



## Q-in-Q Encapsulation Mapping for EPGs

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## Q-in-Q Encapsulation Mapping for EPGs

Using Cisco Application Policy Infrastructure Controller (APIC), you can map double-tagged VLAN traffic ingress on a regular interface, PC, or vPC to an EPG. When this feature is enabled, when double-tagged traffic enters the network for an EPG, both tags are processed individually in the fabric and restored to double-tags when egressing the Cisco Application Centric Infrastructure (ACI) switch. Ingressing single-tagged and untagged traffic is dropped.

The following guidelines and limitations apply:

- This feature is only supported on Cisco Nexus 9300-FX platform switches.
- Both the outer and inner tag must be of EtherType 0x8100.
- MAC learning and routing are based on the EPG port, sclass, and VRF instance, not on the access encapsulations.
- QoS priority settings are supported, derived from the outer tag on ingress, and rewritten to both tags on egress.
- EPGs can simultaneously be associated with other interfaces on a leaf switch, that are configured for single-tagged VLANs.
- Service graphs are supported for provider and consumer EPGs that are mapped to Q-in-Q encapsulated interfaces. You can insert service graphs, as long as the ingress and egress traffic on the service nodes is in single-tagged encapsulated frames.
- When vPC ports are enabled for Q-in-Q encapsulation mode, VLAN consistency checks are not performed.

The following features and options are not supported with this feature:

- Per-port VLAN feature
- FEX connections

- Mixed mode

For example, an interface in Q-in-Q encapsulation mode can have a static path binding to an EPG with double-tagged encapsulation only, not with regular VLAN encapsulation.

- STP and the "Flood in Encapsulation" option
- Untagged and 802.1p mode
- Multi-pod and Multi-Site
- Legacy bridge domain
- L2Out and L3Out connections
- VMM integration
- Changing a port mode from routed to Q-in-Q encapsulation mode
- Per-VLAN mis-cabling protocol on ports in Q-in-Q encapsulation mode

## Configuring Q-in-Q Encapsulation Mapping for EPGs Using the GUI

### Enabling Q-in-Q Encapsulation on Specific Leaf Switch Interfaces Using the GUI

Leaf switch ports, PCs, or vPCs are enabled for Q-in-Q encapsulation mode in the **Interface** tab of one of the following locations in the APIC GUI.

- **Fabric > Inventory > Topology**
- **Fabric > Inventory > Pod**
- **Fabric > Inventory > Pod > leaf-name**

Configure vPCs on the **Topology** or **Pod Interface** tab.

#### Before you begin

The tenant, application profile, and the application EPG that will be mapped with an interface configured for Q-in-Q mode should be created.

#### Procedure

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- Step 1** On the menu bar, choose **Fabric > Inventory** and click **Topology**, **Pod**, or expand **Pod** and choose a leaf.
  - Step 2** On the **Topology** or **Pod** panel **Interface** tab.
  - Step 3** Click the **Operation/Configuration** toggle-button to display the configuration panel.
  - Step 4** Click + to add diagrams of leaf switches, choose one or more switches, and click **Add Selected**.

On the *leaf-name* panel **Interface** tab, a diagram of the switch appears automatically, after you click the **Operation/Configuration** toggle-button.

- Step 5** Click the interfaces to be enabled for Q-in-Q encapsulation mode.
- Step 6** To configure a port, perform the following steps:
- Click **L2** on the upper left.
  - On the L2 tab, on the **L2 QinQ State** field, click **Double Q Tag Port** and click **Submit**
- Step 7** To configure a PC, perform the following steps:
- Click **PC** on the upper left.
  - On the **Physical Interface** tab, enter the **Policy Group Name**.
  - On the L2 tab, on the **L2 QinQ State** field, click **Double Q Tag Port** and click **Submit**
- Step 8** To configure a vPC, perform the following steps:
- On two leaf switch diagrams, click the interfaces for the two legs of the VPC.
  - Click **vPC**.
  - On the **Physical Interface** tab, enter the **Logical Pair ID** (The identifier for the auto-protection group. Each protection group has a unique ID. The ID is a range of 1 to 1000) and the **Policy Group Name**.
  - On the L2 tab, on the **L2 QinQ State** field, click **Double Q Tag Port** and click **Submit**

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## Enabling Q-in-Q Encapsulation for Leaf Interfaces With Fabric Interface Policies Using the GUI

Enable leaf interfaces, PCs, and vPCs for Q-in-Q encapsulation, using a leaf interface profile.

### Before you begin

The tenant, application profile, and the application EPG that will be mapped with an interface configured for Q-in-Q mode should be created.

### Procedure

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- Step 1** On the menu bar, click **Fabric > External Access Policies**.
- Step 2** On the Navigation bar, click **Policies > Interface > L2 Interface**.
- Step 3** Right-click **L2 Interface**, select **Create L2 Interface Policy**, and perform the following actions:
- In the **Name** field, enter a name for the Layer 2 Interface policy.
  - Optional. Add a description of the policy. We recommend that you describe the purpose for the L2 Interface Policy.
  - To create an interface policy that enables Q-in-Q encapsulation, in the **QinQ** field, click **doubleQtagPort**.
  - Click **Submit**.
- Step 4** Apply the L2 Interface policy to a Policy Group with the following steps:
- Click on **Fabric > External Access Policies > Interfaces > Leaf Interfaces**, and expand **Policy Groups**.
  - Right-click **Leaf Access Port**, **PC Interface**, or **vPC Interface** and choose one of the following, depending on the type of interface you are configuring for the tunnel.

- **Create Leaf Access Port Policy Group**
- **Create PC Policy Group**
- **Create vPC Policy Group**

c) In the resulting dialog box, enter the policy group name, choose the L2 Interface policy that you previously created, and click **Submit**.

**Step 5** Create a Leaf Interface Profile with the following steps:

- a) Click on **Fabric > External Access Policies > Interface > Leaf Interfaces > Profiles**.
- b) Right-click on **Leaf Profiles**, choose **Create Leaf Interface Policy**, and perform the following steps:
  - In the **Name** field, type a name for the **Leaf Interface Profile**.  
Optional. Add a description.
  - On the **Interface Selectors** field, click the +, and enter the following information:
    - In the **Name** field, type a name for the interface selector.  
Optional. Add a description.
    - Enter the selector name, and optionally, a description.
    - In the **Interface IDs** field, enter the interface or multiple interfaces to be included in the profile.
    - In the **Interface Policy Group** field, choose the interface policy group that you previously created.

## Mapping an EPG to a Q-in-Q Encapsulation-Enabled Interface Using the GUI

You can associate EPGs with Q-in-Q encapsulation-enabled interfaces in one of the following models:

- Deploy a static EPG on specific Q-in-Q encapsulation-enabled interfaces
- Statically link an EPG with a Q-in-Q encapsulation-enabled leaf switch
- Associate an EPG with a Q-in-Q encapsulation-enabled endpoint (with a static MAC address)

All three tasks are performed in the same area of the APIC GUI.

### Before you begin

- Create the tenant, application profile, and application EPG that will be mapped with an interface configured for Q-in-Q mode.
- The target interfaces should be configured for Q-in-Q encapsulation.

### Procedure

**Step 1** In the menu bar, click **Tenants > tenant-name**.

- Step 2** In the Navigation pane, expand **Application Profiles** > > *application-profile-name* > **Application EPGs** > *application-EPG-name*.
- Step 3** To deploy a static EPG on an interface, PC, or vPC that has been enabled for Q-in-Q mode, perform the following steps:
- Under the application EPG, right- click **Static Ports** and choose **Deploy Static EPG on PC, vPC, or Interface**.
  - Choose the path type, the node, and the path to the Q-in-Q enabled interface.
  - On the **Port Encap (or Secondary VLAN for Micro-Seg)** field, choose **QinQ** and enter the outer and inner VLAN tags for traffic mapped to the EPG.
  - Click **Submit**.
- Step 4** To statically link an EPG with a node enabled with Q-in-Q mode, perform the following steps:
- Under the application EPG, right- click **Static Leafs** and choose **Statically Link With Node**.
  - In the Node field, choose the Q-in-Q-enabled switches from the list.
  - On the Encap field, choose **QinQ** and enter the outer and inner VLAN tags for the EPG.
  - Click **Submit**.
- Step 5** To associate an EPG with a static endpoint, perform the following steps:
- Under the application EPG, right- click **Static EndPoints** and choose **Create Static EndPoint**.
  - Enter the MAC address of the interface.
  - Choose the path type, node, and path to the Q-in-Q encapsulation-enabled interface.
  - Optional. Add IP addresses for the endpoint.
  - On the **Encap** field, choose **QinQ** and enter the outer and inner VLAN tags.
  - Click **Submit**.

## Mapping EPGs to Q-in-Q Encapsulated Leaf Interfaces Using the NX-OS Style CLI

Enable an interface for Q-in-Q encapsulation and associate the interface with an EPG.

### Before you begin

Create the tenant, application profile, and application EPG that will be mapped with an interface configured for Q-in-Q mode.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>Configure</b> <b>Example:</b> apicl# configure	Enters global configuration mode.
<b>Step 2</b>	<b>leaf number</b> <b>Example:</b>	Specifies the leaf to be configured.

	Command or Action	Purpose
	apic1(config)# leaf 101	
<b>Step 3</b>	<b>interface ethernet</b> <i>slot/port</i> <b>Example:</b> apic1 (config-leaf)# interface ethernet 1/25	Specifies the interface to be configured.
<b>Step 4</b>	<b>switchport mode dot1q-tunnel</b> <i>doubleQtagPort</i> <b>Example:</b> apic1(config-leaf-if)# switchport mode dot1q-tunnel doubleQtagPort	Enables an interface for Q-in-Q encapsulation.
<b>Step 5</b>	<b>switchport trunk qinq outer-vlan</b> <i>vlan-number</i> <b>inner-vlan</b> <i>vlan-number</i> <b>tenant</b> <i>tenant-name</i> <b>application</b> <i>application-name</i> <b>epg</b> <i>epg-name</i> <b>Example:</b> apic1(config-leaf-if)# switchport trunk qinq outer-vlan 202 inner-vlan 203 tenant tenant64 application AP64 epg EPG64	Associates the interface with an EPG.

### Example

The following example enables Q-in-Q encapsulation (with outer-VLAN ID 202 and inner-VLAN ID 203) on the leaf interface 101/1/25, and associates the interface with EPG64.

```
apic1(config)# leaf 101
apic1(config-leaf)# interface ethernet 1/25
apic1(config-leaf-if)# switchport mode dot1q-tunnel doubleQtagPort
apic1(config-leaf-if)# switchport trunk qinq outer-vlan 202 inner-vlan 203 tenant tenant64
application AP64 epg EPG64
```

## Mapping EPGs to Q-in-Q Encapsulation Enabled Interfaces Using the REST API

### Before you begin

Create the tenant, application profile, and application EPG that will be mapped with an interface configured for Q-in-Q mode.

### Procedure

Enable an interface for Q-in-Q encapsulation and associate the interface with an EPG, with XML such as the following example:

### Example:

```
<polUni>
  <fvTenant dn="uni/tn-tenant64" name="tenant64">
    <fvCtx name="VRF64"/>
    <fvBD name="BD64_1">
      <fvRsCtx tnFvCtxName="VRF64"/>
      <fvSubnet ip="20.0.1.2/24"/>
    </fvBD>
    <fvAp name="AP64">
      <fvAEPg name="WEB7">
        <fvRsBd tnFvBDName="BD64_1"/>
        <fvRsQinqPathAtt tDn="topology/pod-1/paths-101/pathep-[eth1/25]"
encap="qinq-202-203"/>
      </fvAEPg>
    </fvAp>
  </fvTenant>
</polUni>
```

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