EPGs

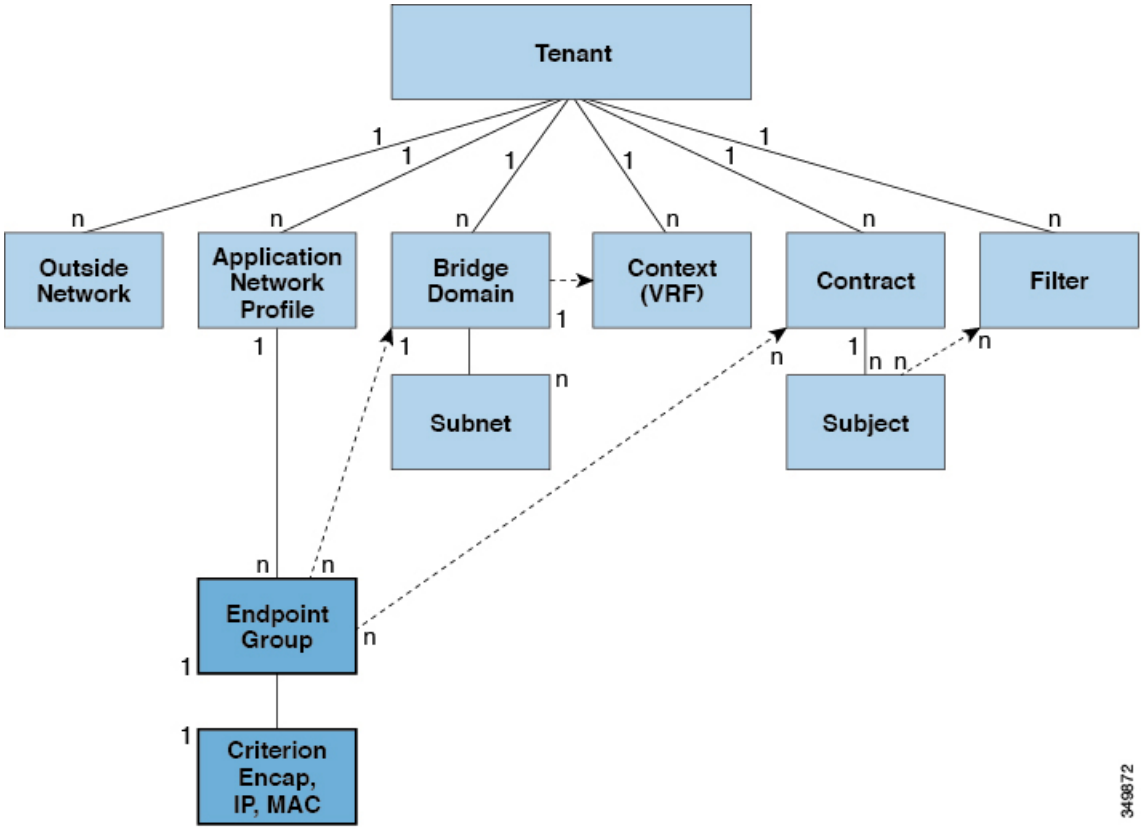
This chapter contains the following sections:

About Endpoint Groups

Endpoint Groups

The endpoint group (EPG) is the most important object in the policy model. The following figure shows where application EPGs are located in the management information tree (MIT) and their relation to other objects in the tenant.

Figure 1: Endpoint Groups



An EPG is a managed object that is a named logical entity that contains a collection of endpoints. Endpoints are devices that are connected to the network directly or indirectly. They have an address (identity), a location, attributes (such as version or patch level), and can be physical or virtual. Knowing the address of an endpoint also enables access to all its other identity details. EPGs are fully decoupled from the physical and logical topology. Endpoint examples include servers, virtual machines, network-attached storage, or clients on the Internet. Endpoint membership in an EPG can be dynamic or static.

The ACI fabric can contain the following types of EPGs:

- Application endpoint group (`fvAEPg`)
- Layer 2 external outside network instance endpoint group (`l2extInstP`)
- Layer 3 external outside network instance endpoint group (`l3extInstP`)
- Management endpoint groups for out-of-band (`mgmtOoB`) or in-band (`mgmtInB`) access.

EPGs contain endpoints that have common policy requirements such as security, virtual machine mobility (VMM), QoS, or Layer 4 to Layer 7 services. Rather than configure and manage endpoints individually, they are placed in an EPG and are managed as a group.

Policies apply to EPGs, never to individual endpoints. An EPG can be statically configured by an administrator in the APIC, or dynamically configured by an automated system such as vCenter or OpenStack.

Note When an EPG uses a static binding path, the encapsulation VLAN associated with this EPG must be part of a static VLAN pool. For IPv4/IPv6 dual-stack configurations, the IP address property is contained in the `fvStIp` child property of the `fvStCEp` MO. Multiple `fvStIp` objects supporting IPv4 and IPv6 addresses can be added under one `fvStCEp` object. When upgrading ACI from IPv4-only firmware to versions of firmware that support IPv6, the existing IP property is copied to an `fvStIp` MO.

Regardless of how an EPG is configured, EPG policies are applied to the endpoints they contain.

WAN router connectivity to the fabric is an example of a configuration that uses a static EPG. To configure WAN router connectivity to the fabric, an administrator configures an `l3extInstP` EPG that includes any endpoints within an associated WAN subnet. The fabric learns of the EPG endpoints through a discovery process as the endpoints progress through their connectivity life cycle. Upon learning of the endpoint, the fabric applies the `l3extInstP` EPG policies accordingly. For example, when a WAN connected client initiates a TCP session with a server within an application (`fvAEPg`) EPG, the `l3extInstP` EPG applies its policies to that client endpoint before the communication with the `fvAEPg` EPG web server begins. When the client server TCP session ends and communication between the client and server terminate, that endpoint no longer exists in the fabric.

Note If a leaf switch is configured for *static binding (leaf switches)* under an EPG, the following restrictions apply:

- The static binding cannot be overridden with a static path.
- Interfaces in that switch cannot be used for routed external network (L3out) configurations.
- Interfaces in that switch cannot be assigned IP addresses.

Virtual machine management connectivity to VMware vCenter is an example of a configuration that uses a dynamic EPG. Once the virtual machine management domain is configured in the fabric, vCenter triggers the dynamic configuration of EPGs that enable virtual machine endpoints to start up, move, and shut down as needed.

ACI Policy Configuration in EPG Shutdown

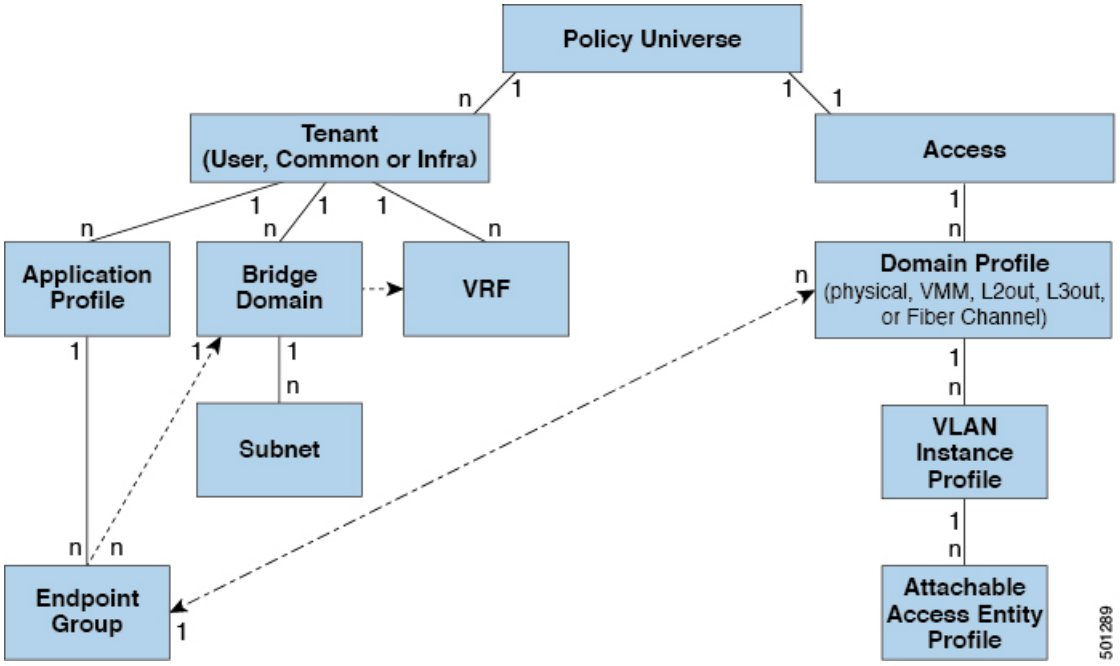
When the EPG is in shut down mode, the ACI policy configuration related to the EPG is removed from all the switches. The EPG is deleted from all the switches. While the EPG still exists in the ACI Data Store, it will be in inactive mode. In the APIC GUI you can check the box to remove the EPG from service.

Note Hosts attached to a EPG in shutdown mode cannot send or receive to/from the EPG.

Access Policies Automate Assigning VLANs to EPGs

While tenant network policies are configured separately from fabric access policies, tenant policies are not activated unless their underlying access policies are in place. Fabric access external-facing interfaces connect to external devices such as virtual machine controllers and hypervisors, hosts, routers, or Fabric Extenders (FEXs). Access policies enable an administrator to configure port channels and virtual port channels, protocols such as LLDP, CDP, or LACP, and features such as monitoring or diagnostics.

Figure 2: Association of Endpoint Groups with Access Policies



In the policy model, EPGs are tightly coupled with VLANs. For traffic to flow, an EPG must be deployed on a leaf port with a VLAN in a physical, VMM, L2out, L3out, or Fibre Channel domain. For more information, see Networking Domains.

In the policy model, the domain profile associated to the EPG contains the VLAN instance profile. The domain profile contains both the VLAN instance profile (VLAN pool) and the attacheable Access Entity Profile (AEP), which are associated directly with application EPGs. The AEP deploys the associated application EPGs to all the ports to which it is attached, and automates the task of assigning VLANs. While a large data center could easily have thousands of active virtual machines provisioned on hundreds of VLANs, the ACI fabric can automatically assign VLAN IDs from VLAN pools. This saves a tremendous amount of time, compared with trunking down VLANs in a traditional data center.

VLAN Guidelines

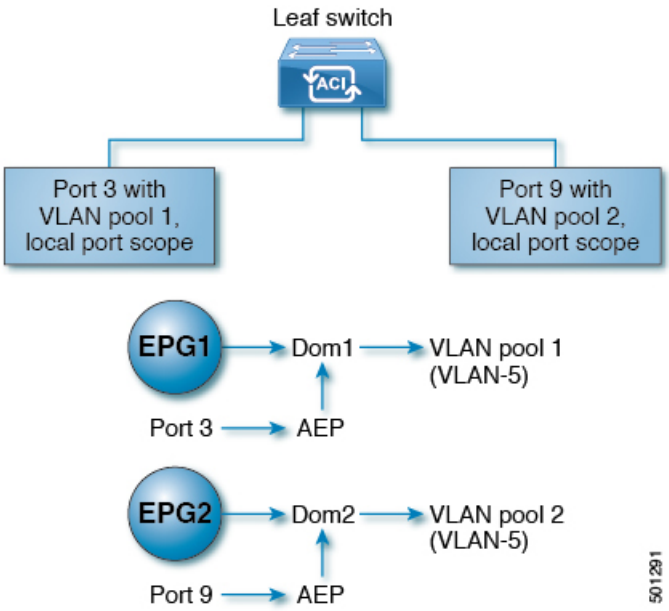
Use the following guidelines to configure the VLANs where EPG traffic will flow.

- Multiple domains can share a VLAN pool, but a single domain can only use one VLAN pool.
- To deploy multiple EPGs with same VLAN encapsulation on a single leaf switch, see Per Port VLAN, on page 4.

Per Port VLAN

In ACI versions prior to the v1.1 release, a given VLAN encapsulation maps to only a single EPG on a leaf switch. If there is a second EPG which has the same VLAN encapsulation on the same leaf switch, the ACI raises a fault.

Starting with the v1.1 release, you can deploy multiple EPGs with the same VLAN encapsulation on a given leaf switch (or FEX), in the Per Port VLAN configuration, similar to the following diagram:



To enable deploying multiple EPGs using the same encapsulation number, on a single leaf switch, use the following guidelines:

- EPGs must be associated with different bridge domains.
- EPGs must be deployed on different ports.
- Both the port and EPG must be associated with the same domain that is associated with a VLAN pool that contains the VLAN number.
- Ports must be configured with `portLocal` VLAN scope.

For example, with Per Port VLAN for the EPGs deployed on ports 3 and 9 in the diagram above, both using VLAN-5, port 3 and EPG1 are associated with Dom1 (pool 1) and port 9 and EPG2 are associated with Dom2 (pool 2).

Traffic coming from port 3 is associated with EPG1, and traffic coming from port 9 is associated with EPG2.

This does not apply to ports configured for Layer 3 external outside connectivity.

When an EPG has more than one physical domain with overlapping VLAN pools, avoid adding more than one domain to the AEP that is used to deploy the EPG on the ports. This avoids the risk of traffic forwarding issues.

When an EPG has only one physical domain with overlapping VLAN pool, you can associate multiple domains with single AEP.

Only ports that have the `vlanScope` set to `portlocal` allow allocation of separate (Port, VLAN) translation entries in both ingress and egress directions. For a given port with the `vlanScope` set to `portGlobal` (the default), each VLAN used by an EPG must be unique on a given leaf switch.

Note Per Port VLAN is not supported on interfaces configured with Multiple Spanning Tree (MST), which requires VLAN IDs to be unique on a single leaf switch, and the VLAN scope to be global.

Reusing VLAN Numbers Previously Used for EPGs on the Same Leaf Switch

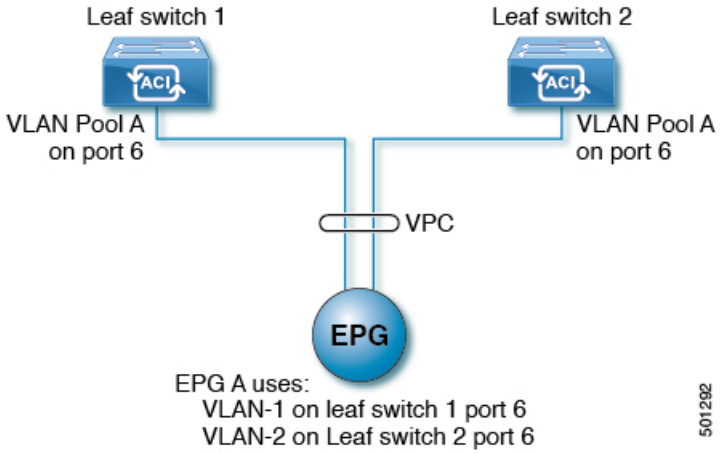
If you have previously configured VLANs for EPGs that are deployed on a leaf switch port, and you want to reuse the same VLAN numbers for different EPGs on different ports on the same leaf switch, use a process, such as the following example, to set them up without disruption:

In this example, EPGs were previously deployed on a port associated with a domain including a VLAN pool with a range of 9-100. You want to configure EPGs using VLAN encapsulations from 9-20.

1. Configure a new VLAN pool on a different port (with a range of, for example, 9-20).
2. Configure a new physical domain that includes leaf ports that are connected to firewalls.
3. Associate the physical domain to the VLAN pool you configured in step 1.
4. Configure the VLAN Scope as `portLocal` for the leaf port.
5. Associate the new EPGs (used by the firewall in this example) to the physical domain you created in step 2.
6. Deploy the EPGs on the leaf ports.

VLAN Guidelines for EPGs Deployed on vPCs

Figure 3: VLANs for Two Legs of a vPC



When an EPG is deployed on a vPC, it must be associated with the same domain (with the same VLAN pool) that is assigned to the leaf switch ports on the two legs of the vPC.

In this diagram, EPG A is deployed on a vPC that is deployed on ports on Leaf switch 1 and Leaf switch 2. The two leaf switch ports and the EPG are all associated with the same domain, containing the same VLAN pool.

Deploying an EPG on a Specific Port

Deploying an EPG on a Specific Node or Port Using the GUI

Before you begin

The tenant where you deploy the EPG is already created.

You can create an EPG on a specific node or a specific port on a node.

Procedure

Step 1 Log in to the Cisco APIC.

Step 2 Choose **Tenants** > ***tenant*** .

Step 3 In the left navigation pane, expand ***tenant*** , **Application Profiles**, and the ***application profile*** .

Step 4 Right-click **Application EPGs** and choose **Create Application EPG**.

Step 5 In the **Create Application EPG STEP 1 > Identity** dialog box, complete the following steps:

a) In the **Name** field, enter a name for the EPG.

b) From the **Bridge Domain** drop-down list, choose a bridge domain.

c) Check the **Statically Link with Leaves/Paths** check box.

This check box allows you to specify on which port you want to deploy the EPG.

d) Click **Next**.

e) From the **Path** drop-down list, choose the static path to the destination EPG.

Step 6 In the **Create Application EPG STEP 2 > Leaves/Paths** dialog box, from the **Physical Domain** drop-down list, choose a physical domain.

Step 7 Complete one of the following sets of steps:

Option	Description
If you want to deploy the EPG on...	Then
A node	**a.** Expand the **Leaves** area. **b.** From the **Node** drop-down list, choose a node. **c.** In the **Encap** field, enter the appropriate VLAN. **d.** (Optional) From the **Deployment Immediacy** drop-down list, accept the default **On Demand** or choose **Immediate**. **e.** (Optional) From the Mode drop-down list, accept the default **Trunk** or choose another mode.
A port on the node	**a.** Expand the **Paths** area. **b.** From the **Path** drop-down list, choose the appropriate node and port.

Option	Description
	c. (Optional) In the **Deployment Immediacy** field drop-down list, accept the default **On Demand** or choose **Immediate**. **d.** (Optional) From the Mode drop-down list, accept the default **Trunk** or choose another mode. **e.** In the **Port Encap** field, enter the secondary VLAN to be deployed. **f.** (Optional) In the **Primary Encap** field, enter the primary VLAN to be deployed.

Step 8 Click **Update** and click **Finish**.

Step 9 In the left navigation pane, expand the EPG that you created.

Step 10 Complete one of the following actions:

- If you created the EPG on a node, click **Static Leafs**, and in the work pane view details of the static binding paths.
- If you created the EPG on a port of the node, click **Static Ports**, and in the work pane view details of the static binding paths.

Deploying an EPG on a Specific Port with APIC Using the NX-OS Style CLI

Procedure

Step 1 Configure a VLAN domain:

Example:

```
apic1(config)# vlan-domain dom1
apic1(config-vlan)# vlan 10-100
```

Step 2 Create a tenant:

Example:

```
apic1# configure
apic1(config)# tenant t1
```

Step 3 Create a private network/VRF:

Example:

```
apic1(config-tenant)# vrf context ctx1
apic1(config-tenant-vrf)# exit
```

Step 4 Create a bridge domain:

Example:

```
apic1(config-tenant)# bridge-domain bd1
```

```
apic1(config-tenant-bd)# vrf member ctx1
apic1(config-tenant-bd)# exit
```

Step 5 Create an application profile and an application EPG:

Example:

```
apic1(config-tenant)# application AP1
apic1(config-tenant-app)# epg EPG1
apic1(config-tenant-app-epg)# bridge-domain member bd1
apic1(config-tenant-app-epg)# exit
apic1(config-tenant-app)# exit
apic1(config-tenant)# exit
```

Step 6 Associate the EPG with a specific port:

Example:

```
apic1(config)# leaf 1017
apic1(config-leaf)# interface ethernet 1/13
apic1(config-leaf-if)# vlan-domain member dom1
apic1(config-leaf-if)# switchport trunk allowed vlan 20 tenant t1 application AP1 epg EPG1
```

Note The vlan-domain and vlan-domain member commands mentioned in the above example are a pre-requisite for deploying an EPG on a port.

Deploying an EPG on a Specific Port with APIC Using the REST API

Before you begin

The tenant where you deploy the EPG is created.

Procedure

Deploy an EPG on a specific port.

Example:

```
<fvTenant name="<tenant_name>" dn="uni/tn-test1" >
    <fvCtx name="<network_name>" pcEnfPref="enforced" knwMcastAct="permit"/>
    <fvBD name="<bridge_domain_name>" unkMcastAct="flood" >
        <fvRsCtx tnFvCtxName="<network_name>"/>
    </fvBD>
    <fvAp name="<application_profile>" >
        <fvAEPg name="<epg_name>" >
            <fvRsPathAtt tDn="topology/pod-1/paths-1017/pathep-[eth1/13]" mode="regular"
instrImedcy="immediate" encap="vlan-20"/>
        </fvAEPg>
    </fvAp>
</fvTenant>
```

Creating Domains, Attach Entity Profiles, and VLANs to Deploy an EPG on a Specific Port

Creating Domains, Attach Entity Profiles, and VLANs to Deploy an EPG on a Specific Port

This topic provides a typical example of how to create physical domains, Attach Entity Profiles (AEP), and VLANs that are mandatory to deploy an EPG on a specific port.

All endpoint groups (EPGs) require a domain. Interface policy groups must also be associated with Attach Entity Profile (AEP), and the AEP must be associated with a domain, if the AEP and EPG have to be in same domain. Based on the association of EPGs to domains and of interface policy groups to domains, the ports and VLANs that the EPG uses are validated. The following domain types associate with EPGs:

- Application EPGs
- Layer 3 external outside network instance EPGs
- Layer 2 external outside network instance EPGs
- Management EPGs for out-of-band and in-band access

The APIC checks if an EPG is associated with one or more of these types of domains. If the EPG is not associated, the system accepts the configuration but raises a fault. The deployed configuration may not function properly if the domain association is not valid. For example, if the VLAN encapsulation is not valid for use with the EPG, the deployed configuration may not function properly.

Note EPG association with the AEP without static binding does not work in a scenario when you configure the EPG as **Trunk** under the AEP with one end point under the same EPG supporting Tagging and the other end point in the same EPG does not support VLAN tagging. While associating AEP under the EPG, you can configure it as Trunk, Access (Tagged) or Access (Untagged).

Creating Domains, and VLANS to Deploy an EPG on a Specific Port Using the GUI

Before you begin

- The tenant where you deploy the EPG is already created.
- An EPG is statically deployed on a specific port.

Procedure

Step 1 On the menu bar, click **Fabric** > **Access Policies**.

Step 2 In the **Navigation** pane, click **Quick Start**.

Step 3 In the **Work** pane, click **Configure an Interface, PC, and vPC**.

Step 4 In the **Configure an Interface, PC, and vPC** dialog box, click the + icon to select switches and perform the following actions:

a) From the **Switches** drop-down list, check the check box for the desired switch.
b) In the **Switch Profile Name** field, a switch name is automatically populated.

Note Optionally, you can enter a modified name.

c) Click the + icon to configure the switch interfaces.
d) In the **Interface Type** field, click the **Individual** radio button.
e) In the **Interfaces** field, enter the range of desired interfaces.
f) In the **Interface Selector Name** field, an interface name is automatically populated.

Note Optionally, you can enter a modified name.

g) In the **Interface Policy Group** field, choose the **Create One** radio button.
h) From the **Link Level Policy** drop-down list, choose the appropriate link level policy.

Note Create additional policies as desired, otherwise the default policy settings are available.

i) From the **Attached Device Type** field, choose the appropriate device type.
j) In the **Domain** field, click the **Create One** radio button.
k) In the **Domain Name** field, enter a domain name.
l) In the **VLAN** field, click the **Create One** radio button.
m) In the **VLAN Range** field, enter the desired VLAN range. Click **Save**, and click **Save** again.
n) Click **Submit**.

Step 5 On the menu bar, click **Tenants**. In the **Navigation** pane, expand the appropriate ***Tenant_name*** > **Application Profiles** > **Application EPGs** > ***EPG_name*** and perform the following actions:

a) Right-click **Domains (VMs and Bare-Metals)**, and click **Add Physical Domain Association**.
b) In the **Add Physical Domain Association** dialog box, from the **Physical Domain Profile** drop-down list, choose the appropriate domain.
c) Click **Submit**.
The AEP is associated with a specific port on a node and with a domain. The physical domain is associated with the VLAN pool and the Tenant is associated with this physical domain.

The switch profile and the interface profile are created. The policy group is created in the port block under the interface profile. The AEP is automatically created, and it is associated with the port block and with the domain. The domain is associated with the VLAN pool and the Tenant is associated with the domain.

Creating AEP, Domains, and VLANs to Deploy an EPG on a Specific Port Using the NX-OS Style CLI

Before you begin

- The tenant where you deploy the EPG is already created.

- An EPG is statically deployed on a specific port.

Procedure

Step 1 Create a VLAN domain and assign VLAN ranges:

Example:

```
apic1(config)# vlan-domain domP
apic1(config-vlan)# vlan 10
apic1(config-vlan)# vlan 25
apic1(config-vlan)# vlan 50-60
apic1(config-vlan)# exit
```

Step 2 Create an interface policy group and assign a VLAN domain to the policy group:

Example:

```
apic1(config)# template policy-group PortGroup
apic1(config-pol-grp-if)# vlan-domain member domP
```

Step 3 Create a leaf interface profile, assign an interface policy group to the profile, and assign the interface IDs on which the profile will be applied:

Example:

```
apic1(config)# leaf-interface-profile InterfaceProfile1
apic1(config-leaf-if-profile)# leaf-interface-group range
apic1(config-leaf-if-group)# policy-group PortGroup
apic1(config-leaf-if-group)# interface ethernet 1/11-13
apic1(config-leaf-if-profile)# exit
```

Step 4 Create a leaf profile, assign the leaf interface profile to the leaf profile, and assign the leaf IDs on which the profile will be applied:

Example:

```
apic1(config)# leaf-profile SwitchProfile-1019
apic1(config-leaf-profile)# leaf-interface-profile InterfaceProfile1
apic1(config-leaf-profile)# leaf-group range
apic1(config-leaf-group)# leaf 1019
apic1(config-leaf-group)#
```

Creating AEP, Domains, and VLANs to Deploy an EPG on a Specific Port Using the REST API

Before you begin

- The tenant where you deploy the EPG is already created.
- An EPG is statically deployed on a specific port.

Procedure

Step 1 Create the interface profile, switch profile and the Attach Entity Profile (AEP).

Example:

```
   <infraInfra>

      <infraNodeP  name="<switch_profile_name>" dn="uni/infra/nprof-<switch_profile_name>"
 >
           <infraLeafS  name="SwitchSeletor" descr="" type="range">
                <infraNodeBlk name="nodeBlk1" descr="" to_="1019" from_="1019"/>
           </infraLeafS>
          <infraRsAccPortP tDn="uni/infra/accportprof-<interface_profile_name>"/>
      </infraNodeP>

      <infraAccPortP name="<interface_profile_name>"
dn="uni/infra/accportprof-<interface_profile_name>" >
           <infraHPortS  name="portSelector"  type="range">
                <infraRsAccBaseGrp tDn="uni/infra/funcprof/accportgrp-<port_group_name>"
fexId="101"/>
              <infraPortBlk name="block2"  toPort="13" toCard="1" fromPort="11"
fromCard="1"/>
         </infraHPortS>
     </infraAccPortP>

    <infraAccPortGrp  name="<port_group_name>"
dn="uni/infra/funcprof/accportgrp-<port_group_name>" >
          <infraRsAttEntP tDn="uni/infra/attentp-<attach_entity_profile_name>"/>
          <infraRsHIfPol tnFabricHIfPolName="1GHifPol"/>
    </infraAccPortGrp>

    <infraAttEntityP  name="<attach_entity_profile_name>"
dn="uni/infra/attentp-<attach_entity_profile_name>" >
         <infraRsDomP tDn="uni/phys-<physical_domain_name>"/>
    </infraAttEntityP>

<infraInfra>
```

Step 2 Create a domain.

Example:

```
<physDomP  name="<physical_domain_name>" dn="uni/phys-<physical_domain_name>">
    <infraRsVlanNs tDn="uni/infra/vlanns-[<vlan_pool_name>]-static"/>
</physDomP>
```

Step 3 Create a VLAN range.

Example:

```
<fvnsVlanInstP  name="<vlan_pool_name>" dn="uni/infra/vlanns-[<vlan_pool_name>]-static"
allocMode="static">
    <fvnsEncapBlk name="" descr="" to="vlan-25" from="vlan-10"/>
</fvnsVlanInstP>
```

Step 4 Associate the EPG with the domain.

Example:

```
<fvTenant  name="<tenant_name>" dn="uni/tn-" >
    <fvAEPg prio="unspecified" name="<epg_name>" matchT="AtleastOne"
dn="uni/tn-test1/ap-AP1/epg-<epg_name>" descr="">
        <fvRsDomAtt tDn="uni/phys-<physical_domain_name>" instrImedcy="immediate"
resImedcy="immediate"/>
```

```
    </fvAEPg>
</fvTenant>
```

Validating Overlapping VLANs

This global feature prevents association of overlapping VLAN pools on a single EPG. If there are any overlapping pools allocated with any EPG in APIC, then this feature cannot be enabled (an error is displayed if there is an attempt to enable it). If no existing overlapping pools are present, then this feature can be enabled. Once enabled, when an attempt to allocate a domain on an EPG is performed, and the domain contains a VLAN pool with a range overlapping with another domain already associate to the EPG, then the configuration is blocked.

When overlapping VLAN pools exist under an EPG, then the FD VNID allocated for the EPG by each switch is non-deterministic and different switches may allocate different VNIDs. This can cause EPM sync failures between leafs within a vPC domain (causing intermittent connectivity for all endpoints within the EPG). It can also cause bridging loops if user is extending STP between the EPG, as the BPDUs will be dropped between switches due to FD VNID mismatch.

Validating Overlapping VLANs Using the GUI

This procedure provides an example of using the APIC GUI to configure overlapping VLAN validation.

Procedure

Step 1 On the menu bar, choose **System** > **System Settings**.

Step 2 In the navigation pane, choose **Fabric Wide Setting**.

Step 3 In the work pane, locate and check **Enforce EPG VLAN Validation**.

Note If overlapping VLAN pools already exist and this parameter is checked, the system returns an error. You must assign VLAN pools that are not overlapping to the EPGs before choosing this feature.

If this parameter is checked and an attempt is made to add an overlapping VLAN pool to an EPG, the system returns an error.

Step 4 Click **Submit**.

Validating Overlapping VLANs Using the REST API

This procedure provides an example of using the REST API to configure overlapping VLAN validation.

Procedure

Step 1 Send this HTTP POST message to enable the validation using the XML API.

Example:

```
POST https://apic-ip-address/api/mo/infra/settings.xml
```

Step 2 Include this XML structure in the body of the POST message.

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<infraSetPol validateOverlappingVlans=yes />'
```

Note If overlapping VLANs already exist, an error message appears during the POST with the corresponding EPG that has overlapping VLANs:

```
<?xml version="1.0" encoding="UTF-8"?><imdata totalCount="1">
<error code="100" text="Validation failed: Vlan ranges for an EPg cannot overlap
 Dn0=uni/tn-ag/ap-app/epg-e1,
"/></imdata>
```

Deploying EPGs to Multiple Interfaces Through Attached Entity Profiles

Deploying an Application EPG through an AEP or Interface Policy Group to Multiple Ports

Through the APIC Advanced GUI and REST API, you can associate attached entity profiles directly with application EPGs. By doing so, you deploy the associated application EPGs to all those ports associated with the attached entity profile in a single configuration.

Through the APIC REST API or the NX-OS style CLI, you can deploy an application EPG to multiple ports through an Interface Policy Group.

Deploying an EPG through an AEP to Multiple Interfaces Using the APIC GUI

You can quickly associate an application with an attached entity profile to quickly deploy that EPG over all the ports associated with that attached entity profile.

Before you begin

- The target application EPG is created.
- The VLAN pools has been created containing the range of VLANs you wish to use for EPG Deployment on the AEP.
- The physical domain has been created and linked to the VLAN Pool and AEP.
- The target attached entity profile is created and is associated with the ports on which you want to deploy the application EPG.

Procedure

Step 1 Navigate to the target attached entity profile.

a) Open the page for the attached entity profile to use. In the GUI, click **Fabric** > **Access Policies** > **Policies** > **Global** > **Attachable Access Entity Profiles**.

b) Click the target attached entity profile to open its Attachable Access Entity Profile window.

Step 2 Click the **Show Usage** button to view the leaf switches and interfaces associated with this attached entity profile.

the application EPGs associated with this attached entity profile are deployed to all the ports on all the switches associated with this attached entity profile.

Step 3 Use the **Application EPGs** table to associate the target application EPG with this attached entity profile. Click + to add an application EPG entry. Each entry contains the following fields:

Field	Action
Application EPGs	Use the drop down to choose the associated Tenant, Application Profile, and target application EPG.
Encap	Enter the name of the VLAN over which the target application EPG will communicate.
Primary Encap	If the application EPG requires a primary VLAN, enter the name of the primary VLAN.
Mode	Use the drop down to specify the mode in which data is transmitted: • **Trunk** -- Choose if traffic from the host is tagged with a VLAN ID. • **Access** -- Choose if traffic from the host is tagged with an 802.1p tag. • **Access Untagged** -- Choose if the traffic from the host is untagged.

Step 4 Click **Submit**.
the application EPGs associated with this attached entity profile are deployed to all the ports on all the switches associated with this attached entity profile.

Deploying an EPG through an Interface Policy Group to Multiple Interfaces Using the NX-OS Style CLI

In the NX-OS CLI, an attached entity profile is not explicitly defined to associate with an EPG for rapid deployment; instead the interface policy group is defined, assigned a domain, applied to all the ports associated with a VLAN and configured to include the application EPG to be deployed over that VLAN.

Before you begin

- The target application EPG is created.

- The VLAN pools has been created containing the range of VLANs you wish to use for EPG Deployment on the AEP.
- The physical domain has been created and linked to the VLAN Pool and AEP.
- The target attached entity profile is created and is associated with the ports on which you want to deploy the application EPG.

Procedure

Step 1 Associate the target EPG with the interface policy group.

The sample command sequence specifies an interface policy group **pg3** associated with VLAN domain, **domain1**, and with VLAN **1261**. The application EPG, **epg47** is deployed to all interfaces associated with this policy group.

Example:

```
 apic1# configure terminal
apic1(config)# template policy-group pg3
apic1(config-pol-grp-if)# vlan-domain member domain1
apic1(config-pol-grp-if)# switchport trunk allowed vlan 1261 tenant tn10 application pod1-AP

      epg epg47
```

Step 2 Check the target ports to ensure deployment of the policies of the interface policy group associated with application EPG.

The output of the sample **show** command sequence indicates that policy group **pg3** is deployed on Ethernet port **1/20** on leaf switch **1017**.

Example:

```
 apic1# show run leaf 1017 int eth 1/20
# Command: show running-config leaf 1017 int eth 1/20
# Time: Mon Jun 27 22:12:10 2016
  leaf 1017
    interface ethernet 1/20
      policy-group pg3
      exit
    exit
ifav28-ifc1#
```

Deploying an EPG through an AEP to Multiple Interfaces Using the REST API

The interface selectors in the AEP enable you to configure multiple paths for an AEPg. The following can be selected:

1. A node or a group of nodes
2. An interface or a group of interfaces

   The interfaces consume an interface policy group (and so an `infra:AttEntityP`).
3. The infra:AttEntityP is associated to the AEPg, thus specifying the VLANs to use.

An infra:AttEntityP can be associated with multiple AEPgs with different VLANs.

When you associate the infra:AttEntityP with the AEPg, as in 3, this deploys the AEPg on the nodes selected in 1, on the interfaces in 2, with the VLAN provided by 3.

In this example, the AEPg `uni/tn-Coke/ap-AP/epg-EPG1` is deployed on interfaces 1/10, 1/11, and 1/12 of nodes 101 and 102, with vlan-102.

Before you begin

- Create the target application EPG (`AEPg`).
- Create the VLAN pool containing the range of VLANs you wish to use for EPG deployment with the Attached Entity Profile (AEP).
- Create the physical domain and link it to the VLAN pool and AEP.

Procedure

To deploy an AEPg on selected nodes and interfaces, send a post with XML such as the following:

Example:

```
 <infraInfra dn="uni/infra">
   <infraNodeP name="NodeProfile">
       <infraLeafS name="NodeSelector" type="range">
          <infraNodeBlk name="NodeBlok" from_="101" to_="102"/>
          <infraRsAccPortP tDn="uni/infra/accportprof-InterfaceProfile"/>
        </infraLeafS>
   </<infraNodeP>

   <infraAccPortP name="InterfaceProfile">
      <infraHPortS name="InterfaceSelector" type="range">
          <infraPortBlk name=" InterfaceBlock" fromCard="1" toCard="1" fromPort="10"
toPort="12"/>
          <infraRsAccBaseGrp tDn="uni/infra/funcprof/accportgrp-PortGrp" />
      </infraHPortS>
   </infraAccPortP>

   <infraFuncP>
       <infraAccPortGrp name="PortGrp">
           <infraRsAttEntP  tDn="uni/infra/attentp-AttEntityProfile"/>
       </infraAccPortGrp>
   </infraFuncP>

   <infraAttEntityP name="AttEntityProfile" >
       <infraGeneric name="default" >
          <infraRsFuncToEpg tDn="uni/tn-Coke/ap-AP/epg-EPG1" encap="vlan-102"/>
       </infraGeneric>
   </infraAttEntityP>
</infraInfra>
```

Intra-EPG Isolation

Intra-EPG Endpoint Isolation

Intra-EPG endpoint isolation policies provide full isolation for virtual or physical endpoints; no communication is allowed between endpoints in an EPG that is operating with isolation enforced. Isolation enforced EPGs reduce the number of EPG encapsulations required when many clients access a common service but are not allowed to communicate with each other.

An EPG is isolation enforced for all Cisco Application Centric Infrastructure (ACI) network domains or none. While the Cisco ACI fabric implements isolation directly to connected endpoints, switches connected to the fabric are made aware of isolation rules according to a primary VLAN (PVLAN) tag.

Note If an EPG is configured with intra-EPG endpoint isolation enforced, these restrictions apply:

- All Layer 2 endpoint communication across an isolation enforced EPG is dropped within a bridge domain.
- All Layer 3 endpoint communication across an isolation enforced EPG is dropped within the same subnet.
- Preserving QoS CoS priority settings is not supported when traffic is flowing from an EPG with isolation enforced to an EPG without isolation enforced.

BPDUs are not forwarded through EPGs with intra-EPG isolation enabled. Therefore, when you connect an external Layer 2 network that runs spanning tree in a VLAN that maps to an isolated EPG on Cisco ACI, Cisco ACI might prevent spanning tree in the external network from detecting a Layer 2 loop. You can avoid this issue by ensuring that there is only a single logical link between Cisco ACI and the external network in these VLANs.

Intra-EPG Isolation for Bare Metal Servers

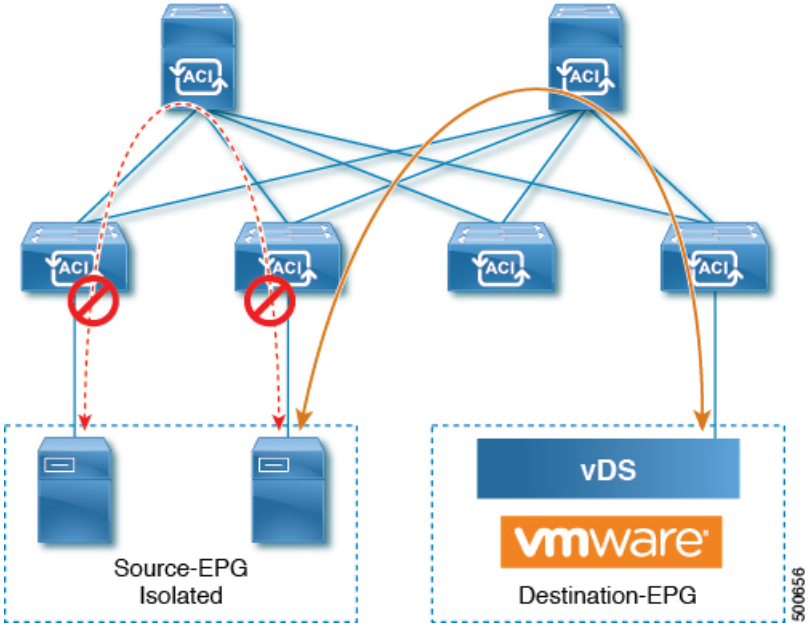
Intra-EPG Isolation for Bare Metal Servers

Intra-EPG endpoint isolation policies can be applied to directly connected endpoints such as bare metal servers.

Examples use cases include the following:

- Backup clients have the same communication requirements for accessing the backup service, buy they don't need to communicate with each other.
- Servers behind a load balancer have the same communication requirements, but isolating them from each other protects against a server that is compromised or infected.

Figure 4: Intra-EPG Isolation for Bare Metal Servers



Bare metal EPG isolation is enforced at the leaf switch. Bare metal servers use VLAN encapsulation. All unicast, multicast and broadcast traffic is dropped (denied) within isolation enforced EPGs. ACI bridge-domains can have a mix of isolated and regular EPGs. Each Isolated EPG can have multiple VLANs where intra-vlan traffic is denied.

Configuring Intra-EPG Isolation for Bare Metal Servers Using the GUI

The port the EPG uses must be associated with a bare metal server interface in the physical domain that is used to connect the bare metal servers directly to leaf switches.

Procedure

Step 1 In a tenant, right click on an **Application Profile**, and open the **Create Application EPG** dialog box to perform the following actions:

a) In the **Name** field, add the EPG name (intra_EPG-deny).
b) For **Intra EPG Isolation**, click **Enforced**.
c) In the **Bridge Domain** field, choose the bridge domain from the drop-down list (bd1).
d) Check the **Statically Link with Leaves/Paths** check box.
e) Click **Next**.

Step 2 In the **Leaves/Paths** dialog box, perform the following actions:

a) In the **Path** section, choose a path from the drop-down list (Node-107/eth1/16) in Trunk Mode.

Specify the **Port Encap** (vlan-102) for the secondary VLAN.

Note If the bare metal server is directly connected to a leaf switch, only the Port Encap secondary VLAN is specified.

Specify the **Primary Encap** (vlan-103) for the primary VLAN.

b) Click **Update**.
c) Click **Finish**.

Configuring Intra-EPG Isolation for Bare Metal Servers Using the NX-OS Style CLI

Procedure

	Command or Action	Purpose

Step 1	In the CLI, create an intra-EPG isolation EPG:
	Example:
	The VMM case is below.
	`ifav19-ifc1(config)# tenant Test_Isolation`
	`ifav19-ifc1(config-tenant)# application PVLAN`
	`ifav19-ifc1(config-tenant-app)# epg EPG1`
	
	`ifav19-ifc1(config-tenant-app-epg)# show running-config`
	`# Command: show running-config`
	`tenant Test_Isolation`
	`application PVLAN epg EPG1`
	`tenant Test_Isolation`
	`application PVLAN`
	`epg EPG1`
	`bridge-domain member BD1`
	`contract consumer bare-metal`
	`contract consumer default`
	`contract provider Isolate_EPG`
	`isolation enforce <---- This enables EPG isolation mode.`
	`exit`
	`exit`
	`ifav19-ifc1(config)# leaf ifav19-leaf3`
	`ifav19-ifc1(config-leaf)# interface ethernet 1/16`
	`ifav19-ifc1(config-leaf-if)# show running-config`
	`ifav19-ifc1(config-leaf-if)# switchport trunk native vlan 101 tenant Test_Isolation application PVLAN epg StaticEPG primary-vlan 100`
	`exit`	

Step 2	Verify the configuration:
	Example:
	`show epg StaticEPG detail`
	`Application EPg Data:`
	`Tenant : Test_Isolation`
	`Application : PVLAN`
	`AEPg : StaticEPG`
	`BD : BD1`
	`uSeg EPG : no`
	`Intra EPG Isolation : enforced`
	`Vlan Domains : phys`	

	Command or Action	Purpose

```
Consumed Contracts  : bare-metal
Provided Contracts  : default,Isolate_EPG

Denied Contracts    :
Qos Class           : unspecified
Tag List            :
VMM Domains:
Domain                 Type
Deployment Immediacy  Resolution
Immediacy  State           Encap
Primary
Encap
 --------------------  ---------
--------------------
--------------------  --------------
----------  ----------
 DVS1                   VMware     On
Demand             immediate
  formed          auto        auto


Static Leaves:
 Node        Encap            Deployment
 Immediacy  Mode
Modification Time
----------  -----------------
--------------------  ------------------
  ------------------------------

Static Paths:
 Node        Interface
     Encap            Modification Time

 ----------
------------------------------
----------------
------------------------------
 1018        eth101/1/1
      vlan-100
2016-02-11T18:39:02.337-08:00
 1019        eth1/16
      vlan-101
2016-02-11T18:39:02.337-08:00

Static Endpoints:
 Node        Interface          Encap
          End Point MAC      End Point
 IP Address          Modification Time

 ----------
------------------------------
----------------  -----------------
------------------------------
------------------------------
```

Configuring Intra-EPG Isolation for Bare Metal Servers Using the REST API

Before you begin

The port the EPG uses must be associated with a bare metal server interface in the physical domain.

Procedure

Step 1 Send this HTTP POST message to deploy the application using the XML API.

Example:

```
POST https://apic-ip-address/api/mo/uni/tn-ExampleCorp.xml
```

Step 2 Include this XML structure in the body of the POST message.

Example:

```
<fvTenant name="Tenant_BareMetal" >
  <fvAp name="Web">
    <fvAEPg name="IntraEPGDeny" pcEnfPref="enforced">
          <!-- pcEnfPref="enforced" ENABLES ISOLATION-->
          <fvRsBd tnFvBDName="bd" />
          <fvRsDomAtt tDn="uni/phys-Dom1" />
          <!-- PATH ASSOCIATION -->
          <fvRsPathAtt tDn="topology/pod-1/paths-1017/pathep-[eth1/2]" encap="vlan-51"
primaryEncap="vlan-100" instrImedcy='immediate'/>
    </fvAEPg>
 </fvAp>
</fvTenant>
```

Intra-EPG Isolation for VMWare vDS

Intra-EPG Isolation for VMware VDS or Microsoft Hyper-V Virtual Switch

Intra-EPG Isolation is an option to prevent physical or virtual endpoint devices that are in the same base EPG or microsegmented (uSeg) EPG from communicating with each other. By default, endpoint devices included in the same EPG are allowed to communicate with one another. However, conditions exist in which total isolation of the endpoint devices from on another within an EPG is desirable. For example, you may want to enforce intra-EPG isolation if the endpoint VMs in the same EPG belong to multiple tenants, or to prevent the possible spread of a virus.

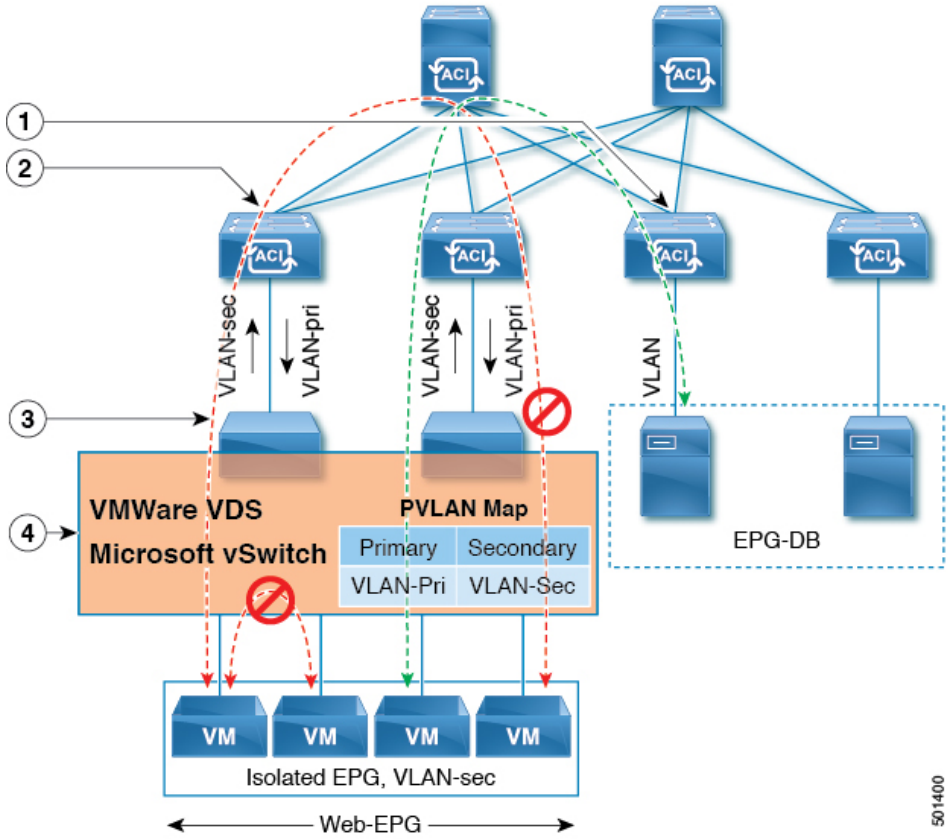
A Cisco ACI virtual machine manager (VMM) domain creates an isolated PVLAN port group at the VMware VDS or Microsoft Hyper-V Virtual Switch for each EPG that has intra-EPG isolation enabled. A fabric administrator specifies primary encapsulation or the fabric dynamically specifies primary encapsulation at the time of EPG-to-VMM domain association. When the fabric administrator selects the VLAN-pri and VLAN-sec values statically, the VMM domain validates that the VLAN-pri and VLAN-sec are part of a static block in the domain pool.

Note When intra-EPG isolation is not enforced, the VLAN-pri value is ignored even if it is specified in the configuration.

VLAN-pri/VLAN-sec pairs for the VMware VDS or Microsoft Hyper-V Virtual Switch are selected per VMM domain during the EPG-to-domain association. The port group created for the intra-EPG isolation EPGs uses the VLAN-sec tagged with type set to `PVLAN`. The VMware VDS or the Microsoft Hyper-V Virtual Switch and fabric swap the VLAN-pri/VLAN-sec encapsulation:

- Communication from the Cisco ACI fabric to the VMware VDS or Microsoft Hyper-V Virtual Switch uses VLAN-pri.
- Communication from the VMware VDS or Microsoft Hyper-V Virtual Switch to the Cisco ACI fabric uses VLAN-sec.

Figure 5: Intra-EPG Isolation for VMware VDS or Microsoft Hyper-V Virtual Switch



Note these details regarding this illustration:

1. EPG-DB sends VLAN traffic to the Cisco ACI leaf switch. The Cisco ACI egress leaf switch encapsulates traffic with a primary VLAN (PVLAN) tag and forwards it to the Web-EPG endpoint.
2. The VMware VDS or Microsoft Hyper-V Virtual Switch sends traffic to the Cisco ACI leaf switch using VLAN-sec. The Cisco ACI leaf switch drops all intra-EPG traffic because isolation is enforced for all intra VLAN-sec traffic within the Web-EPG.

3. The VMware VDS or Microsoft Hyper-V Virtual Switch VLAN-sec uplink to the Cisco ACI Leaf is in isolated trunk mode. The Cisco ACI leaf switch uses VLAN-pri for downlink traffic to the VMware VDS or Microsoft Hyper-V Virtual Switch.
4. The PVLAN map is configured in the VMware VDS or Microsoft Hyper-V Virtual Switch and Cisco ACI leaf switches. VM traffic from WEB-EPG is encapsulated in VLAN-sec. The VMware VDS or Microsoft Hyper-V Virtual Switch denies local intra-WEB EPG VM traffic according to the PVLAN tag. All intra-ESXi host or Microsoft Hyper-V host VM traffic is sent to the Cisco ACI leaf using VLAN-Sec.

Related Topics

For information on configuring intra-EPG isolation in a Cisco ACI Virtual Edge environment, see the chapter "Intra-EPG Isolation Enforcement for Cisco ACI Virtual Edge" in the *Cisco ACI Virtual Edge Configuration Guide* .

For information on configuring intra-EPG isolation in a Cisco AVS environment, see the chapter "Intra-EPG Isolation Enforcement for Cisco AVS" in the *Cisco Application Virtual Switch Configuration Guide* .

Configuring Intra-EPG Isolation for VMware VDS or Microsoft Hyper-V Virtual Switch using the GUI

Procedure

Step 1 Log into Cisco APIC.

Step 2 Choose **Tenants** > ***tenant*** .

Step 3 In the left navigation pane expand the **Application Profiles** folder and appropriate application profile.

Step 4 Right-click the **Application EPGs** folder and then choose **Create Application EPG**.

Step 5 In the **Create Application EPG** dialog box, complete the following steps:

a) In the **Name** field, add the EPG name.
b) In the **Intra EPG Isolation** area, click **Enforced**.
c) In the **Bridge Domain** field, choose the bridge domain from the drop-down list.
d) Associate the EPG with a bare metal/physical domain interface or with a VM Domain.

- For the VM Domain case, check the **Associate to VM Domain Profiles** check box.
- For the bare metal case, check the **Statically Link with Leaves/Paths** check box.

e) Click **Next**.
f) In the **Associated VM Domain Profiles** area, click the + icon.
g) From the **Domain Profile** drop-down list, choose the desired VMM domain.

For the static case, in the **Port Encap (or Secondary VLAN for Micro-Seg)** field, specify the secondary VLAN, and in the **Primary VLAN for Micro-Seg** field, specify the primary VLAN. If the Encap fields are left blank, values will be allocated dynamically.

Note For the static case, a static VLAN must be available in the VLAN pool.

Step 6 Click **Update** and click **Finish**.

Configuring Intra-EPG Isolation for VMware VDS or Microsoft Hyper-V Virtual Switch using the NX-OS Style CLI

Procedure

Step 1 In the CLI, create an intra-EPG isolation EPG:

Example:

The following example is for VMware VDS:

```
apic1(config)# tenant Test_Isolation
apic1(config-tenant)# application PVLAN
apic1(config-tenant-app)# epg EPG1
apic1(config-tenant-app-epg)# show running-config
# Command: show running-config tenant Tenant_VMM application Web epg intraEPGDeny
  tenant Tenant_VMM
    application Web
      epg intraEPGDeny
        bridge-domain member VMM_BD
        vmware-domain member PVLAN encap vlan-2001 primary-encap vlan-2002 push on-demand
        vmware-domain member mininet
          exit
        isolation enforce
        exit
      exit
    exit
apic1(config-tenant-app-epg)#
```

Example:

The following example is for Microsoft Hyper-V Virtual Switch:

```
apic1(config)# tenant Test_Isolation
apic1(config-tenant)# application PVLAN
apic1(config-tenant-app)# epg EPG1
apic1(config-tenant-app-epg)# show running-config
# Command: show running-config tenant Tenant_VMM application Web epg intraEPGDeny
  tenant Tenant_VMM
    application Web
      epg intraEPGDeny
        bridge-domain member VMM_BD
        microsoft-domain member domain1 encap vlan-2003 primary-encap vlan-2004
        microsoft-domain member domain2
          exit
        isolation enforce
        exit
      exit
    exit
apic1(config-tenant-app-epg)#
```

Step 2 Verify the configuration:

Example:

```
 show epg StaticEPG detail
Application EPg Data:
Tenant              : Test_Isolation
Application         : PVLAN
AEPg                : StaticEPG
BD                  : VMM_BD
uSeg EPG            : no
```

```
Intra EPG Isolation : enforced
Vlan Domains        : VMM
Consumed Contracts  : VMware_vDS-Ext
Provided Contracts  : default,Isolate_EPG
Denied Contracts    :
Qos Class           : unspecified
Tag List            :
VMM Domains:
Domain                Type       Deployment Immediacy  Resolution Immediacy  State
   Encap       Primary
Encap
 --------------------  ---------  --------------------  --------------------  --------------
  ----------  ----------
 DVS1                  VMware     On Demand             immediate             formed
    auto        auto

Static Leaves:
 Node        Encap             Deployment Immediacy  Mode                Modification Time

----------  ----------------  --------------------  ------------------
------------------------------

Static Paths:
 Node        Interface                       Encap             Modification Time

 ----------  ------------------------------  ----------------  ------------------------------

 1018        eth101/1/1                      vlan-100          2016-02-11T18:39:02.337-08:00

 1019        eth1/16                         vlan-101          2016-02-11T18:39:02.337-08:00


Static Endpoints:
 Node        Interface          Encap             End Point MAC      End Point IP Address
         Modification Time
 ----------  -----------------------------  ----------------  -----------------
------------------------------  -------------------------------

Dynamic Endpoints:
Encap: (P):Primary VLAN, (S):Secondary VLAN
 Node        Interface            Encap             End Point MAC      End Point IP Address
         Modification Time
 ----------  -----------------------------  ----------------  -----------------
------------------------------  -------------------------------
1017        eth1/3               vlan-943(P)       00:50:56:B3:64:C4  ---
      2016-02-17T18:35:32.224-08:00
                                 vlan-944(S)
```

Configuring Intra-EPG Isolation for VMware VDS or Microsoft Hyper-V Virtual Switch using the REST API

Procedure

Step 1 Send this HTTP POST message to deploy the application using the XML API.

Example:

```
POST https://apic-ip-address/api/mo/uni/tn-ExampleCorp.xml
```

Step 2 For a VMware VDS or Microsoft Hyper-V Virtual Switch deployment, include one of the following XML structures in the body of the POST message.

Example:

The following example is for VMware VDS:

```
<fvTenant name="Tenant_VMM" >
  <fvAp name="Web">
    <fvAEPg name="IntraEPGDeny" pcEnfPref="enforced">
          <!-- pcEnfPref="enforced" ENABLES ISOLATION-->
          <fvRsBd tnFvBDName="bd" />
          <!-- STATIC ENCAP ASSOCIATION TO VMM DOMAIN-->
          <fvRsDomAtt encap="vlan-2001" instrImedcy="lazy" primaryEncap="vlan-2002"
resImedcy="immediate" tDn="uni/vmmp-VMware/dom-DVS1”>
    </fvAEPg>
 </fvAp>
</fvTenant>
```

Example:

The following example is for Microsoft Hyper-V Virtual Switch:

```
<fvTenant name="Tenant_VMM" >
  <fvAp name="Web">
    <fvAEPg name="IntraEPGDeny" pcEnfPref="enforced">
          <!-- pcEnfPref="enforced" ENABLES ISOLATION-->
          <fvRsBd tnFvBDName="bd" />
         <!-- STATIC ENCAP ASSOCIATION TO VMM DOMAIN-->
       <fvRsDomAtt tDn="uni/vmmp-Microsoft/dom-domain1”>
 <fvRsDomAtt encap="vlan-2004" instrImedcy="lazy" primaryEncap="vlan-2003"
 resImedcy="immediate" tDn="uni/vmmp-Microsoft/dom-domain2”>
   </fvAEPg>
 </fvAp>
</fvTenant>
```

Configuring Intra-EPG Isolation for Cisco ACI Virtual Edge

Intra-EPG Isolation Enforcement for Cisco ACI Virtual Edge

By default, endpoints with an EPG can communicate with each other without any contracts in place. However, you can isolate endpoints within an EPG from each other. For example, you may want to enforce endpoint isolation within an EPG to prevent a VM with a virus or other problem from affecting other VMs in the EPG.

You can configure isolation on all or none of the endpoints within an application EPG; you cannot configure isolation on some endpoints but not on others.

Isolating endpoints within an EPG does not affect any contracts that enable the endpoints to communicate with endpoints in another EPG.

Note Enforcing intra-EPG Isolation is not supported for the EPG that is associated with Cisco ACI Virtual Edge domains in VLAN mode. If you try to enforce intra-EPG isolation with such an EPG, a fault is triggered.

Note Using intra-EPG isolation on a Cisco ACI Virtual Edge microsegment (uSeg) EPG is not currently supported.

Note Proxy ARP is not supported for Cisco ACI Virtual Edge EPGs using VXLAN encapsulation and on which intra-EPG Isolation is enforced. Therefore, intra-subnet communication is not possible between intra-EPG isolated EPGs even though contracts are in place between those Cisco ACI Virtual Edge EPGs. (VXLAN).

Configure Intra-EPG Isolation for Cisco ACI Virtual Edge Using the GUI

Follow this procedure to create an EPG in which the endpoints of the EPG are isolated from each other.

The port that the EPG uses must belong to one of the VM Managers (VMMs).

Note This procedure assumes that you want to isolate endpoints within an EPG when you create the EPG. If you want to isolate endpoints within an existing EPG, select the EPG in Cisco APIC, and in the **Properties** pane, in the **Intra EPG Isolation** area, choose **Enforced**, and then click **SUBMIT**.

Before you begin

Make sure that VXLAN-related configuration is present on the Cisco ACI Virtual Edge VMM domain, particularly a Cisco ACI Virtual Edge fabric-wide multicast address and pool of multicast addresses (one per EPG).

Procedure

Step 1 Log in to Cisco APIC.

Step 2 Choose **Tenants**, expand the folder for the tenant, and then expand the **Application Profiles** folder.

Step 3 Right-click an application profile, and choose **Create Application EPG**.

Step 4 In the **Create Application EPG** dialog box, complete the following steps:

a) In the **Name** field, enter the EPG name.
b) In the **Intra EPG Isolation** area, click **Enforced**.
c) From the **Bridge Domain** drop-down list, choose the bridge domain.
d) Check the **Associate to VM Domain Profiles** check box.
e) Click **Next**.
f) In the **Associate VM Domain Profiles** area, complete the following steps:

- Click the + (plus) icon, and from the **Domain Profile** drop-down list, choose the desired Cisco ACI Virtual Edge VMM domain.

- From the **Switching Mode** drop-down list, choose **AVE**.
- From the **Encap Mode** drop-down list, choose **VXLAN** or **Auto**.

  If you choose **Auto**, make sure that encapsulation mode of the Cisco ACI Virtual Edge VMM domain is VXLAN.
- (Optional) Choose other configuration options appropriate to your setup.

g) Click **Update** and click **Finish**.

What to do next

You can select statistics and view them to help diagnose problems involving the endpoint. See the sections Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 and View Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 in this guide.

Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab

If you configured intra-EPG isolation on a Cisco ACI Virtual Edge, choose statistics—such as denied connections, received packets, or transmitted multicast packets—for the endpoints. You can then view the statistics.

Procedure

Step 1 Log in to Cisco APIC.

Step 2 Choose **Tenants** > ***tenant*** .

Step 3 In the tenant navigation pane, expand the **Application Profiles**, ***profile*** , and **Application EPGs** folders, and then choose the EPG containing the endpoint the statistics for which you want to view.

Step 4 In the EPG **Properties** work pane, click the **Operational** tab to display the endpoints in the EPG.

Step 5 Double-click the endpoint.

Step 6 In the **Properties** dialog box for the endpoint, click the **Stats** tab and then click the check icon.

Step 7 In the **Select Stats** dialog box, in the **Available** pane, choose the statistics that you want to view for the endpoint, and then use the right-pointing arrow to move them into the **Selected** pane.

Step 8 Click **Submit**.

View Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab

If you configured intra-EPG isolation on a Cisco ACI Virtual Edge, once you have chosen statistics for the endpoints, you can view them.

Before you begin

You must have chosen statistics to view for isolated endpoints. See Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 in this guide for instructions.

Procedure

Step 1 Log in to Cisco APIC.

Step 2 Choose **Tenants** > ***tenant*** .

Step 3 In the tenant navigation pane, expand the **Application Profiles**, ***profile*** , and **Application EPGs** folders, and then choose the EPG containing the endpoint with statistics that you want to view.

Step 4 In the EPG **Properties** work pane, click the **Operational** tab to display the endpoints in the EPG.

Step 5 Double-click the endpoint with statistics that you want to view.

Step 6 In the **Properties** work pane for the endpoint, click the **Stats** tab.

The work pane displays the statistics that you chose earlier. You can change the view by clicking the table view or chart view icon on the upper left side of the work pane.

Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Virtual Networking Tab

If you configured intra-EPG isolation on a Cisco ACI Virtual Edge, choose statistics—such as denied connections, received packets, or transmitted multicast packets—for the endpoints. You can then view the statistics.

Procedure

Step 1 Log in to Cisco APIC.

Step 2 Choose **Virtual Networking** > **Inventory** > **VMM Domains** > **VMware** > ***VMM domain*** > **Controllers** > ***controller instance name*** > ***DVS-VMM name*** > **Portgroups** > ***EPG name*** > ***Learned Point MAC address (node)*** > **.**

Step 3 Click the **Stats** tab.

Step 4 Click the tab with the check mark.

Step 5 In the **Select Stats** dialog box, click the statistics that you want to view in the **Available** pane, and then click the arrow pointing right to put them in the **Selected** pane.

Step 6 (Optional) Choose a sampling interval.

Step 7 Click **Submit**.

View Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Virtual Networking Tab

If you configured intra-EPG isolation on a Cisco ACI Virtual Edge, once you have chosen statistics for the endpoints, you can view them.

Before you begin

You must have chosen statistics to view for isolated endpoints. See Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 in this guide for instructions.

Procedure

Step 1 Log in to Cisco APIC.

Step 2 Choose **Virtual Networking** > **Inventory** > **VMM Domains** > **VMware** > ***VMM name*** > **Controllers** > **controller instance name** > ***DVS-VMM name*** > **Portgroups** > ***EPG name*** > ***Learned Point MAC address (node)***

Step 3 Click the **Stats** tab.

The central pane displays the statistics that you chose earlier. You can change the view by clicking the table view or chart view icon on the upper left side of the work pane.

Configure Intra-EPG Isolation for Cisco ACI Virtual Edge Using the NX-OS Style CLI

Before you begin

Make sure that VXLAN-related configuration is present on the Cisco ACI Virtual Edge VMM domain, particularly a Cisco ACI Virtual Edge fabric-wide multicast address and pool of multicast addresses (one per EPG).

Procedure

In the CLI, create an intra-EPG isolation EPG:

Example:

```
# Command: show running-config tenant Tenant2 application AP-1 epg EPG-61
  tenant Tenant2
    application AP-1
      epg EPG-61
        bridge-domain member BD-61
        vmware-domain member D-AVE-SITE-2-3
          switching-mode AVE
          encap-mode vxlan
          exit
        isolation enforce            # This enables EPG into isolation mode.
        exit
      exit
    exit
```

What to do next

You can select statistics and view them to help diagnose problems involving the endpoint. See the sections Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 and View Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 in this guide.

Configure Intra-EPG Isolation for Cisco ACI Virtual Edge Using the REST API

Before you begin

Make sure that VXLAN-related configuration is present on the Cisco ACI Virtual Edge VMM domain, particularly a Cisco ACI Virtual Edge fabric-wide multicast address and pool of multicast addresses (one per EPG).

Procedure

Step 1 Send this HTTP POST message to deploy the application using the XML API.

Example:

```
   POST
https://10.197.139.36/api/mo/uni/tn-Tenant2.xml
```

Step 2 For a VMM deployment, include the XML structure in the following example in the body of the POST message.

Example:

```
<fvTenant name="Tenant2" >
  <fvAp name="AP-1">
    <fvAEPg name="EPG-61" pcEnfPref="enforced">
      <!-- pcEnfPref="enforced" ENABLES ISOLATION-->
      <!-- pcEnfPref="unenforced" DISABLES ISOLATION-->
        <fvRsBd tnFvBDName="BD-61" />
        <fvRsDomAtt switchingMode="AVE" encapMode="vxlan" resImedcy="immediate"
tDn="uni/vmmp-VMware/dom-D-AVE-SITE-1-XXIII" >
        </fvRsDomAtt>
    </fvAEPg>
  </fvAp>
</fvTenant>
```

What to do next

You can select statistics and view them to help diagnose problems involving the endpoint. See the sections Choose Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 and View Statistics for Isolated Endpoints on Cisco ACI Virtual Edge Under the Tenants Tab, on page 30 in this guide.