Q-in-Q Encapsulation Mapping for EPGs

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Using Cisco Application Policy Infrastructure Controller (APIC), you can map double-tagged VLAN traffic ingressing 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 supported on Cisco Nexus 9300-FX, 9300-FX2, and 9300-FX3 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

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:

a) Click **L2** on the upper left.
b) 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:

a) Click **PC** on the upper left.
b) On the **Physical Interface** tab, enter the **Policy Group Name**.
c) 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:

a) On two leaf switch diagrams, click the interfaces for the two legs of the VPC.
b) Click **vPC**.
c) 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**.
d) On the L2 tab, on the **L2 QinQ State** field, click **Double Q Tag Port** and click **Submit**

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

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:

a) In the **Name** field, enter a name for the Layer 2 Interface policy.
b) Optional. Add a description of the policy. We recommend that you describe the purpose for the L2 Interface Policy.
c) To create an interface policy that enables Q-in-Q encapsulation, in the **QinQ** field, click **doubleQtagPort**.
d) Click **Submit**.

Step 4 Apply the L2 Interface policy to a Policy Group with the following steps:

a) Click on **Fabric** > **External Access Policies** > **Interfaces** > **Leaf Interfaces**, and expand **Policy Groups**.
b) 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.

SUMMARY STEPS

1. In the menu bar, click **Tenants** > ***tenant-name***.
2. In the Navigation pane, expand **Application Profiles** > > ***application-profile-name*** > **Application EPGs** > ***application-EPG-name***.
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:

4. To statically link an EPG with a node enabled with Q-in-Q mode, perform the following steps:
5. To associate an EPG with a static endpoint, perform the following steps:

DETAILED STEPS

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:

a) Under the application EPG, right- click **Static Ports** and choose **Deploy Static EPG on PC, vPC, or Interface**.
b) Choose the path type, the node, and the path to the Q-in-Q enabled interface.
c) 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.
d) Click **Submit**.

Step 4 To statically link an EPG with a node enabled with Q-in-Q mode, perform the following steps:

a) Under the application EPG, right- click **Static Leafs** and choose **Statically Link With Node**.
b) In the Node field, choose the Q-in-Q-enabled switches from the list.
c) On the Encap field, choose **QinQ** and enter the outer and inner VLAN tags for the EPG.
d) Click **Submit**.

Step 5 To associate an EPG with a static endpoint, perform the following steps:

a) Under the application EPG, right- click **Static EndPoints** and choose **Create Static EndPoint**.
b) Enter the MAC address of the interface.
c) Choose the path type, node, and path to the Q-in-Q encapsulation-enabled interface.
d) Optional. Add IP addresses for the endpoint.
e) On the **Encap** field, choose **QinQ** and enter the outer and inner VLAN tags.
f) 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.

SUMMARY STEPS

1. **Configure**

2. **leaf** *number*
3. **interface ethernet***slot/port*
4. **switchport mode dot1q-tunnel** doubleQtagPort
5. **switchport trunkqinq outer-vlan***vlan-number* **inner-vlan** *vlan-number* **tenant** *tenant-name* **application** *application-name* **epg** *epg-name*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**Configure** **Example:** `apic1# configure`	Enters global configuration mode.
Step 2	**leaf** *number* **Example:** apic1(config)# leaf 101	Specifies the leaf to be configured.
Step 3	**interface ethernet***slot/port* **Example:** `apic1 (config-leaf)# interface ethernet 1/25`	Specifies the interface to be configured.
Step 4	**switchport mode dot1q-tunnel** doubleQtagPort **Example:** `apic1(config-leaf-if)# switchport mode dot1q-tunnel doubleQtagPort`	Enables an interface for Q-in-Q encapsulation.
Step 5	**switchport trunkqinq outer-vlan***vlan-number* **inner-vlan** *vlan-number* **tenant** *tenant-name* **application** *application-name* **epg** *epg-name* **Example:** `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
```