Infrastructure Management

Cisco ACI Multi-Site and Cisco APIC Interoperability Support

Prior to Release 2.2(1), you were required to run the same APIC versions in all sites and the version of the Orchestrator that corresponded to that APIC release. During fabric upgrade you were also required to upgrade all the APIC sites first before upgrading the Multi-Site Orchestrator. For example, if you were upgrading the fabrics from APIC Release 4.0(1) to Release 4.1(1), you had to remain on Release 2.0(1) of the Orchestrator until all sites were on APIC Release 4.1(1).

Starting with Release 2.2(1), Multi-Site Orchestrator releases have been decoupled from the APIC releases. The APIC clusters in each site as well as the Orchestrator itself can now be upgraded independently of each other and run in mixed operation mode.

Mixed operation mode is supported for sites running any of the following APIC releases:

- 3.2(6) or later
- 4.0(1) or later
- 4.1(1) or later
- 4.2(1) or later

However, keep in mind that if you upgrade the Orchestrator before upgrading the APIC clusters in one or more sites, the new Orchestrator features may not yet be supported by an earlier APIC release. In that case a check is performed on each template to ensure that every configured option is supported by the target sites. The check is performed when you save a template or deploy a template. If the template is already assigned to a site, any unsupported configuration options will not be saved; if the template is not yet assigned, you will be able to assign it to a site, but not be able to save or deploy the schema if it contains configuration unsupported by the site. In case an unsupported configuration is detected, an error message will show, for example: `This APIC site version <site-version> is not supported by MSO. The minimum version required for this <feature> is <required-version> or above.`

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

Feature	Minimum APIC Version
ACI Multi-Pod Support	Release 3.2(6)
Service Graphs (L4-L7 Services)	Release 3.2(6)
External EPGs	Release 3.2(6)
ACI Virtual Edge VMM Support	Release 3.2(6)
DHCP Support	Release 3.2(6)
Consistency Checker	Release 3.2(6)
CloudSec Encryption	Release 4.0(1)
Layer 3 Multicast	Release 4.0(1)
MD5 Authentication for OSPF	Release 4.0(1)
EPG Preferred Group	Release 4.0(2)
Host Based Routing	Release 4.1(1)
Intersite L3Out	Release 4.2(1)

Multi-Site Orchestrator Communication Ports

There are three types of network communication to or from the Multi-Site Orchestrator cluster:

- Client traffic to the Multi-Site Orchestrator cluster.

  Multi-Site Orchestrator uses TCP port 433 (`https`) to allow user access via GUI or REST API for creating, managing, and deploying policy configurations.

- REST API traffic from the Multi-Site Orchestrator to the APIC controllers of the ACI fabrics that are part of the Multi-Site domain

  Multi-Site Orchestrator uses TCP port 433 for REST API traffic to deploy policies to each site.

- Intra-cluster communication.

  All control-plane and data-plane traffic between Cisco ACI Multi-Site Orchestrator nodes (including intra-cluster communication and container overlay network traffic) is encrypted with IPSec's Encapsulating Security Payload (ESP) using IP protocol number 50 to provide security and allow the cluster deployments over a round-trip time distance of up to 150ms. If there is firewall between any Orchestrator nodes, proper rules must be added to allow this traffic.

  If your Multi-Site Orchestrator cluster is deployed directly in VMware ESX without the Application Services Engine, the following ports are used for Docker communications between the cluster nodes:

Note The following TCP and UDP ports are listed for educational perspective only as no traffic is ever sent in clear text across the network leveraging these ports.

- TCP port 2377 for Cluster Management Communications
- TCP and UDP port 7946 for Inter-Manager Communication
- UDP port 4789 for Docker Overlay Network Traffic

Configuring Fabric Access Policies for All APIC Sites

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

Configuring Fabric Access Global Policies

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

Step 1 Log in directly to the site's APIC GUI.

Step 2 From the main navigation menu, select **Fabric** > **Access Policies**.

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

Step 3 Specify the VLAN pool.

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

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

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

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

Step 4 Configure Attachable Access Entity Profiles (AEP).

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

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

c) Click **Next** and **Submit**

No additional changes, such as interfaces, are required.

Step 5 Configure domain.

The domain you configure is what you will select from the Multi-Site Orchestrator when adding this site.

a) In the left navigation tree, browse to **Physical and External Domains** > **External Routed Domains**.
b) Right-click the **External Routed Domains** category and choose **Create Layer 3 Domain**.

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

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

c) Click **Submit**.

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

What to do next

After you have configured the global access policies, you must still add interfaces policies as described in Configure Fabric Access Interface Policies on Each APIC, on page 4.

Configure Fabric Access Interface Policies on Each APIC

This section describes the fabric access interface configurations that must be done for the Multi-Site Orchestrator on each APIC site.

Before you begin

Configure the global fabric access policies, such as VLAN Pool, AEP, and domain, in the site's APIC, as described in Configuring Fabric Access Global Policies, on page 3.

Step 1 Log in directly to the site's APIC GUI.

Step 2 From the main navigation menu, select **Fabric** > **Access Policies**.

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

Step 3 Configure a spine policy group.

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

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

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

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

- For the **Name** field, specify the name for the policy group, for example `Spine1-PolGrp`.
- For the **Link Level Policy** field, specify the link policy used between your spine switch and the ISN.
- For **CDP Policy**, choose whether you want to enable CDP.
- For the **Attached Entity Profile**, select the AEP you have configured in previous section, for example `msite-aep`.

Then click **Submit**. No additional changes, such as security domains, are required.

Step 4 Configure a spine profile.

a) In the left navigation tree, browse to **Interface Policies** > **Profiles** > **Spine Profiles**.

b) Right-click the **Spine Profiles** category and choose **Create Spine Interface Profile**.

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

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

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

Then click **Submit** to save the spine interface profile.

Step 5 Configure a spine switch selector policy.

a) In the left navigation tree, browse to **Switch Policies** > **Profiles** > **Spine Profiles**.

b) Right-click the **Spine Profiles** category and choose **Create Spine Profile**.

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

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

  Then click **Update** to save the selector.

Then click **Next** and on the next screen select the interface profile you have created in the previous step, for example `Spine1-ISN`.

Finally, click **Finish** to save the spine profile.

What to do next

If your fabrics contain Remote Leaf switches, you will need to make additional fabric-specific configuration changes as described in Configuring Sites That Contain Remote Leaf Switches, on page 6

Configuring Sites That Contain Remote Leaf Switches

Starting with Release 2.1(2), the Multi-Site architecture supports APIC sites with Remote Leaf switches. The following sections describe guidelines, limitations, and configuration steps required to allow Multi-Site Orchestrator to manage these sites.

Multi-Site and Remote Leaf Guidelines and Limitations

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

- You must upgrade your Cisco APIC to Release 4.1(2) or later.
- You must upgrade your Multi-Site Orchestrator to Release 2.1(2) or later.
- Only physical Remote Leaf switches are supported in this release
- Only -EX and -FX or later switches are supported as Remote Leaf switches for use with Multi-Site:
- Remote Leaf is not supported with back-to-back connected sites without IPN switches
- Remote Leaf switches in one site cannot use another site's L3out
- Stretching a bridge domain between one site and a Remote Leaf in another site is not supported

You must also perform the following tasks before the site can be added to and managed by the Multi-Site Orchestrator:

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

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

Configuring Routable Subnets for Remote Leaf Switches

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

Step 1 Log in directly to the site's APIC GUI.

Step 2 From the menu bar, select **Fabric** > **Inventory**.

Step 3 In the Navigation pane, click **Pod Fabric Setup Policy**.

Step 4 In the main pane, double-click the pod where you want to configure the subnets.

Step 5 In the **Routable Subnets** area, click the **+** sign to add a subnet.

Step 6 Enter the **IP** and **Reserve Address Count**, set the state to `Active` or `Inactive`, then click **Update** to save the subnet.

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

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

Enabling Direct Communication for Remote Leaf Switches

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

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

Step 1 Log in directly to the site's APIC.

Step 2 Enable direct traffic forwarding for Remote Leaf switches.

a) From the menu bar, navigate to **System** > **System Settings**.
b) From the left side bar, select **Fabric Wide Setting**.
c) Check the **Enable Remote Leaf Direct Traffic Forwarding** checkbox.

Note You cannot disable this option after you enable it.

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

Adding Sites

This section describes how to add sites using the Cisco ACI Multi-Site Orchestrator GUI.

Before you begin

You must have completed the site-specific configurations in each site's APIC, as decribed in previous sections in this chapter.

Step 1 Log in to the Multi-Site GUI, in the **Main menu**, click **Sites**.

If you are logging in for the first time, log in as the **admin** user with the default password **We1come2msc!**, you will then be prompted to change that default password. The new password requirements are:

- At least 12 characters
- At least 1 letter

- At least 1 number
- At least 1 special character apart from * and space

Step 2 In the **Main menu**, select **Infrastructure** > **Sites**.

Step 3 In the top right of the main pane, click **Add Site**.

Step 4 In the **Add Site** screen, provide the site's details.

a) In the **Name** field, enter the site name.

b) In the **Labels** field, choose or create a label.

You can choose to provide multiple labels for the site.

c) In the **APIC Controller URL** field, enter the Cisco APIC URL.

For the APIC URL, you can use the `http` or `https` protocol and the IP address or the DNS hostname, such as`https://`*`<ip-address>`* or `https://`*`<dns-hostname>`*.

d) If you have a cluster of APICs in the fabric, click **+APIC Controller URL** and provide the additional URLs.

e) In the **Username** field, enter the admin user's username for the site's APIC.

f) In the **Password** field, enter the user's password.

g) You can turn on the **Specify Login Domain for Site** switch, if you want to specify a domain to be used for authenticating the user you provided.

If you turn on this option, enter the domain name in the **Domain Name** field.

h) In the **APIC Site ID** field, enter a unique site ID.

The site ID must be a unique identifier of the Cisco APIC site, ranged between `1` and `127`. Once specified, the site ID cannot be changed without factory resetting Cisco APIC.

Step 5 Click **Save** to add the site.

Step 6 If prompted, confirm proxy configuration update.

If you have configured the Orchestrator to use a proxy server and are adding an on-premises site that is not already part of the "no proxy" list, the Orchestrator will inform you of the proxy settings update.

For additional information on proxy configuration, see the "Administrative Operations" chapter in *Cisco ACI Multi-Site Configuration Guide*.

Step 7 Repeat these steps to add any additional sites.

Configuring Infra Prerequisites and Guidelines

The following sections describe the steps necessary to configure the general as well as site-specific fabric Infra settings.

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

- Configuring each site's fabric access policies.
- Configuring direct communication and routable subnets for sites with remote leaf switches.

In addition, keep in mind the following:

- Any infrastructure changes such as adding and removing spine switches or spine node ID changes require a Multi-Site fabric connectivity information refresh described in the Refreshing Site Connectivity Information, on page 9 as part of the general Infra configuration procedures.
- The Overlay Unicast TEP, Overlay Multicast TEP, and BGP-EVPN Router-IDs IP addresses assigned on the Orchestrator should not be taken from the address space of the original fabric's `Infra` TEP pool or from the `0.x.x.x` range.

Configuring Infra: General Settings

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

Step 1 Log in to the Cisco ACI Multi-Site Orchestrator GUI.

Step 2 In the **Main menu**, click **Sites**.

Step 3 In the **Sites** view, click **Configure Infra**.

Step 4 In the left pane, under **Settings**, click **General Settings**.

Step 5 From the **BGP Peering Type** dropdown, choose either `full-mesh` or `route-reflector`.

The `route-reflector` option is effective only when all sites are part of the same BGP Autonomous System (AS).

Step 6 In the **Keepalive Interval (Seconds)** field, enter the keep alive interval seconds.

We recommend keeping the default value.

Step 7 In the **Hold Interval (Seconds)** field, enter the hold interval seconds.

We recommend keeping the default value.

Step 8 In the **Stale Interval (Seconds)** field, enter stale interval seconds.

We recommend keeping the default value.

Step 9 Choose whether you want to turn on the **Graceful Helper** option.

Step 10 In the **Maximum AS Limit** field, enter the maximum AS limit.

Step 11 In the **BGP TTL Between Peers** field, enter the BGP TTL between peers.

Refreshing Site Connectivity Information

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

Step 1 Log in to the Cisco ACI Multi-Site Orchestrator GUI.

Step 2 In the **Main menu**, select **Infrastructure** > **Infra Configuration**.

Step 3 In the top right of the main **Infra Configuration** view, click the **Configure Infra** button.

Step 4 In the left pane, under **Sites**, select a specific site.

Step 5 In the main window, click the **Reload Site Data** button to pull fabric information from the APIC.

Step 6 (Optional) In the **Confirmation** dialog, check the box if you want to remove configuration for decommissioned spine switch nodes.

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

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

This will discover any new or removed spines and all site-related fabric connectivity will be re-imported from the APIC.

Configuring Infra Site-Specific Settings

This section describes how to configure site-specific Infra settings for each site.

Step 1 Log in to the Cisco ACI Multi-Site Orchestrator GUI.

Step 2 In the **Main menu**, click **Sites**.

Step 3 In the **Sites** view, click **Configure Infra**.

Step 4 In the left pane, under **Sites**, select a specific site.

Step 5 In the right **<*Site*> Settings** pane, enable the site by setting the **ACI Multi-Site** knob to `On`.

Step 6 (Optional) Turn on CloudSec encryption for the site.

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

Step 7 Specify the **Overlay Multicast TEP**.

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

Step 8 Specify the **BGP Autonomous System Number**.

Step 9 Specify the **BGP Password**.

Step 10 Specify the **OSPF Area ID**.

When configuring the Multi-Site infra OSPF details, we recommend that you use OSPF Area `0`. If you use an Area ID other than `0`, in the next step configure it as a `regular` OSPF area type and not a `stub` area type.

Step 11 Select the **OSPF Area Type** from the dropdown menu.

The OSPF area type can be one of the following:

- `nssa`
- `regular`
- `stub`

Step 12 Select the external routed domain from the dropdown menu.

Choose an external router domain that you have created in the APIC GUI.

Step 13 Configure OSPF settings for the site.

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

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

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

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

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

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

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

  The default is `5`.
- In the **Transmit Delay (Seconds)** field, enter the transmit delay in seconds.

  The default is `1`.

Configuring Infra: Pod Settings

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

Step 1 Log in to the Cisco ACI Multi-Site Orchestrator GUI.

Step 2 In the **Main menu**, click **Sites**.

Step 3 In the **Sites** view, click **Configure Infra**.

Step 4 In the left pane, under **Sites**, select a specific site.

Step 5 In the main window, select a pod.

Step 6 In the right **POD Properties** pane, add the Overlay Unicast TEP for the POD.

This IP address is deployed on all spine switches that are part of the same pod and used for intersite known unicast traffic.

Step 7 Click **+Add TEP Pool** to add a routable TEP pool.

The routable TEP pools are used for public IP addresses for inter-site connectivity.

Step 8 Repeat the procedure for every pod in the site.

Configuring Infra: Spine Switches

This section describes how to configure spine switches in each site for Cisco ACI Multi-Site.

Step 1 Log in to the Cisco ACI Multi-Site Orchestrator GUI.

Step 2 In the **Main menu**, click **Sites**.

Step 3 In the **Sites** view, click **Configure Infra**.

Step 4 In the left pane, under **Sites**, select a specific site.

Step 5 In the main window, select a spine switch within a pod.

Step 6 In the right **<*Spine*> Settings** pane, click **+Add Port**.

Step 7 In the **Add Port** window, enter the following information:

- In the **Ethernet Port ID** field, enter the port ID, for example `1/29`.
- In the **IP Address** field, enter the IP address/netmask.

  The Orchestrator creates a sub-interface with VLAN 4 with the specified IP ADDRESS under the specified PORT.
- In the **MTU** field, enter the MTU. You can specify either `inherit` or a value between `576` and `9000`.

  MTU of the spine port should match MTU on IPN side.
- In the **OSPF Policy** field, choose the OSPF policy for the switch that you have configured in Configuring Infra Site-Specific Settings, on page 10.

  OSPF settings in the OSPF policy you choose should match on IPN side.
- For **OSPF Authentication**, you can pick either `none` or one of the following:
  - `MD5`
  - `Simple`

Step 8 Enable **BGP Peering** knob.

In a single Pod fabric with more than two spine switches, BGP peering should only be enabled on a pair (for redundancy) of spine switches called **BGP Speakers**. All other spine switches should have BGP peering disabled and will function as **BGP Forwarders**.

In a Multi-Pod fabric BGP peering should only be enabled on a couple of BGP speaker spine switches, each deployed in a different Pod. All other spines switches should have BGP peering disabled and function as BGP forwarders.

Step 9 In the **BGP-EVPN Router-ID** field, provide the IP address used for BGP-eVPN session between sites.

Step 10 Repeat the procedure for every spine switch.

Deploying Infra Configuration

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

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

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

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

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

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

- **Download IPN Device config files only:** Downloads a zip file that contains configuration information that you will use to enable connectivity between the Cisco Cloud Services Router (CSR) without deploying the configuration.

Deleting Sites Using Multi-Site Orchestrator GUI

This section describes how to delete sites using the Multi-Site GUI.

Step 1 Log in to the Multi-Site GUI.

Step 2 Ensure you unbind the site from any Schema's before trying to delete the site.

Step 3 In the **Main menu**, click **Sites**.

Step 4 In the **Sites List** page, hover over the site you want to delete and choose **Action** > **Delete** .

Step 5 Click **YES**.

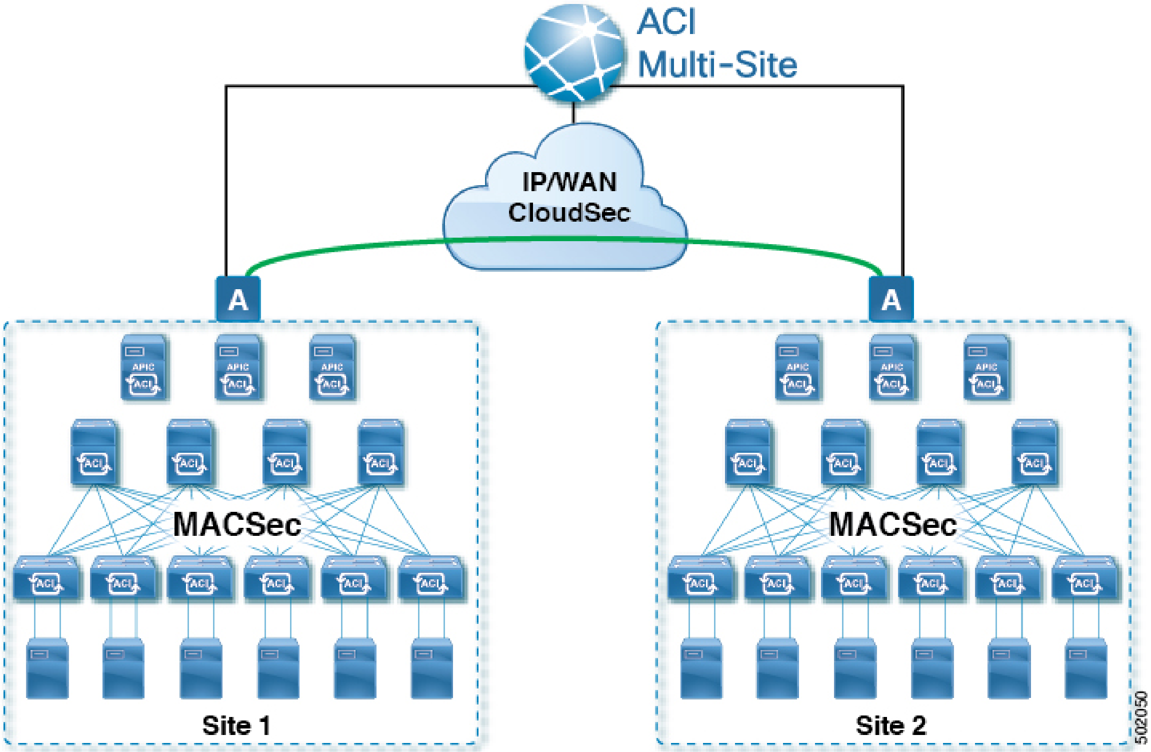
Cisco ACI CloudSec Encryption

As most Cisco ACI deployments are adopting the Cisco ACI Multi-Site architecture to address disaster recovery and scale, the current security implementation using MACsec encryption within local site is becoming insufficient to guarantee data security and integrity across multiple sites connected by insecure external IP networks interconnecting separate fabrics. Cisco ACI Multi-Site Orchestrator Release 2.0(1) introduces the CloudSec Encryption feature designed to provide inter-site encryption of traffic.

Cisco ACI Multi-Site topology uses three tunnel end-point (TEP) IP addresses to provide connectivity between sites. These TEP addresses are configured by the admin on Cisco ACI Multi-Site Orchestrator and pushed down to each site's Cisco APIC, which in turn configures them on the spine switches. These three addresses are used to determine when traffic is destined for a remote site, in which case an encrypted CloudSec tunnel is created between the two spine switches that provide physical connectivity between the two sites through the Inter-Site Network (ISN).

The following figure illustrates the overall encryption approach that combines MACsec for local site traffic and CloudSec for inter-site traffic encryption.

Figure 1: CloudSec Encryption



Requirements and Guidelines

When configuring CloudSec encryption, the following guidelines apply:

- CloudSec has been validated using a Nexus 9000 Inter-Site Network (ISN) infrastructure. If your ISN infrastructure is made up of different devices, or the devices are unknown (such as in the case of circuits purchased from a service provider), it is required that an ASR1K router is the first hop device directly connected to the ACI spine, or the Nexus 9000 ISN network. The ASR1K router with padding-fixup enabled allows the CloudSec traffic to traverse any IP network between the sites.
- If one or more spine switches are down when you attempt to disable CloudSec encryption, the disable process will not complete on those switches until the switches are up. This may result in packet drops on the switches when they come back up.

  We recommend you ensure that all spine switches in the fabric are up or completely decommissioned before enabling or disabling CloudSec encryption.

- The CloudSec Encryption feature is not supported with the following features:
    - Remote Leaf Direct
    - Virtual Pod (vPOD)
    - SDA
    - Intersite L3Out
    - Other routable TEP configurations

Requirements

The CloudSec encryption capability requires the following:

- Cisco ACI spine-leaf architecture with a Cisco APIC cluster for each site
- Cisco ACI Multi-Site Orchestrator to manage each site
- One **Advantage** or **Premier** license per each device (leaf only) in the fabric
- An add-on license **ACI-SEC-XF** per device for encryption if the device is a fixed spine
- An add-on license **ACI-SEC-XM** per device for encryption if the device is a modular spine

The following table provides the hardware platforms and the port ranges that are capable of CloudSec encryption.

Hardware Platform	Port Range
N9K-C9364C spine switches	Ports 49-64
N9K-C9332C spine switches	Ports 25-32
N9K-X9736C-FX line cards	Ports 29-36

If CloudSec is enabled for a site, but the encryption is not supported by the ports, a fault is raised with `unsupported-interface` error message.

CloudSec encryption's packet encapsulation is supported if Cisco QSFP-to-SFP Adapters (QSA), such as CVR-QSFP-SFP10G, is used with a supported optic. The full list of supported optics is available from the following link: https://www.cisco.com/c/en/us/support/interfaces-modules/transceiver-modules/products-device-support-tables-list.html.

CloudSec Encryption Terminology

CloudSec Encryption feature provides a secure upstream symmetric key allocation and distribution method for initial key and rekey requirements between sites. The following terminology is used in this chapter:

- `Upstream device` – The device that adds the CloudSec Encryption header and does the encryption of the VXLAN packet payload on transmission to a remote site using a locally generated symmetric cryptography key.
- `Downstream device` – The device that interprets the CloudSec Encryption header and does the decryption of the VXLAN packet payload on reception using the cryptography key generated by the remote site.

- `Upstream site` – The datacenter fabric that originates the encrypted VXLAN packets.
- `Downstream site` – The datacenter fabric that receives the encrypted packets and decrypts them.
- `TX Key` – The cryptography key used to encrypt the clear VXLAN packet payload. In ACI only one TX key can be active for all the remote sites.
- `RX Key` – The cryptography key used to decrypt the encrypted VXLAN packet payload. In ACI two RX keys can be active per remote site.

  Two RX keys can be active at the same time because during the rekey process, the downstream sites will keep the old and the new RX keys after the new key deployment is finished for some duration to ensure that out of order packet deliveries with either key can be properly decrypted.
- `Symmetric Keys` – When the same cryptography key is used to encrypt (`TX Key`) and decrypt (`RX Key`) a packet stream by the upstream and downstream devices respectively.
- `Rekey` – The process initiated by the upstream site to replace its old key with a newer key for all downstream sites after the old key expires.
- `Secure Channel Identifier (SCI)` – A 64-bit identifier that represents a security association between the sites. It is transmitted in encrypted packet in CloudSec header and is used to derive the RX key on the downstream device for packet decryption.
- `Association Number (AN)` – A 2-bit number (`0, 1, 2, 3`) that is sent in the CloudSec header of the encrypted packet and is used to derive the key at the downstream device in conjunction with the SCI for decryption. This allows multiple keys to be active at the downstream device to handle out of order packet arrivals with different keys from the same upstream device following a rekey operation.

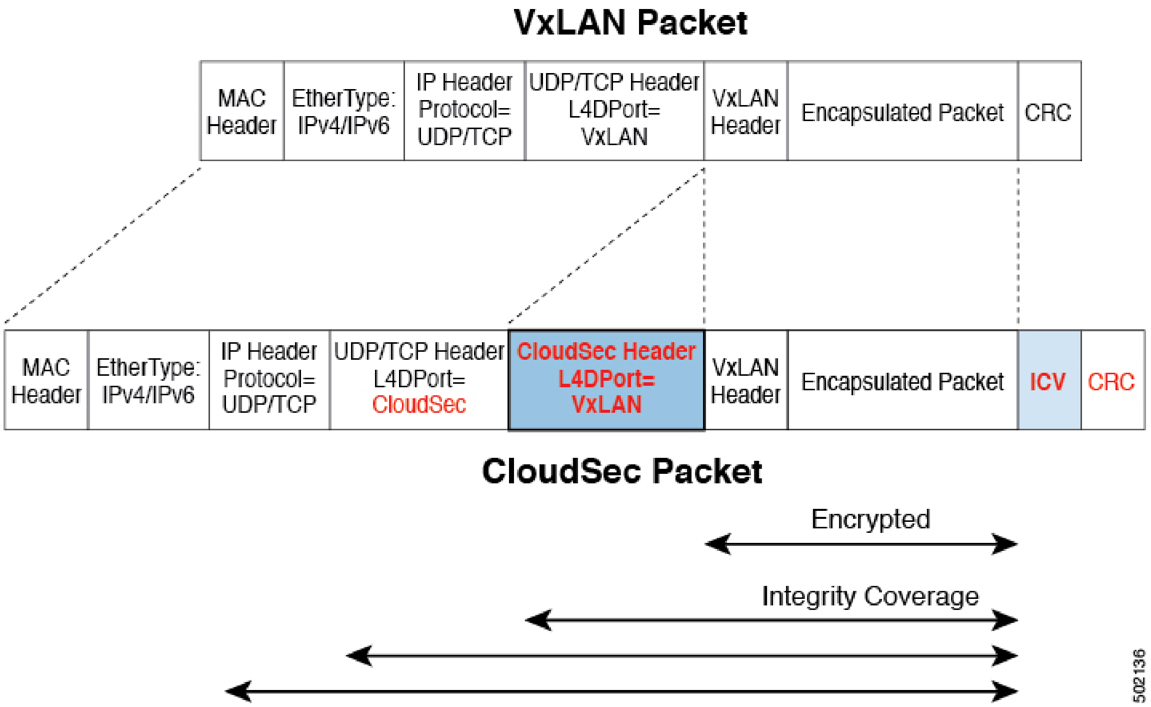
  In ACI only two association number values (`0` and `1`) are used for the two active RX keys and only one association number value (`0` or `1`) is used for the TX Key at any point in time.
- `Pre-shared key (PSK)` – One ore more keys must be configured in the Cisco APIC GUI to be used as a random seed for generating the CloudSec TX and RX keys. If multiple PSK are configured, each rekey process will use the next PSK in order of their indexes; if no higher index PSK is available, a PSK with the lowest index will be used. Each PSK must be a hexadecimal string 64 characters long. Cisco APIC supports up to 256 pre-shared keys.

CloudSec Encryption and Decryption Handling

In order to provide a fully integrated, simple, and cost-effective solution that addresses both, data security and integrity, starting with Release 2.0(1), Cisco ACI Multi-Site provides a CloudSec Encryption feature that allows for complete source-to-destination packet encryption between Multi-Site fabrics.

The following figure shows packet diagram before and after CloudSec encapsulation, followed by descriptions of the encryption and decryption processes:

Figure 2: CloudSec Packet



Packet Encryption

The following is a high level overview of how CloudSec handles outgoing traffic packets:

- The packets are filtered using the outer IP header and Layer-4 destination port information and matching packets are marked for encryption.
- The offset to use for encryption is calculated according to the fields of the packet. For example, the offset may vary based on whether there is a 802.1q VLAN or if the packet is an IPv4 or IPv6 packet.
- The encryption keys are programmed in the hardware tables and are looked up from the table using the packet IP header.

Once the packet is marked for encryption, the encryption key is loaded, and the offset from the beginning of the packet where to start the encryption is known, the following additional steps are taken:

- The UDP destination port number is copied from the UDP header into a CloudSec field for recovery when the packet is decrypted.
- The UDP destination port number is overwritten with a Cisco proprietary Layer-4 port number (Port `9999`) indicating that it is a CloudSec packet.
- The UDP length field is updated to reflect the additional bytes that are being added.
- The CloudSec header is inserted directly after the UDP header.
- The Integrity Check Value (ICV) is inserted at the end of the packet, between the payload and the CRC.
- The ICV requires construction of a 128-bit initialization vector. For CloudSec, any use of the source MAC address for ICV purposes is replaced by a programmable value per SCI.

- CRC is updated to reflect the change in the contents of the packet.

Packet Decryption

The way CloudSec handles incoming packets is symmetric to the outgoing packets algorithm described above:

- If the received packet is a CloudSec packet, it is decrypted and the ICV is verified.

  If ICV verification passed, the extra fields are removed, the UDP destination port number is moved from the CloudSec header to the UDP header, the CRC is updated, and the packet is forwarded to destination after decryption and CloudSec header removal. Otherwise the packet is dropped.

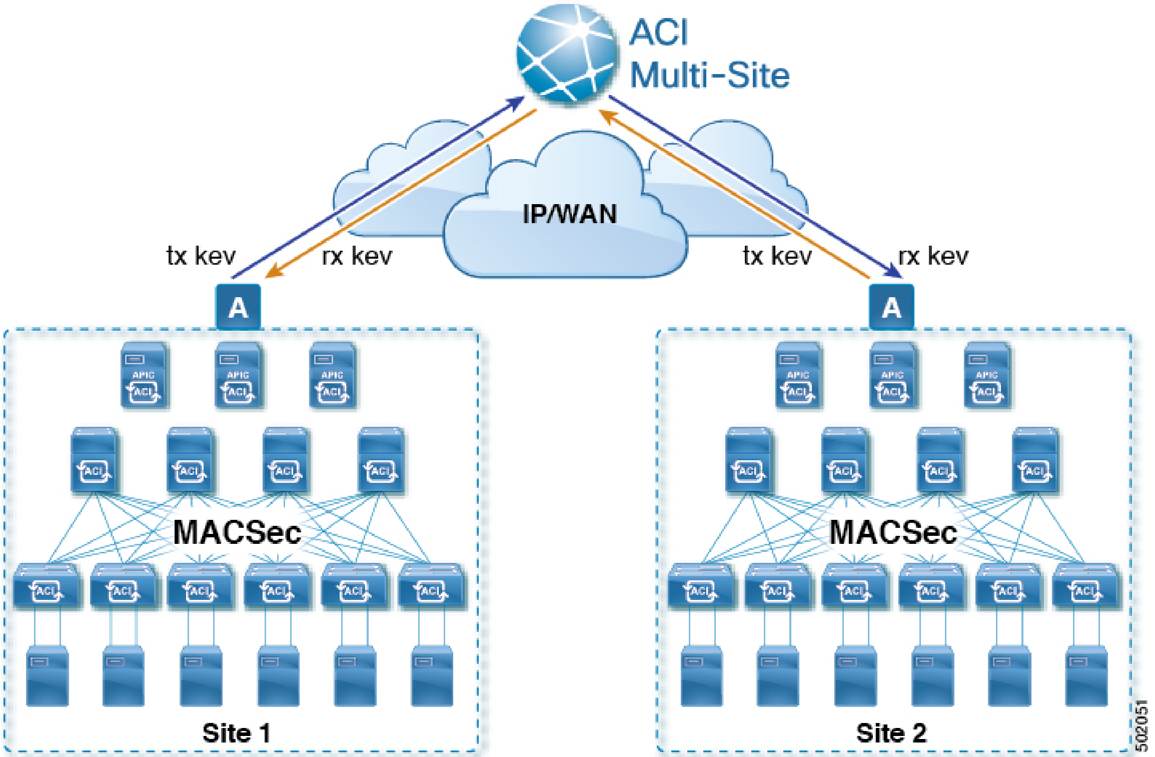
- If the key store returns two or more possible decryption keys, the Association Number (AN) field of the CloudSec header is used to select which key to use.

- If the packet is not a CloudSec packet, the packet is left unchanged.

CloudSec Encryption Key Allocation and Distribution

Initial Key Configuration

Figure 3: CloudSec Key Distribution



The following is a high level overview of the CloudSec encryption key initial allocation and distribution process illustrated by the figure above:

- The upstream site's Cisco APIC generates a local symmetric key intended to be used for data encryption of VXLAN packets transmitted from its site. The same key that is used by the upstream site for encryption is used for decryption of the packets on the downstream remote receiving sites.

  Every site is an upstream site for the traffic it transmits to other sites. If multiple sites exist, each site generates its own site-to-site key and use that key for encryption before transmitting to the remote site.
- The generated symmetric key is pushed to the Cisco ACI Multi-Site Orchestrator (MSO) by the upstream site's Cisco APIC for distribution to downstream remote sites.
- The MSO acts as a message broker and collects the generated symmetric key from the upstream site's Cisco APIC, then distributes it to downstream remote sites' Cisco APICs.
- Each downstream site's Cisco APIC configures the received key as RX key on the local spine switches which are intended to receive the traffic from the upstream site that generated the key.
- Each downstream site's Cisco APIC also collects the deployment status of the RX Key from the local spine switches and then pushes it to the MSO.
- The MSO relays the key deployment status from all downstream remote sites back to the upstream site's Cisco APIC.
- The upstream site's Cisco APIC checks if the key deployment status received from all downstream remote sites is successful.
  - If the deployment status received from a downstream device is successful, the upstream site deploys the local symmetric key as its TX key on the spine switches to enable encryption of the VXLAN packets that are sent to the downstream site.
  - If the deployment status received from a downstream device is failed, a fault is raised on the Cisco APIC site where it failed and it is handled based on the "secure mode" setting configured on the MSO. In "must secure" mode the packets are dropped and in the "should secure" mode the packets are sent clear (unencrypted) to the destination site.

Note In current release, the mode is always set to “should secure” and cannot be changed.

Rekey Process

Each generated TX/RX key expires after a set amount of time, by default key expiry time is set to 15 minutes. When the initial set of TX/RX keys expires, a rekey process takes place.

The same general key allocation and distribution flow applies for the rekey process. The rekey process follows the "make before break" rule, in other words all the RX keys on the downstream sites are deployed before the new TX key is deployed on the upstream site. To achieve that, the upstream site will wait for the new RX key deployment status from the downstream sites before it configures the new TX key on the local upstream site's devices.

If any downstream site reports a failure status in deploying the new RX key, the rekey process will be terminated and the old key will remain active. The downstream sites will also keep the old and the new RX keys after the new key deployment is finished for some duration to ensure that out of order packet deliveries with either key can be properly decrypted.

Note Special precautions must be taken in regards to rekey process during spine switch maintenance, see Rekey Process During Spine Switch Maintenance, on page 23 for details.

Rekey Process Failure

In case of any downstream site failing to deploy the new encryption key generated by the rekey process, the new key is discarded and the upstream device will continue to use the previous valid key as TX key. This approach keeps the upstream sites from having to maintain multiple TX keys per set of downstream sites. However, this approach may also result in the rekey process being delayed if the rekey deployment failures continue to occur with any one of the downstream sites. It is expected that the Multi-Site administrator will take action to fix the issue of the key deployment failure for the rekey to succeed.

Cisco APIC's Role in Key Management

The Cisco APIC is responsible for key allocation (both, initial key and rekey distribution), collection of the key deployment status messages from the spine switches, and notification of the Cisco ACI Multi-Site Orchestrator about each key's status for distribution to other sites.

Cisco ACI Multi-Site Orchestrator's Role in Key Management

The Cisco ACI Multi-Site Orchestrator is responsible for collecting the TX keys (both, initial key and subsequent rekeys) from the upstream site and distributing it to all downstream sites for deployment as RX keys. The MSO also collects the RX key deployment status information from the downstream sites and notifies the upstream site in order for it to update the TX key on successful RX key deployment status.

Upstream Model

In contrast to other technologies, such as MPLS, that use downstream key allocation, CloudSec's upstream model provides the following advantages:

- The model is simple and operationally easier to deploy in the networks.
- The model is preferred for Cisco ACI Multi-Site use cases.
- It provides advantages for multicast traffic as it can use the same key and CloudSec header for each copy of the replicated packet transmitted to multiple destination sites. In downstream model each copy would have to use a different security key for each site during encryption.
- It provides easier troubleshooting in case of failures and better traceability of packets from the source to destination consistently for both, unicast and multicast replicated packets.

Configuring Cisco APIC for CloudSec Encryption

You must configure one or more Pre-Shared Keys (PSK) to be used by the Cisco APIC for generating the CloudSec encryption and decryption keys. The PSK are used as a random seed during the re-key process. If multiple PSK are configured, each re-key process will use the next PSK in order of their indexes; if no higher index PSK is available, a PSK with the lowest index will be used.

Because PSK is used as a seed for encryption key generation, configuring multiple PSK provides additional security by lowering the over-time vulnerability of the generated encryption keys.

Note If no pre-shared key is configured on the Cisco APIC, CloudSec will not be enabled for that site. In that case, turning on CloudSec setting in Cisco ACI Multi-Site will raise a fault.

If at any time you wish to refresh a previously added PSK with a new one, simply repeat the procedure as if you were adding a new key, but specify an existing index.

You can configure one or more pre-shared keys in one of three ways:

- Using the Cisco APIC GUI, as described in Configuring Cisco APIC for CloudSec Encryption Using GUI, on page 21
- Using the Cisco APIC NX-OS Style CLI, as described in Configuring Cisco APIC for CloudSec Encryption Using NX-OS Style CLI, on page 21
- Using the Cisco APIC REST API, as described in Configuring Cisco APIC for CloudSec Encryption Using REST API, on page 22

Configuring Cisco APIC for CloudSec Encryption Using GUI

This section describes how to configure one or more pre-shared keys (PSK) using the Cisco APIC GUI.

Step 1 Log in to APIC.

Step 2 Navigate to **Tenants** > **infra** > **Policies** > **CloudSec Encryption**

Step 3 Specify the **SA Key Expiry Time**.

This option specifies how long each key is valid (in minutes). Each generated TX/RX key expires after the specified amount of time triggering a re-key process. The expiration time can be between 5 and 1440 minutes.

Step 4 Click the **+** icon in the **Pre-Shared Keys** table.

Step 5 Specify the **Index** of the pre-shared key you are adding and then the **Pre-Shared Key** itself.

The **Index** field specifies the order in which the pre-shared keys are used. After the last (highest index) key is used, the process will continue with the first (lowest index) key. Cisco APIC supports up to 256 pre-shared keys, so the PSK index value must be between 1 and 256.

Each **Pre-Shared Key** must be a hexadecimal string 64 characters long.

Configuring Cisco APIC for CloudSec Encryption Using NX-OS Style CLI

This section describes how to configure one or more pre-shared keys (PSK) using the Cisco APIC NX-OS Style CLI.

Step 1 Log in to the Cisco APIC NX-OS style CLI.

Step 2 Enter configuration mode.

Example:

```
apic1# configure
apic1 (config)#
```

Step 3 Enter configuration mode for the default CloudSec profile.

Example:

```
apic1(config)# template cloudsec default
apic1(config-cloudsec)#
```

Step 4 Specify the Pre-Shared Keys (PSK) expiration time.

This option specifies how long each key is valid (in minutes). Each generated TX/RX key expires after the specified amount of time triggering a re-key process. The expiration time can be between 5 and 1440 minutes.

Example:

```
apic1(config-cloudsec)# sakexpirytime <duration>
```

Step 5 Specify one or more Pre-Shared Keys.

In the following command, specify the index of the PSK you're configuring and the PSK string itself.

Example:

```
apic1(config-cloudsec)# pskindex <psk-index>
apic1(config-cloudsec)# pskstring <psk-string>
```

The *<psk-index>* parameter specifies the order in which the pre-shared keys are used. After the last (highest index) key is used, the process will continue with the first (lowest index) key. Cisco APIC supports up to 256 pre-shared keys, so the PSK index value must be between 1 and 256.

The *<psk-string>* parameter specifies the actual PSK, which must be a hexadecimal string 64 characters long.

Step 6 (Optional) View the current PSK configuration.

You can view how many PSK are currently configured and their duration using the following command:

Example:

```
apic1(config-cloudsec)# show cloudsec summary
```

Configuring Cisco APIC for CloudSec Encryption Using REST API

This section describes how to configure one or more pre-shared keys (PSK) using the Cisco APIC REST API.

Configure PSK expiration time, index, and string.

In the following XML POST, replace:

- The value of **`sakExpiryTime`** with the expiration time of each PSK.

  This **`sakExpiryTime`** parameter specifies how long each key is valid (in minutes). Each generated TX/RX key expires after the specified amount of time triggering a re-key process. The expiration time can be between 5 and 1440 minutes.

- The value of **`index`** with the index of the PSK you're configuring.

  The **`index`** parameter specifies the order in which the pre-shared keys are used. After the last (highest index) key is used, the process will continue with the first (lowest index) key. Cisco APIC supports up to 256 pre-shared keys, so the PSK index value must be between 1 and 256.

- The value of **`pskString`** with the index of the PSK you're configuring.

The **pskString** parameter specifies the actual PSK, which must be a hexadecimal string 64 characters long.

Example:

```
<fvTenant annotation="" descr="" dn="uni/tn-infra" name="infra" nameAlias="" ownerKey="" ownerTag="">

   <cloudsecIfPol descr="cloudsecifp" name="default" sakExpiryTime="10" stopRekey= "false" status=""
 >
       <cloudsecPreSharedKey index="1"
pskString="1234567812345678123456781234567812345678123456781234567812345678" status=""/>
    </cloudsecIfPol>
</fvTenant>
```

Enabling CloudSec Encryption Using Cisco ACI Multi-Site Orchestrator GUI

The CloudSec encryption can be enabled or disabled for each site individually. However, the communications between two sites will be encrypted only if the feature is enabled on both sites.

Before you begin

Before you enable the CloudSec encryption between two or more sites, you must have completed the following tasks:

- Installed and configured the Cisco APIC clusters in multiple sites, as described in *Cisco APIC Installation, Upgrade, and Downgrade Guide*
- Installed and configured Cisco ACI Multi-Site Orchestrator, as described in *Cisco ACI Multi-Site Orchestrator Installation and Upgrade Guide*.
- Added each Cisco APIC site to the Cisco ACI Multi-Site Orchestrator, as described in *Cisco ACI Multi-Site Configuration Guide*.

Step 1 Log in to the Cisco ACI Multi-Site Orchestrator.

Step 2 From the left-hand sidebar, select the **Sites** view.

Step 3 Click on the **Configure Infra** button in the top right of the main window.

Step 4 From the left-hand sidebar, select the site for which you want to change the CloudSec configuration.

Step 5 In the right-hand sidebar, toggle the **CloudSec Encryption** setting to enable or disable the CloudSec Encryption feature for the site.

Rekey Process During Spine Switch Maintenance

The following is a summary of the CloudSec rekey process during typical maintenance scenarios for the spine switches where the feature is enabled:

- **Normal Decommissioning** – CloudSec rekey process stops automatically whenever a CloudSec-enabled spine switch is decommissioned. Rekey process will not start again until the decommissioned node is commissioned back or the decommissioned node ID is removed from the Cisco APIC

- **Spine Switch Software Upgrade** – CloudSec rekey process stops automatically if a spine switch is reloaded due to software upgrade. Rekey process will resume after the spine switch comes out of reload.
- **Maintenance (GIR mode)** – CloudSec rekey process must be manually stopped using the instructions provided in Disabling and Re-Enabling Re-Key Process Using NX-OS Style CLI, on page 24. Rekey can be enabled back only after the node is ready to forward traffic again.
- **Decommissioning and Removal from Cisco APIC** – CloudSec rekey process must be manually stopped using the instructions provided in Disabling and Re-Enabling Re-Key Process Using NX-OS Style CLI, on page 24. Rekey can be enabled back only after the node is removed from Cisco APIC.

Disabling and Re-Enabling Re-Key Process Using NX-OS Style CLI

It is possible to manually stop and restart the re-key process. You may be required to manually control the re-key process in certain situations, such as switch decommissioning and maintenance. This section describes how to toggle the setting using Cisco APIC NX-OS Style CLI.

Step 1 Log in to the Cisco APIC NX-OS style CLI.

Step 2 Enter configuration mode.

Example:

```
apic1# configure
apic1(config)#
```

Step 3 Enter configuration mode for the default CloudSec profile.

Example:

```
apic1(config)# template cloudsec default
apic1(config-cloudsec)#
```

Step 4 Stop or restart the re-key process.

To stop the re-key process:

Example:

```
apic1(config-cloudsec)# stoprekey yes
```

To restart the re-key process:

Example:

```
apic1(config-cloudsec)# stoprekey no
```

Disabling and Re-Enabling Re-Key Process Using REST API

It is possible to manually stop and restart the re-key process. You may be required to manually control the re-key process in certain situations, such as switch decommissioning and maintenance. This section describes how to toggle the setting using Cisco APIC REST API.

Step 1 You can disable the rekey process using the following XML message.

Example:

```
<fvTenant annotation="" descr="" dn="uni/tn-infra" name="infra" nameAlias="" ownerKey="" ownerTag="">

    <cloudsecIfPol descr="cloudsecifp" name="default" sakExpiryTime="10" stopRekey= "true" status=""
 />
</fvTenant>
```

Step 2 You can enable the rekey process using the following XML message.

Example:

```
<fvTenant annotation="" descr="" dn="uni/tn-infra" name="infra" nameAlias="" ownerKey="" ownerTag="">

   <cloudsecIfPol descr="cloudsecifp" name="default" sakExpiryTime="10" stopRekey= "false" status=""
 />
</fvTenant>
```

Multi-Site Cross Launch to Cisco APIC

Multi-Site currently supports the basic parameters to choose when creating a Tenant and setting up a site. Multi-Site supports most of the Tenant policies, but in addition to that you can configure some advanced parameters.

Use the Multi-Site GUI to manage the basic properties to configure. If you want to configure advanced properties, the capability to cross launch into Cisco APIC GUI directly from the Multi-Site GUI is provided. You can also configure the additional properties directly in Cisco APIC.

There are three different access points in Multi-Site GUI from where you can cross launch into APIC. From these access points in Multi-Site, you can open a new browser tab with access into Cisco APIC. You will log in to Cisco APIC at that point for the first time, and the associated screen is displayed in the Cisco APIC GUI.

Cross-Launch to Cisco APIC from Sites

Before you begin

- At least one site must be configured in Multi-Site.
- The site must contain at least one tenant with entities such as VRF and bridge domain configured.

Step 1 From the left-hand sidebar, open the **Sites** view.

Step 2 From the **Sites** list, hover over the name of the appropriate site, click the **Actions** icon at the end of the row, and choose **Open in APIC User Interface** to access the Cisco APIC GUI.

The APIC GUI login screen is displayed for logging in with APIC GUI credentials.

Cross-Launch to Cisco APIC from Schemas

Before you begin

- At least one site based on a template must be configured in Multi-Site.
- The site must contain at least one tenant with entities such as VRF and bridge domain configured.

Step 1 From the left-hand sidebar, open the **Schemas** view.

Step 2 From the **Schemas** list, click the appropriate **<*schema-name*>**.

Step 3 From the left-hand sidebar **Sites** list, hover over the name of the appropriate site, click the **Actions** icon at the end of the row, and choose **Open in APIC User Interface** to access the Cisco APIC GUI.

The APIC GUI login screen is displayed for logging in with APIC GUI credentials.

Cross-Launch to Cisco APIC from the Property Pane

Before you begin

- At least one site must be configured in Multi-Site.
- The site must contain at least one tenant with entities such as VRF and bridge domain configured.

Step 1 From the left-hand sidebar, open the **Schemas** view.

Step 2 From the **Schemas** list, click the appropriate **<*schema-name*>**.

Step 3 From the left-hand sidebar **Sites** list, choose the appropriate site.

Step 4 In the **Canvas**, choose the name of a specific entity.

For example, choose an available VRF, Contract, Bridge Domain, or another entity as appropriate.

The details for the specific entity are displayed in the **Property Pane** on the right.

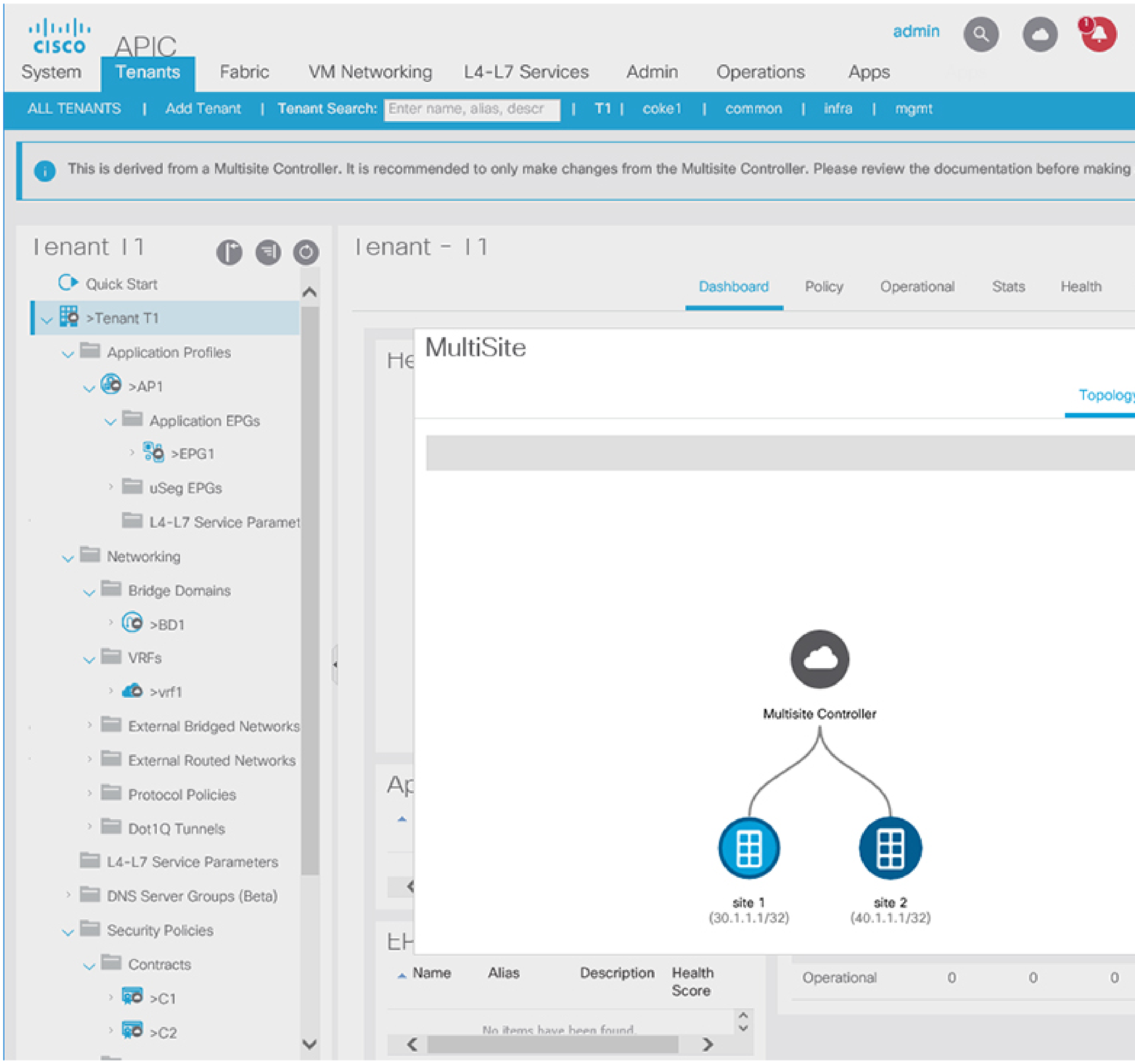
Step 5 In the top right of the **Property Pane**, click the **Open in APIC User Interface** icon to access the Cisco APIC GUI.

The APIC GUI login screen is displayed for logging in with APIC GUI credentials.

Viewing Cisco ACI Multi-Site-Managed Objects Using the Cisco APIC GUI

When an APIC cluster is managed by Multi-Site, cloud icons indicate the relationships with other sites.

Figure 4: Viewing Multi-Site-Managed Objects Using the APIC GUI



This is derived from a Multisite Controller. It is recommended to only make changes from the Multisite Controller. Please review the documentation before making

No items have been found.

Before you begin

The APIC cluster/site must be set up to be managed by Cisco ACI Multi-Site.

Step 1 To view the relationship of the APIC site with other sites, click the cloud icon at the upper right, next to the settings icons.

In the diagram, hover over the light blue site icon to see the local site details, and hover over the dark blue icon to see the remote site details.

In the image, T1 and its Application Profile, EPG, BD, VRF, and contracts are marked with cloud icons. This indicates that they are managed by Multi-Site. We recommend that you only make changes to these objects in the Multi-Site GUI.

Step 2 To view the localized or stretched usage of a VRF, bridge domain, or other objects, where there is a **Show Usage** button on the information page, perform the following steps; for example for Bridge Domain and VRF:

a) On the menu bar, click **Tenants** and double-click on a tenant that is managed by Multi-Site.

b) Click **Networking** > **Bridge Domains** > ***BD-name*** or **Networking** > **VRFs** > ***vrf-name***.

Step 3 Click **Show Usage**.

Here you can view the nodes or policies using the object.

Note It is recommended to make changes to managed policies only in the Multi-Site GUI.

Step 4 To set the scope of deployment notification settings for this BD or VRF, click **Change Deployment Settings**. You can enable warnings to be sent for all deletions and modifications of the object on the **Policy** tab.

Step 5 To enable or disable Global warnings, check or uncheck the **(Global) Show Deployment Warning on Delete/Modify** check box.

Step 6 To enable or disable Local warnings, choose **Yes** or **No** on the **(Local) Show Deployment Warning on Delete/Modify** field.

Step 7 To view any past warnings, click the **History** tab **Events** or **Audit Logs**.