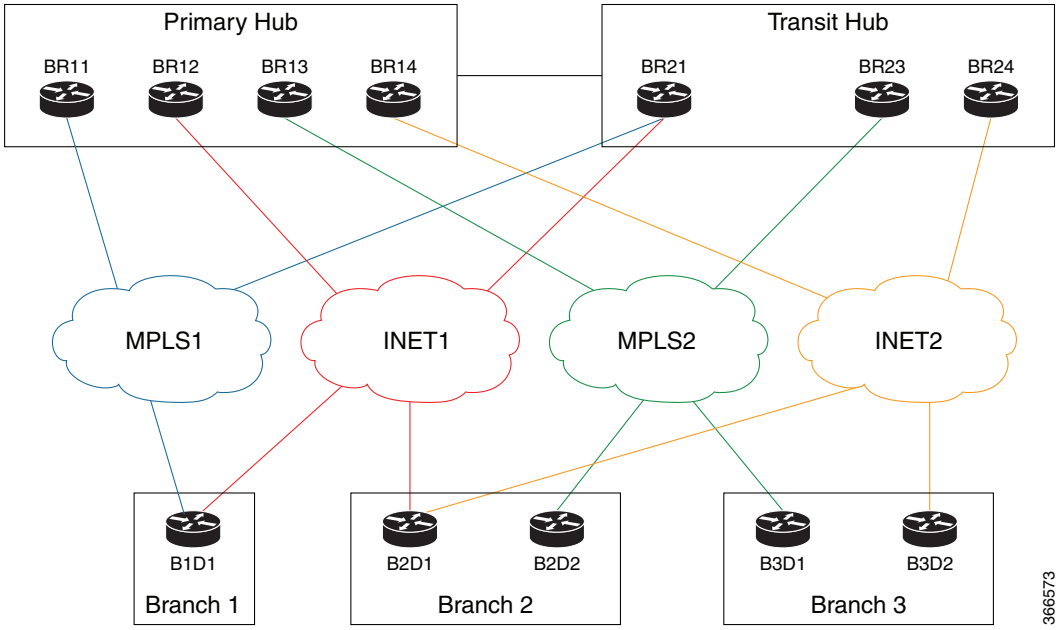
Effective with Cisco IWAN Release 2.0, you can perform the following for a provisioned site:

- Add WAN clouds and service providers.
- Add a maximum of two links of any type (Private or Public). The new links do not affect the existing device priority nor do they change the path preference.
- Connect different hub sites to different service providers (the maximum number of service providers is four).

Homogeneous Topology

In a homogeneous topology, a primary hub site and the associated transit hub site have the same total connections to service providers. The sites can have a different number of devices handling the connections, as a single device can have more than one connection. In the example, both hub sites have connectivity to all four service providers.

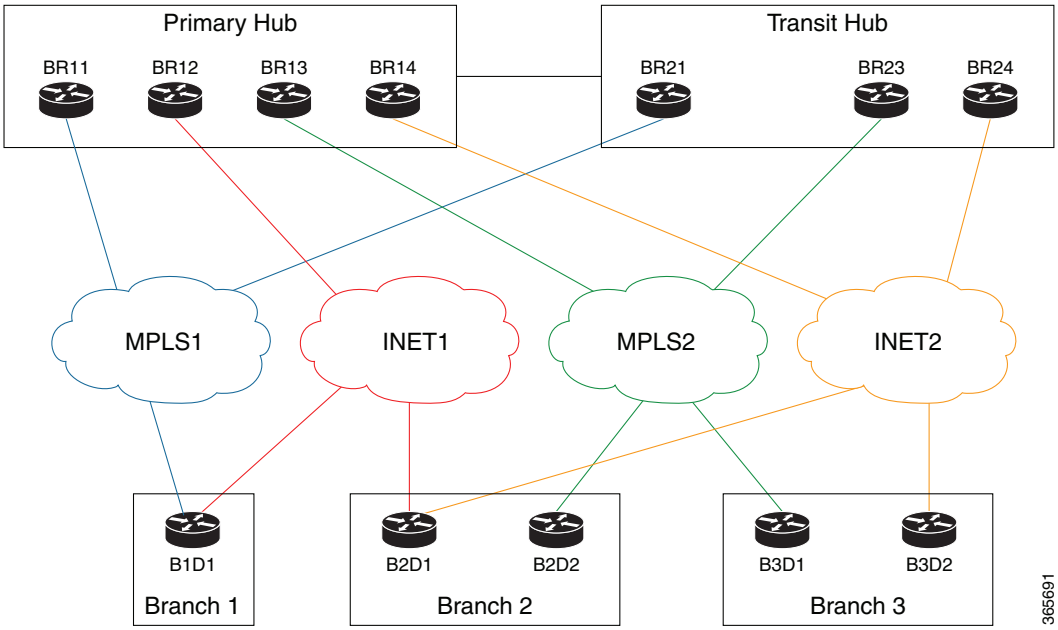
Figure 4-7 Homogeneous Topology



Heterogeneous Topology

In a heterogeneous topology, a primary hub site and the associated transit hub do not have connections to all of the same service providers. In the example, the primary hub is connected to four service providers and the transit hub is connected to only three.

Figure 4-8 Heterogeneous Topology



Understanding IP Address Pools

The IWAN App automatically uses IP addresses from the global enterprise IP address pool space. When provisioning hub and spoke devices, the IWAN App uses IP addresses allocated in the user-configured IP address pools. This includes interface, LAN, VPN overlay, and routing IP addresses.

One or more LAN greenfield IP address pools can be defined to further refine the branch LAN side IP address space. If all LAN greenfield IP address pools are exhausted, the global IP address pool is used.

It is important to define the size of the IP address pools to accommodate the long term needs of the IWAN site. VPN requirements dictate that subnets must be defined and allocated internally before any sites are provisioned. In the current Cisco IWAN release, you can increase the site and service provider counts after initial provisioning, but you cannot change the IP address pool once specified. Therefore, we recommend that you account for any future scale of service providers and site sizes when defining the IP address pools. The service provider IP address pool is used for overlay and loopback addresses.

Optionally, wherever specific IP addresses are required, site-specific LAN and VLAN requirements can be defined and prioritized over the service provider and global IP address pools.

Site-Specific Profile

Site-specific profile is optional and is required only for pre-provisioning LAN IP addresses on each site. Pre-provisioning allows you to define a site using the site name and device combination before devices are added to the unclaimed device list. This is accomplished by matching the device serial number with the site name. VLAN definition for each site allows you to specify IP address pool ranges, otherwise, the LAN greenfield IP address pools or the global IP address pool provides the required LAN IP addresses.

Branch Site-Specific Profile

You can pre-provision specifications for the branch sites. A single or dual router site can be defined using device serial numbers and site name along with VLANs for the site.

For a single router branch, you must specify the serial number of the device. For a dual router branch, you must specify the serial number of both the devices separated by a semi-colon. The Cisco IWAN app automatically matches the site name and device serial numbers and uses the previously defined VLANs and IP address pools. Thus, branch sites are available before the devices are displayed in the site provisioning workflow under unclaimed devices.

Defining the site and VLAN enables you to easily configure the devices when devices are provisioned in the site provisioning workflow. When the devices are claimed and provisioned, the site provisioning workflow does not conflict with the existing site configuration and site name.

You cannot modify the IP address pools after you have saved them.

LAN Brownfield IP Address Pool

In the Cisco IWAN release 1.3, the LAN brownfield role was introduced to define LAN IP addresses for brownfield branch devices.

When a brownfield branch is provisioned, its VLAN subnets are reserved.

If the VLAN subnets are subnets of a LAN brownfield IP address pool, they are reserved from a LAN brownfield IP address pool.

If there are no LAN brownfield subnets for the VLAN subnets, they are reserved as site-specific IP address pools.

The add, delete, and update operations are not allowed on brownfield site-specific IP address pools.

Configuring Multi-tunnel Termination (MTT)

The IWAN App supports multiple WAN links for a hub device. Multiple links may be added to a device at the time of site provisioning (Day 0) or after provisioning (Day N). The feature is available both for primary hub sites and transit hub sites. (Transit hub sites operate in parallel with primary hub sites, providing load balancing and/or failover support.)

Primary and Transit Hub Sites Require Connectivity to All Links

For topologies that use primary and transit hub sites together, both the primary and transit hubs must have connectivity to the same service providers at Day 0 (at the time of provisioning). This is called a "homogeneous" topology (see Homogeneous and Heterogeneous Topologies, page 4-25).

Number of Devices at Primary and Transit Hub Sites May be Different

When using a topology that includes a primary hub site and a transit hub site, it is not necessary for the device configuration to be identical at both sites. The sites may have a different number of devices, but those devices most share the same connectivity. This may require configuring multiple links to a single device.

For example, if a primary site has two devices, each with a single link to a service provider, and the associated transit site has ony one device, that single device must have two links to provide the same connectivity as the primary site.

Day 0 Multiple WAN Link Configuration: Features, Limitations, Procedure

Features

Table 4-4 Day 0 Multiple WAN Link Features

Feature
Service Providers, Devices, Links
Supported service providers: 2 to 4
Minimum number of devices for a hub site: 1
Maximum number of links per device: 3
Options
Provision a multi-link hub site with any combination of public/private links.
Different devices at a hub site can be provisioned to operate with different sets of links.
Provision multiple hub sites with a different number of devices at each site.

Requirements and Limitations

Table 4-5 Day 0 Multiple WAN Link Requirements and Limitations

Requirement/Limitation
OS for Participating Devices
Cisco IOS XE 16.3.3
Connectivity
At the time of hub site provisioning (Day 0), each hub site must have connectivity to all service providers.

Adding Multiple Links to a Hub Device at Day 0

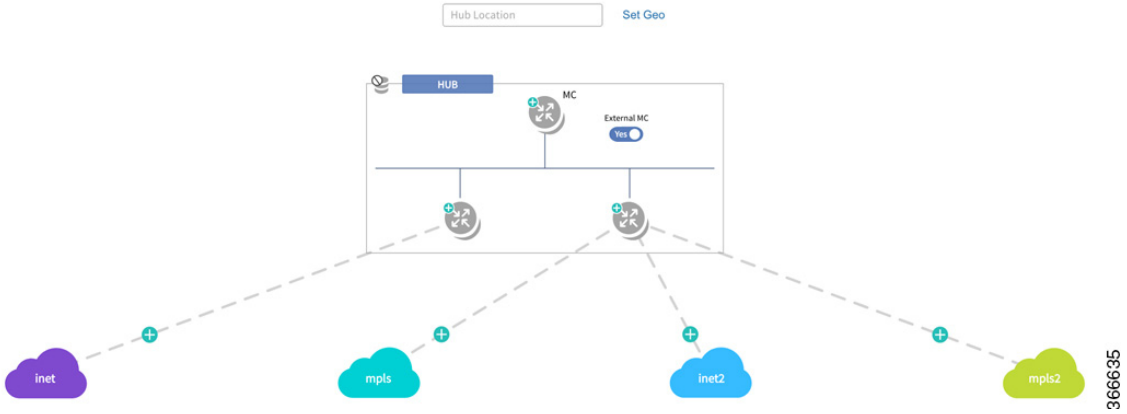
Adding a link to a device before provisioning (Day 0) requires drawing a link between a device and a cloud. Use the following procedure.

Procedure

Step 1 Open the Network Wide Settings page > IWAN Aggregation Site tab.

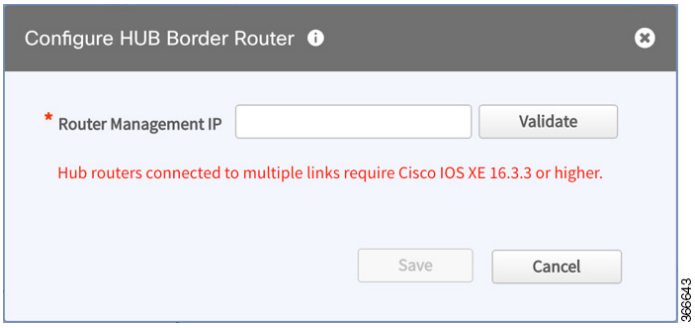
Step 2 To add a link for a hub device, click and hold over the device, and "draw" a line to the intended cloud icon. If required, draw multple new links.

The newly drawn links appear as dotted lines to indicate that they have not yet been configured.



Step 3 Click the device with a new link (or click one of the devices with a new link if adding links to more than one device).

A dialog box appears, prompting you to enter the router management IP. The dialog also indicates that to perform this operation, the device must be running Cisco IOS XE 16.3.3.



Step 4 Enter the required information and click the **Save** button to proceed.

Step 5 In the subsequent dialog boxes, enter the SNMP and SSH/Telnet information as required, and click the **Add Device** button.

Step 6 In the LAN IP-interface area, select the interface(s) to use, and click the **Save** button.

The IWAN App performs several validations. If any validations fail, a Validation Status dialog box appears, indicating the errors. For example, if the device OS is not compatible with the links that you have drawn for it, a validation error appears.

Step 7 For each new link, click the plus-sign on the new link to open the Configure Link dialog box.

Step 8 Enter information for the WAN IP-interface and other required fields.

Step 9 Click the **Save** button.

The lines indicating links (which were formerly dotted lines) appear solid.

Step 10 If other devices have newly drawn links, click the devices one-by-one and repeat the preceding steps for each.

Step 11 At the bottom of the page, click the **Save & Continue** button.

A summary of the configuration appears.

Step 12 Click the **Continue** button to begin provisioning.

Day N Multiple WAN Link Configuration: Features, Limitations, Procedure

Features

Table 4-6 Day N Multiple WAN Link Features

Feature
Service Providers, Devices, Links
Supported service providers: 2 to 4
Minimum number of devices for a hub site: 1
Maximum number of links per device: 3
Options
Add new links to one or more hub devices (see Adding Links to an Existing Hub Device at Day N, page 4-31).
Different devices at a hub site can be configured to operate with different sets of links.
Delete a transit hub site with multi-linked devices.

Requirements and Limitations

Table 4-7 Day N Multiple WAN Link Requirements and Limitations

Requirement/Limitation
OS for Participating Devices
Cisco IOS XE 16.3.3
Connectivity
After hub site provisioning (Day N), hub sites may have different connectivity to service providers. This arrangement is called “heterogenous” (see Homogeneous and Heterogeneous Topologies, page 4-25).
Limitations
Cannot delete an existing link from a hub router on Day N. If the device has the last link connected to a cloud, can de-provision the branch attached and then delete the hub device. After doing this, can then re-provision the branch site, using the desired links.
Cannot add a new link to a hub "master controller" (MC) device.
Adding a link to a device interrupts routing activity on the device.
When adding a link to the only device providing connectivity to a branch site, connectivity to that site will be lost during this process.

Adding Links to an Existing Hub Device at Day N

The procedure for adding a link to a device after provisioning (Day N) differs from the procedure used before provisioning (Day 0). At Day 0, add links by drawing a link between a device and a cloud. At Day N, use the following procedure.

Note

- Adding a link to a device interrupts routing activity on the device.
- If this is the only device providing connectivity to a branch site, connectivity to that site will be lost during this process.

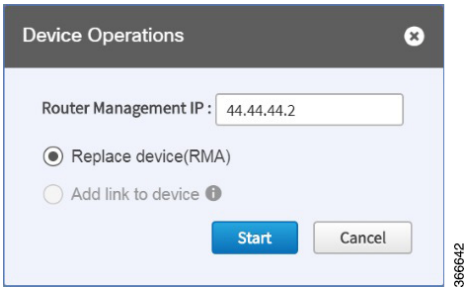
Procedure

Step 1 Create a clean configuration file on the bootflash of the router with the filename: IWAN_RECOVERY.cfg

This is a config file containing the configuration prior to use of the device with the IWAN app. The file must include the current LAN, WAN, and SNMP details, along with the information for the new WAN link being added.

Step 2 Open the Network Wide Settings page > IWAN Aggregation Site tab.

Step 3 Click the device to display the Device Operations dialog box.



Step 4 In the Device Operations dialog box, select **Add link to device** and click the **Start** button.

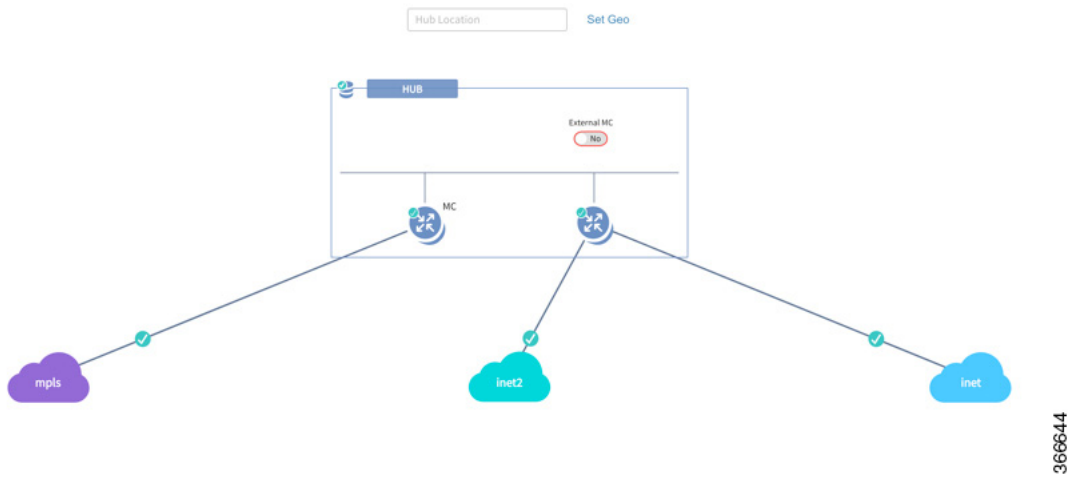
The "Add link to device" dialog box appears, displaying important information about adding a link.

Step 5 Select each item in the "Add link to device" dialog box to confirm and proceed.

Step 6 A series of "Configure Hub Border Router" dialog boxes appear, providing options for adding the link.

- **Automatic method**: If the clean configuration file on the device includes up-to-date LAN IP information and SNMP credentials, the IWAN App auto-populates the fields in the dialog boxes that follow, and closes them automatically, without requiring any user input. **Result**: The IWAN app reverts the device to the configuration defined in the clean configuration file, adds the existing WAN link automatically, and prompts you for the new link information.
- **Manual method**: If the clean configuration file on the device contains different LAN IP information or different SNMP credentials, the "Configure Hub Border Router" dialog boxes prompt you for that information, assisting you in reprovisioning the device with the existing WAN link and configuring the new link. Enter the information to proceed with adding the new link to the device.

After completing the process, the new link appears as a solid line in the topology.



Updating the WAN Bandwidth of a Provisioned Hub Site

You can change the upload or download WAN bandwidth after a hub site is provisioned ("day N"). Also see Updating the WAN Bandwidth of a Provisioned Branch Site, page 5-26.

Valid bandwidth values depend on the interface type:

- TenGigabit interface: 0.1 to 10000 Mbps
- Gigabit interface: 0.1 to 1000 Mbps
- Cellular interface: 0.1 to 300 Mbps

Use the following procedure to update the bandwidth settings.

Procedure

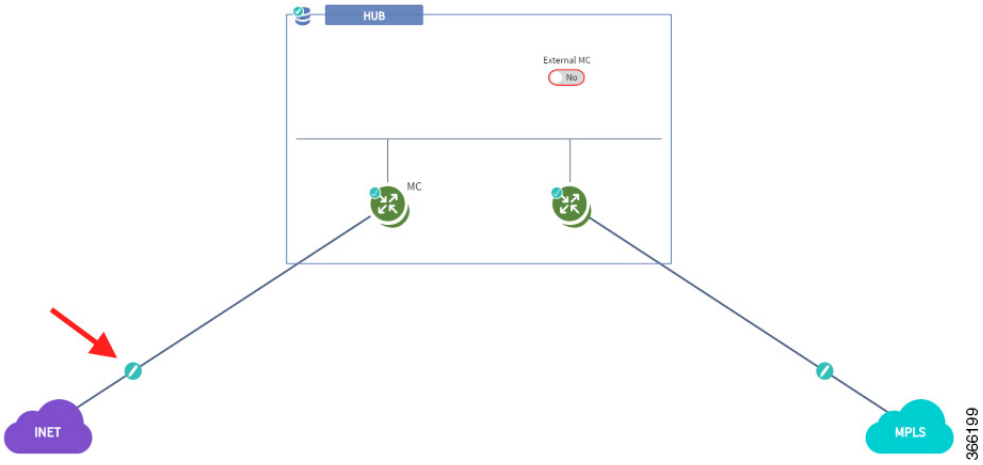
Step 1 From the IWAN app home page, click **Set up Branch Sites**.

Step 2 Click the **Sites** tab.

Step 3 Click the pencil icon (Edit Site) for a hub site. The IWAN Aggregation Site page opens.

Note You can also reach this page by clicking **Configure Hub Site & Settings** on the IWAN front page, and then clicking the **IWAN Aggregation Site** tab.

Step 4 Click the pencil icon on the WAN link. The Configure Link dialog box opens.



Step 5 In the Bandwidth field, enter a new value.

Step 6 Click **Save** in the dialog box.

Step 7 Click the **Save & Continue** button at the bottom left of the page. The Hub Site summary dialog box appears.

Step 8 Click **Continue** to close the summary.

Modifying the QoS Bandwidth Percentages for a Hub Site

You can modify the QoS bandwidth percentages for a hub site after the site is provisioned (Day N).

Procedure

Step 1 From the IWAN app home page, click **Set up Branch Sites**. The Sites page opens.

Step 2 Click the **Sites** tab.

Step 3 Click the pencil icon (Edit Site) for a hub site.

Note You can also reach this page by clicking **Configure Hub Site & Settings** on the IWAN front page, and then clicking the IWAN Aggregation Site tab.

Step 4 Click the pencil icon on a WAN link (link between router and cloud). The Configure Link dialog box opens.

Step 5 In the Configure Link dialog box, click the **Edit** (pencil) icon next to the Service Provider field. A dialog box opens, showing information for the specific service profile.

Step 6 Modify the QoS bandwidth percentages as needed.

Step 7 Click **Update**. The modified bandwidth percentages are applied to the WAN link.

Modifying the QoS Bandwidth Percentages for a Service Profile

You can modify the QoS bandwidth percentages globally for a service profile at any time. Any WAN connection using the service profile is updated, whether the connection is for a hub or for a branch site. This operation is available even after sites using the service profile have been provisioned (Day N).

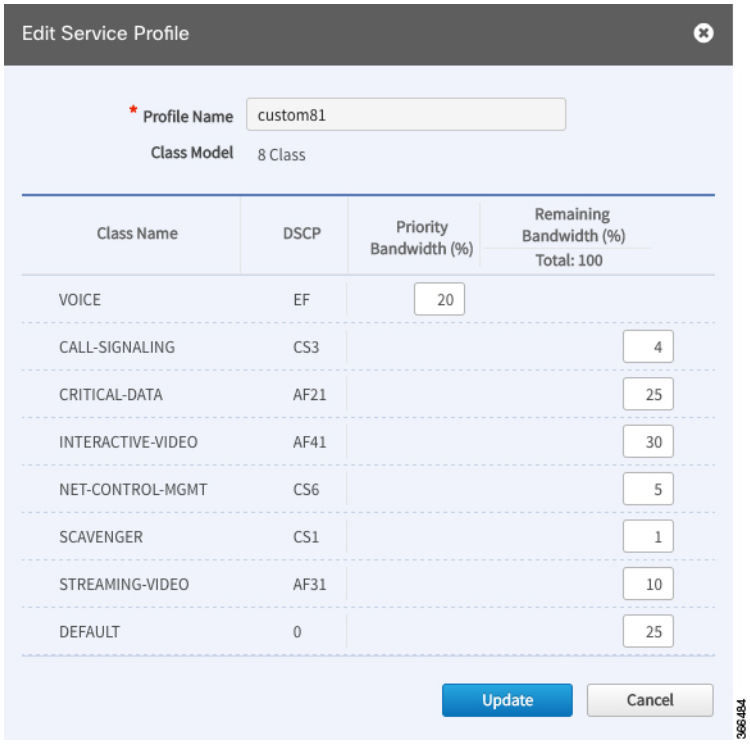
Updating the QoS bandwidth percentages globally for the service profile can save time, compared with updating the percentages individually for each connection. This may be useful when the changes are intended for each WAN connection that uses the specific service profile.

Procedure

Step 1 From the IWAN app home page, click **Configure Hub Site & Settings**. The Network Wide Settings page opens.

Step 2 Open the **Service Providers** tab.

Step 3 The "Available QoS models for Service Providers" section lists existing service profiles, including default and user-created profiles. To edit a service profile, click the pencil icon for the profile. The Edit Service Profile dialog box opens.



Step 4 Modify the QoS bandwidth percentages as needed.

Step 5 Click the **Update** button. The modified bandwidth percentages are applied to all WAN links using the service profile.

Deleting a User-defined QoS Bandwidth Service Profile

You can delete a user-defined QoS bandwidth service profile that is not in use.

Procedure

Step 1 From the IWAN app home page, click **Configure Hub Site & Settings**. The Network Wide Settings page opens.

Step 2 Open the **Service Providers** tab.

Step 3 The "Available QoS models for Service Providers" section lists existing service profiles, including default and user-created profiles. To delete a user-defined service profile, click the "X" icon for the profile.

If you attempt to delete a service profile that is in use, the IWAN app displays a warning.

Setting the Geographic Location of a Hub Site

Setting the geographic location of a hub site is optional. The location may be set at any time, even after provisioning the site (Day N).

After setting the geographic site location, that information appears on the Sites list page, and in the Site Details page for the site.

Procedure

Step 1 From the IWAN app home page, click **Configure Hub Site & Settings**. The Network Wide Settings page opens.

Step 2 Open the IWAN Aggregation Site tab.

Step 3 Above each hub site, do one of the following:

a. Enter a city name in the field. As you type, city options will appear. Select one.

or

b. Click Set Geo to set the location in a map view.

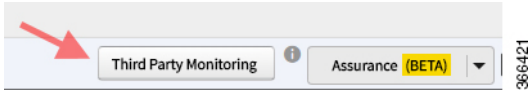
Collecting Network Data Using LiveAction

The IWAN App operates together with a network statistics "collector" to collect network performance data from the IWAN network. Specifically, the collector exports Cisco AVC and Performance Routing (PfR) Netflow records from routers in the network to the IWAN App.

By default, the IWAN App operates with Cisco Prime Infrastructure to collect network performance data. Optionally, you can configure the IWAN App to use LiveAction for collecting performance data.

Indication that the IWAN App Is Using LiveAction

When the IWAN App is configured to use LiveAction, the map view provides an indicator of third-party monitoring.



Limitations When Using LiveAction

- When using LiveAction to collect network data, you cannot filter the display of IWAN sites by application status.
- The site details dialog boxes do not display the application status.

Enabling LiveAction Network Monitoring

For information about enabling LiveAction network monitoring, see the LiveAction templates in Custom Configuration Default Templates, page 6-2.

Configuring LiveAction

Procedure

Step 1 From the IWAN app home page, click **Configure Hub Site & Settings**. The Network Wide Settings page opens.

Step 2 Open the System tab.

Step 3 In the Netflow Collector section:

a. In the Netflow Destination IP field, configure the collector address.

b. In the Port Number field, enter 2055, the port used by Live Action.

Note When using Cisco Prime Infrastructure, set the port number to 9991.

Interoperability between APIC-EM and a non-IWAN-enabled Network

If devices at an IWAN-enabled branch site managed by APIC-EM handle traffic flowing to or from a non-IWAN-enabled network, use the IWAN App to manually configure the non-IWAN-enabled network as an enterprise prefix list for the devices. Without this, the IWAN App may be unable to provision devices at the branch site. There are two ways to add the non-IWAN-enable network as an enterprise prefix list - create a global address pool as a LAN brownfield pool or add a DC prefix list.

Adding a LAN Brownfield Pool

Procedure

Step 1 From the IWAN app home page, click **Configure Hub Site & Settings**.

Step 2 Open the IP Address Pools tab.

Step 3 In the Global Address Pool area, click the **Add Address Pool** button. A new line is added to the Global Address Pool table.

Step 4 On the new line for defining an address pool, in the IP Pool Role column, select **LAN Brownfield**.

Step 5 On the new line, enter the network IP address and mask of the non-IWAN-enabled network.

Adding a DC Prefix List

Procedure

Step 1 From the IWAN app home page, click **Configure Hub Site & Settings**.

Step 2 Open the IWAN Aggregation Site tab.

Step 3 Click the icon for the hub. The LAN Routing dialog box opens.

Step 4 In the LAN Routing dialog box, click **Add DCIP/Mask** and enter the subnet IP and mask and of the non-IWAN-enabled network. Click the plus sign (**+**) to complete the entry.

Step 5 In the LAN Routing dialog box, click **Save**.