Cisco ACI with VMware vRealize

This chapter contains the following sections:

About Cisco ACI with VMware vRealize

Cisco Application Centric Infrastructure (ACI), in addition to integrating with VMware vCenter, integrates with VMware's products vRealize Automation (vRA) and vRealize Orchestrator (vRO). vRA and vRO are parts of the VMware vRealize Suite for building and managing multivendor hybrid cloud environments.

Beginning with Cisco Application Policy Infrastructure Controller (APIC) Release 2.0(1), vRA and vRO support Cisco AVS in addition to VMware DVS. Beginning with Cisco APIC Release 3.1(1), vRA and vRO support Cisco Application Centric Infrastructure (ACI) Virtual Edge (Cisco ACI Virtual Edge).

Note In the Cisco APIC GUI, Cisco ACI Virtual Edge is indicated with the term **AVE**.

Cisco ACI with VMware vRealize Solution Overview

vRA integration is delivered through a set of service blueprints imported into vRA. The service blueprints leverage the vRO Application Policy Infrastructure Controller (APIC) workflows, providing a set of catalog items in a self-service portal that allows Tenants to build, manage, and remove networking components. Multi-machine with ACI workflows achieve following functionalities:

- Auto-create Tenant Endpoint Groups (EPGs)

- Required policies in APIC
- Create VMs and portgroups in vCenter
- Auto-place the VMs is respective port groups
- Created by APIC
- Create security policy with access lists
- Configure L4-L7 services, and provide external connectivity

This consumption model allows users to deploy single and multi-tier application workloads in single click with pre-defined as well as customizable compute and network policies. Catalog items are published by infrastructure administrators, whereby granular entitlements can be added or removed on a per-tenant basis.

The integration offers two modes of networking:

Mode	Description
Shared	Shared mode is for Tenants who do not have a preference for what IP address space they use and a shared address space with shared context (VRF) is used across tenants. Isolation is provided using ACI Endpoint Groups (EPGs) and connectivity among EPGs are enabled using a white listing method.
Virtual Private Cloud (VPC)	VPC mode is a bring your own address space architecture, where network connectivity is isolated via a unique context (VRF) per tenant and external connectivity is provided via a common shared L3 out.

Physical and Logical Topology

This section shows the logical model of the vRealize ACI Integration and comparison between a Shared Services Plan and Virtual Private Cloud Plan.

Figure 1: This figure shows a logical model of the vRealize ACI Integration.

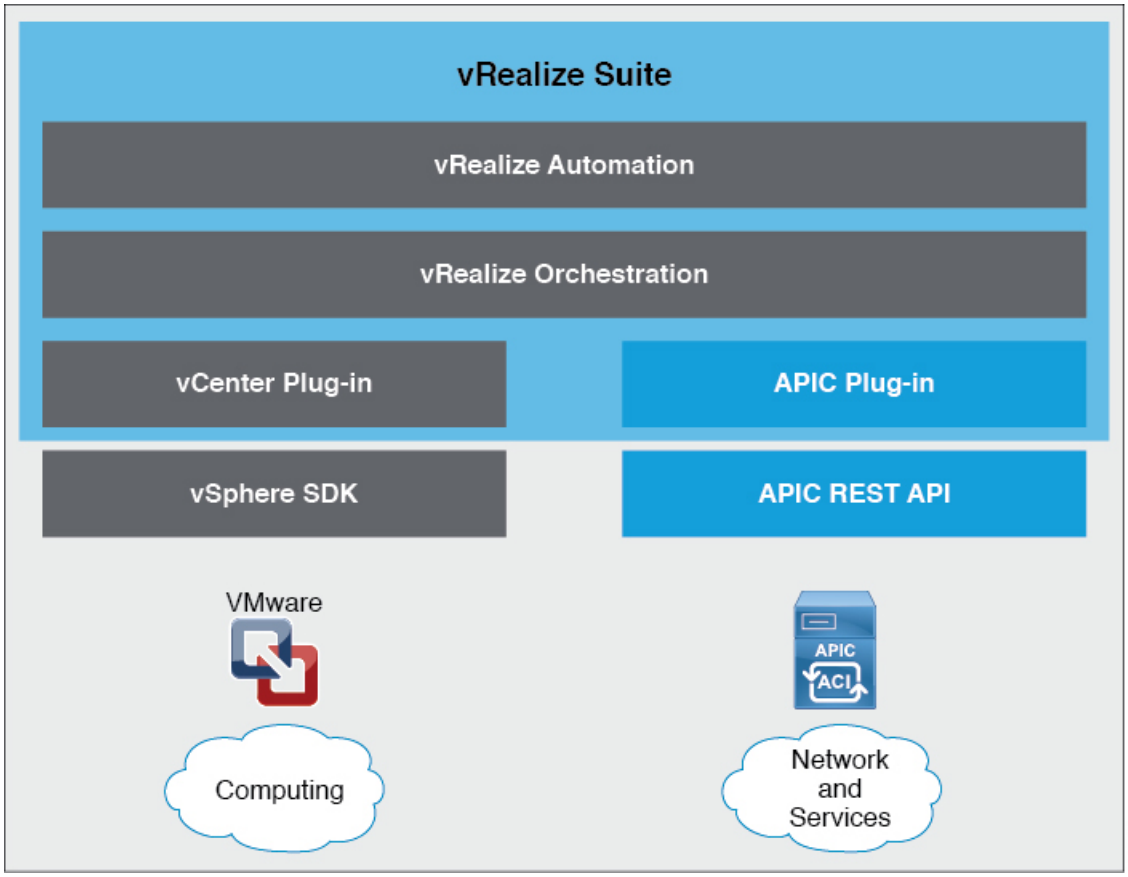
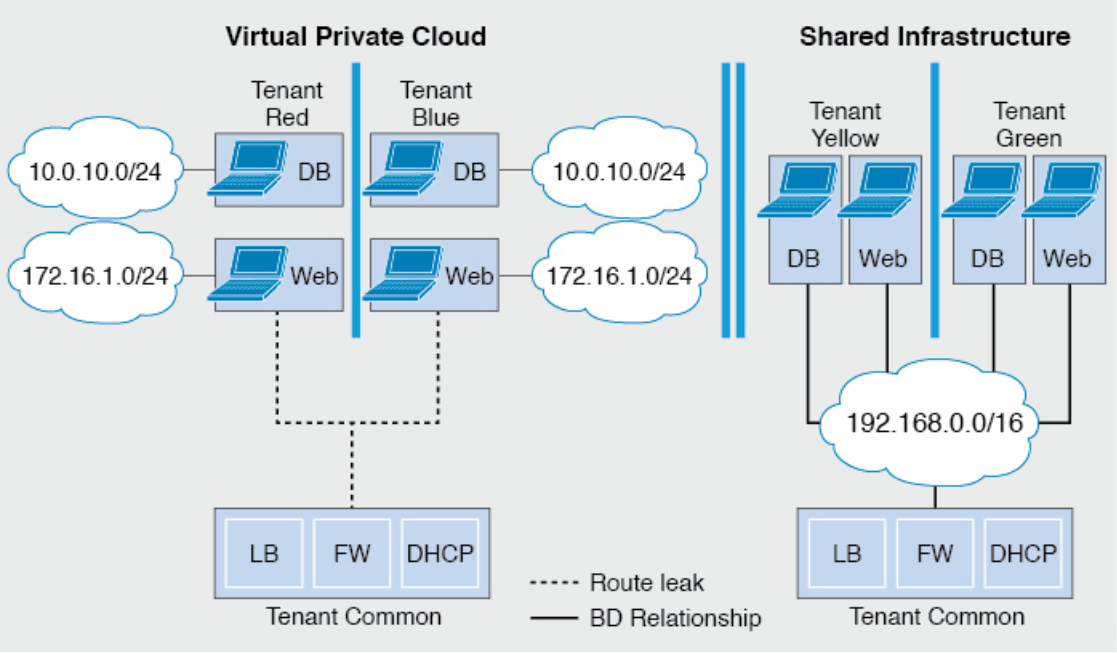


Figure 2: This figure shows the comparison between a Shared Services Plan and Virtual Private Cloud Plan.



For details, see the *Cisco APIC Basic Configuration Guide*.

About the Mapping of ACI Constructs in VMware vRealize

This table shows the mapping between the features of Cisco ACI policy and vRealize policy

Cisco ACI	VMware vRealize
Tenant	Tenant
EPGs	Networks
Layer 3 external connectivity	External routed network
Contract	Security policy
Filter	Rule entry list
L4-L7 service device	Shared load balancer or firewall

This list provides details regarding the features:

- Tenant—Tenants can be employees within an organization, business units, application owners, or applications. Or if you are a service provider, they can be hosting customers (individuals or organizations that pay you to provide IT services).
- Networks—In Cisco ACI, the term “network” refers to EPGs, which are used to provide a new model for mapping applications to the network. Rather than using forwarding constructs, such as addresses or VLANs, to apply connectivity and policy, EPGs use a grouping of application endpoints. EPGs are mapped to networks in the vRealize portal. The isolated networks act as containers for collections of

applications, or of application components and tiers, that can be used to apply forwarding and policy logic. They allow the separation of network policy, security, and forwarding from addressing and instead apply these to logical application boundaries. When a network is created in vRealize, in the back end it is created as a port group in vCenter. A vRealize tenant can use vCenter to manage the computing resources and can attach the virtual machine to the appropriate network.

- Layer 3 external connectivity—The Cisco ACI fabric connects to the outside through Layer 3 external networks. These constructs are also available for vRealize tenants to access other services within the data center, across the data center, or on the internet.
- Security policy—Cisco ACI is built on a highly secure model, in which traffic between EPGs (isolated networks) is denied, unless explicitly allowed by policy contracts. A Cisco ACI contract is mapped to a security policy in the vRealize portal. The security policy describes which networks (EPGs) will provide and consume a service. The security policy contains one or more rule entry lists (filters), stateless firewall rules that describe a set of Layer 4 TCP or User Datagram Protocol (UDP) port numbers that define the communication between the various applications.
- Shared load balancer and firewall—Cisco ACI treats services as an integral part of an application. Any services that are required are managed as a service graph that is instantiated on the Application Policy Infrastructure Controller (APIC) . Users define the service for the application, and service graphs identify the set of network and service functions that are needed by the application. Cisco ACI has an open ecosystem of L4-7 service vendors whose services integrate natively with Cisco ACI. This integration is achieved through device packages written and owned by the vendors. The APIC manages the network services and inserts the services according to the Cisco ACI policy model. For vRealize, Cisco ACI offers F5 and Citrix load balancers and Cisco ASA firewalls, both in virtual and physical form factors, which are connected to the Cisco ACI fabric and shared across the various vRealize tenants. After the device has been integrated into Cisco ACI, the vRealize administrator can choose to add the device as a premium service and upsell the plan. The vRealize administrator manages the virtual IP address range for the shared device, to simplify the vRealize tenant's workflow.
- VPC plan—In a VPC plan, vRealize tenants can define their own address spaces, bring a DHCP server, and map their address spaces to networks. A VPC tenant can also be offered services, such as load balancing, from the shared service plan. In this scenario, a device would have multiple virtual NICs (vNICs). One vNIC would connect to the private address space, and another would connect to the shared service infrastructure. The vNIC that connects to the shared service infrastructure would have an address assigned by the infrastructure and would also consume a shared load balancer owned by the infrastructure.

Event Broker VM Customization

vRealize Automation Event Broker is a workflow subscription service for vRealize Automation to call workflows from the vRealize Orchestrator under predefined conditions the user sets. It is supported beginning with Cisco APIC 3.0(1).

A deployment of a single or multitier application is automatically subscribed to the Event Broker. Machine operations such as creation or deletion on any machine, configured by the vRA, trigger the Event Broker. This invokes the preconfigured operations to the Cisco APIC defined by the Property Groups associated to a single or multitier application.

To add the Cisco APIC workflow subscription, follow the instructions at Setting Up the VMware vRealize Automation Appliance for ACI, on page 9. The workflow subscription then will be added automatically.

Getting Started with Cisco ACI with VMware vRealize

This section describes how to get started with Cisco ACI with VMware vRealize.

You must download and unzip the Cisco ACI and VMware vRealize file for the 2.2(1) release before installing Cisco ACI with VMware vRealize.

Procedure

Step 1 Go to Cisco's Application Policy Infrastructure Controller (APIC) Website:

http://www.cisco.com/c/en/us/support/cloud-systems-management/application-policy-infrastructure-controller-apic/tsd-products-support-series-home.html

Step 2 Choose **All Downloads for this Product**.

Step 3 Choose the release version and the **apic-vrealize-2.2.1x.tgz** file.

Step 4 Click **Download**.

Step 5 Unzip the **apic-vrealize-2.2.1x.tgz** file.

Note Cisco ACI with VMware vRealize only supports ASCII characters. Non-ASCII characters are not supported.

Prerequisites for Getting Started with Cisco ACI with VMware vRealize

Before you get started, ensure that you have verified that your vRealize computing environment meets the following prerequisites:

- vRealize Automation Release 7.0-7.4 must be installed.

  See VMware's vRealize documentation.

- The vRealize ACI plug-in version and the Cisco APIC version must match.
- A tenant is configured in vRealize automation and associated with identity store. The tenant must have one or more users configured with "Infra Admin", "Tenant Admin", and "Tenant user" roles.

  See VMware's vRealize documentation.

- The tenant must have one more "Business group" configured.

  See VMware's vRealize documentation.

- Configure vRealize Orchestrator as an end-point.

  See VMware's vRealize documentation.

- Configure vCenter as an endpoint.

  See VMware's vRealize documentation.

- Configure "Reservations" using the vCenter compute resources.

See VMware's vRealize documentation.

- Set up the vRealize Appliance.

  See VMware's vRealize documentation.

- If Layer 3 (L3) Out policies are to be consumed by a tenant, you must configure a BGP route reflector.

  See the *Cisco APIC Basic Configuration Guide* about Configuring an MP-BGP Route Reflector Using the Basic GUI or Configuring an MP-BGP Route Reflector.

- Setup a vRA handle in vRO.

  This is used for Installing the ACI service catalog workflow.

- Setup a IAAS handle in vRO.

  This is used for Installing the ACI service catalog workflow.

  See Setting Up an IaaS Handle in vRealize Orchestrator, on page 7.

- Install the vCAC/vRA Custom Property Toolkit for vCO/vRO. You can download the package from the following URL:

  https://communities.vmware.com/docs/DOC-26693

- The embedded vRO in vRA has the vCAC vRO plug-in that is installed by default. If you are using a standalone vRO, the vCAC vRO plug-in must be installed. You can download the plug-in from the following URL:

  https://solutionexchange.vmware.com/store/products/vmware-vrealize-orchestrator-plug-in-for-vra-6-2-0

Setting Up an IaaS Handle in vRealize Orchestrator

This section describes how to set up an Infrastructure as a Service (IaaS) handle in the vRealize Orchestrator (vRO).

Procedure

Step 1 Log in to the VMware vRealize Orchestrator as administrator.

Step 2 Once the VMware vRealize Ochestrator GUI appears, from the drop-down list, choose **Run** from the menu bar.

Step 3 In the **navigation** pane, choose the **Workflows** icon.

Step 4 Choose **Adminstrator@*vra_name*** > **Library** > **vRealize Automation** > **Configuration** > **Add the IaaS host of a vRA host**.

Step 5 Right-click **Add the IaaS host of a vRA host** and choose **Start Workflow**.

Step 6 In the **Start Workflow: Add the IaaS host of a vRA host** dialog box, perform the following actions:

a) In the **vRA host** field, enter your vRealize Handle.
b) Click **Next**.

Step 7 In the next screen, perform the following actions:

a) In the **Host Name** field, enter a name.
b) In the **Host URL** field, enter the URL of your IaaS host.
c) Use the default values for the remaining fields.

d) Click **Next**.

Step 8 In the next screen, perform the following actions:

a) In the **Session mode** drop-down list, choose **Shared Session.**
b) In the **Authentication user name** field, enter the authentication user name.
c) In the **Authentication password** field, enter the password.
d) Click **Next**.

Step 9 In the next screen, perform the following actions:

a) In the **Workstation for NTLM authentication** field, enter the name of the workstation that you will use for NTLM authentication.
b) In the **Domain for NTLM authentication** field, enter the domain that is used in the IaaS host URL.
c) Click **Submit**.

Cisco ACI with VMware vRealize Installation Workflow

This section describes the Cisco ACI with VMware vRealize installation workflow.

Procedure

Step 1 Install the APIC plug-in on the vRealize Orchestrator (vRO).

For more information, see Installing the APIC Plug-in on the vRealize Orchestrator, on page 8.

Step 2 Set up the VMware vRealize Automation Appliance for ACI.

For more information, see Setting Up the VMware vRealize Automation Appliance for ACI, on page 9.

Installing the APIC Plug-in on the vRealize Orchestrator

This section describes how to install APIC plug-in on the vRealize Orchestrator.

Procedure

Step 1 Once you have unzipped the package, save the **aci-vra-plugin-3.0.1000.N.dar** file in a known directory.

Step 2 Log in to the vRA appliance as root using SSH, enter:

```
$ ssh root@<vra_ip>
```

Step 3 Start the configurator to enable the configurator services web interface, enter the following commands:

```
# service vco-configurator start
.
.
.
Tomcat started.
```

```
Status:          Running as PID=15178
```

Ensure the status is running.

Step 4 Log in to the VMware appliance using the Firefox browser, enter:

https:// *applicance_address* **:8283/vco-controlcenter**

Note Cisco recommends using the Firefox browser.

Do not use the Internet Explorer or the Chrome browser for the first time. There is a known issue when you use the default username and password. It does not login properly.

For more information, see https://communities.vmware.com/thread/491785.

a) In the VMware vRealize Orchestrator Configuration GUI, enter the default username and password which is **vmware**/**vmware**. You will then be required to change the password.

Step 5 Under the **Plug-Ins** section, click **Manage Plug-Ins**.

Step 6 Under Install plug-in, click the Browse... button and perform the following steps:

a) Locate where you saved the **aci-vra-plugin-3.0.1000.N.dar** file and choose the **aci-vra-plugin-3.0.1000.N.dar** file.

b) Click **Install** on the right, and when the Cisco APIC Plug-in displays, click **Install** again.

- A message highlighted in green displays, saying that the plug-in is installed.
- A message highlighted in yellow displays, saying "The Orchestrator server must be restarted for the changes to take effect. The restart can be performed from the Startup Options page."

Step 7 Click **Startup Options**.

You will be directed to the **Startup Options** page.

Step 8 Click **Restart** to restart the server. Wait until the Current Status displays RUNNING.

Step 9 Navigate back to the **Manage Plug-Ins** page by clicking **Home** on the top left and then clicking **Manage Plug-Ins** under the **Plug-Ins** section.

Step 10 Verify the Cisco APIC plug-in has been installed by looking for it under **Plug-Ins**.

The plug-in will be displayed first with the Cisco icon.

Setting Up the VMware vRealize Automation Appliance for ACI

This section describes how to set up the VMware vRealize Automation Appliance for Cisco ACI.

Procedure

Step 1 Log in to the VMware vRealize Automation Appliance as the administrator through your tenant portal using the browser:

https:// *applicance_address* **/vcac/org/** *tenant_id*

Example:

https://192.168.0.10/vcac/org/tenant1

Enter the admin username and password.

Step 2 In the VMware vRealize Automation Appliance GUI, perform the following actions:

a) Choose **Administration** > **Users & Groups** > **Custom Groups**
b) In the **Custom Group** pane, click **Add** to add a custom group.
c) Enter the name of the custom group. (Service Architect)
d) In the **Roles to this group** field, select the custom group you created in the previous step. (Service Architect)
e) Choose the **Member** pane, enter and select the user name(s).
f) Click **Add**.
This creates a custom group with members.
g) In the **Custom Group** pane, choose the custom group you created. (Service Architect)
h) In the **Edit Group** pane, you can verify the members in the **Members** pane.

Step 3 In the browser, enter the vRealize Automation Appliance.

https://*applicance_address*

For example:

https://vra3-app.ascisco.net

a) Choose the **vRealize Orchestrator Client** to download the client.jnlp file.
b) The **Downloads** dialog box will appear, launch the **client.jnlp** file.

Step 4 Log in to the VMware vRealize Orchestrator as administrator.

Step 5 Once the VMware vRealize Orchestrator GUI appears, from the drop-down list, choose **Run** from the menu bar.

Step 6 In the **Navigation** pane, choose the **Workflows** icon.

Step 7 Choose **Adminstrator*@vra3-app.ascisco.net*** > **Cisco APIC Workflows** > **Utils** > **Install ACI Service Catalog**.

Step 8 Right-click **Install ACI Service Catalog** and choose **Start Workflow**.

Step 9 In the **Start Workflow - Install ACI Service Catalog** dialog box, perform the following actions:

a) In the **APIC Hostname/IP Address** field, enter the APIC hostname or IP address.
b) In the **APIC Admin Password** field, enter the APIC admin password.
c) In the **vRealize Automation IP Address** field, provide the IP address for the vRA.
d) In the **vRealize Automation handle** field, click **Not set**, navigate and choose the vRealize automation handle for this appliance.
e) In the **Business group** field, click **Not set** to choose business group.

Note If running vRealize 7.0, you need to select the **Business Group** from **Business Group (Deprecated)**.

Note Usernames need to include the domain name. For example: admin1@vsphere.local

f) In the **Admin User** field, enter the tenant admin user.
g) In the **vRealize Automation Admin Password** field, enter the admin password for the vRA.
h) In the **End users** field, click **Not set** and enter the user names to enable privilege for.

Note Do not copy and paste the end user names, you should type the user names.

i) In the **JSON File containing vRealize Properties** field, click **Not set**, navigate and choose the JSON file containing the vRealize properties. (aci-vra-properties-3.0.1000.x.json)

Note Usernames need to include the domain name. For example: admin1@vsphere.local

j) In the **Zip file containing the service blueprints** field, click **Not set**, navigate and choose the zip file containing the service blueprints. (aci-vra-asd-3.0.1000.x.zip)

k) Click **Submit**.

Step 10 In the **Navigation** pane, you will see a green check mark next to the **Install ACI Service Catalog**, if the installation was successful.

Step 11 In the **Navigation** pane, choose the **Workflows** icon.

Step 12 Right-click **Install ACI Property Definitions** and choose **Start Workflow**.

Step 13 In the **Start Workflow - Install ACI Property Definitions** dialog box, click **Net set**, navigate and choose the IaaS host.

a) Click **Submit**.

In the **Navigation** pane, you will see a green checkmark next to the Install ACI Property Definitions, if the installation was successful.

Step 14 To verify as a tenant, log in to the vRealize Automation Appliance as tenant, choose **Catalog** and you will see the services.

Step 15 To verify as an administrator, log in to the vRealize Automation Appliance as administrator, choose **Catalog** and you will see the services.

a) Choose **Infrastructure** > **Blueprints** > **Property Definitions** and you will see the properties.

Day-0 Operations of ACI

This section describes day-0 operations of ACI.

Before you begin

- Fabric bring-up

  Bring up the fabric and all topologies are supported.

- Access policies
  - Attach Entity Policy (AEP)
  - Configure access policies between the leaf switches and ESXi hosts to ensure CDP and LLDP is enabled between the leaf and host.

- Layer 3 (L3) Out configuration
  - Create any L3 Out configurations in the common tenant that you wish to be consumed user tenants.
  - You can choose any name for the L3 policy.
  - External EPG must be named "[L3OutName|InstP]".
  - Create two policies.

    For shared plan, specify "default" and for VPC plan, specify "vpcDefault".

For more information, see About L3 External Connectivity, on page 38.

- Service graph templates and devices

  Create any service graph devices in the common tenant.

  For more information, see Configuring the Services on APIC Using XML POST, on page 35.

- Security domains and tenant user
  - vRealize plug-in requires two user accounts.

    The first account needs administrator privileges. This account allows you to create, read, update, and destroy objects in the tenant common, access policies, and VMM domains.

    The second account needs restricted tenant privileges. This account allows you to only read common tenant and VMM domains, but you can create, read, update, and destroy objects in their own tenant.
  - Role-based access control (RBAC) rules are enforced through the APIC not the plug-in.

Procedure

See the *Cisco APIC Basic Configuration Guide* for more information.

Associating AEP with VMware VMM Domain

This section describes how to associate an attachable entity profile (AEP) with VMware VMM domain.

Note You do not need to perform this procedure if the domain type is Cisco AVS.

Procedure

Step 1 Log in to the APIC GUI, and then choose **Fabric** > **Access Policies**.

Step 2 In the navigation pane, expand **Policies** > **Global** > **Attachable Access Entity Profiles** and then click the ***profile*** .

Step 3 In the work pane, perform the following actions:

a) In the **Domains (VMM, Physical or External) Associated to Interfaces** field, click the + to expand.

b) In the **unformed** field, choose a VMM domain and click **Update**.

Cisco ACI with VMware vRealize Upgrade Workflow

This section describes the Cisco ACI with VMware vRealize upgrade workflow.

Procedure

Step 1 Upgrade the APIC image.

Step 2 Upgrade the APIC plug-in on the vRealize Orchestrator (vRO).

For more information, see Upgrading the APIC Plug-in on the vRealize Orchestrator, on page 13.

Step 3 Set Up the VMware vRealize Automation Appliance for ACI.

For more information, see Setting Up the VMware vRealize Automation Appliance for ACI, on page 9.

Step 4 Verify the connection between APIC and vRealize.

For more information, see Verifying the Connection Between APIC and vRealize, on page 13.

Upgrading the APIC Plug-in on the vRealize Orchestrator

This section describes how to upgrade the APIC plug-in certificate on the vRealize Orchestrator.

Procedure

Step 1 To upgrade, first follow the directions in Installing the APIC Plug-in on the vRealize Orchestrator, on page 8.

Step 2 Upgrade your service blueprints, service categories, and entitlements, see Setting Up the VMware vRealize Automation Appliance for ACI, on page 9.

Verifying the Connection Between APIC and vRealize

After you have upgraded the Application Policy Infrastructure Controller (APIC) controller and the switch software, you must verify the connection from the vRealize Orchestrator to APIC.

Before you begin

- Ensure the APIC controller and the switch software is upgraded.

  For more information, see the *Cisco ACI Firmware Management Guide*.

Procedure

Step 1 Log in to the vRealize Orchestrator as administrator.

Step 2 In the **navigation** pane, choose the Inventory icon.

Step 3 Expand the **Cisco APIC Plugin**, choose the APIC and check the following:

a) In the **General** pane, check if the controllers are showing in the **Name** field.

b) Check if you can maneuver through the nested hierarchy below the APIC. This ensures you are communicating with APIC.

If the connection from vRO to APIC is not established, then next to the APIC name the string **down** will be present, indicating that the connection is down.

Cisco ACI with VMware vRealize Downgrade Workflow

This section describes the Cisco ACI with VMware vRealize downgrade workflow.

Procedure

Step 1 Downgrade the APIC image.

Step 2 Delete the APIC plug-in package and all the APIC workflows.

For more information, see Deleting Package and Workflows , on page 14.

Step 3 Install the APIC plug-in on the vRealize Orchestrator (vRO).

For more information, see Upgrading the APIC Plug-in on the vRealize Orchestrator, on page 13.

Step 4 Set up the VMware vRealize Automation Appliance for ACI.

For more information, see Setting Up the VMware vRealize Automation Appliance for ACI, on page 9.

Step 5 Verify the connection between APIC and vRealize.

For more information, see Verifying the Connection Between APIC and vRealize, on page 13.

Deleting Package and Workflows

This section describes how to delete the package and workflows.

Procedure

Step 1 Log in to the vRO client as administrator.

Step 2 Choose the **Design** role.

Step 3 Choose the **Packages** tab.

Step 4 Right-click on the **com.cisco.apic.package** and choose **Delete element with content**.

Step 5 Choose **Keep Shared** in the pop-up window.

Step 6 Choose the **Workflows** tab.

Step 7 Ensure that all workflows in the "Cisco APIC workflows" folder and subfolders are deleted.

To delete the workflow: Select the workflow, right-click and choose **Delete**.

Use Case Scenarios for the Administrator and Tenant Experience

This section describes use case scenarios for the administrator and tenant experience.

Overview of Tier Application Deployment

This section describes the overview of 3-tier application deployment.

Deployment of a single-tier application using property groups	See Deploying a Single-Tier Application Using Property Groups, on page 15.
Deployment of a 3-tier application using a multi-machine blueprint	See Deploying a 3-Tier Application Using a Multi-Machine Blueprint, on page 17.

Deploying a Single-Tier Application Using Property Groups

This section describes how to deploy a single-tier application using property groups.

Procedure

Step 1 Connect to the vRealize Automation appliance by pointing your browser to the following URL:

`https://appliance_address/vcac/org/tenant_id`

Step 2 Enter the tenant administrator username and password.

Step 3 Choose **Catalog**.

Step 4 Click **Configure Property Groups**.

You will configure the database tier.

Step 5 Click **Request**.

Step 6 In the **Request Information** tab, enter a description of the request.

Step 7 Click **Next**.

Step 8 In the **Common** tab, perform the following actions:

a) In the **IaaS Host for vRealize** field, click **Add**.
b) Put a check in the box next to the desired IaaS host.
c) Click **Submit**.
d) In the **APIC Tenant** field, click **Add**.
e) Expand ***apic_name*** > **Tenants**.
f) Put a check in the box next to the desired tenant's name.

Example:

```
green
```

g) Click **Submit**.
h) In the **Property Group Name** field, enter a name for the property group.

Example:

```
green-app-bp
```

i) In the **Plan Type (Shared or VPC)** field, click **Shared**.
j) In the **VMM Domain/DVS** field, click **Add**.
k) Expand ***apic_name*** > **Vcenters** > ***vcenter_name***
l) Put a check in the box next to the desired vCenter's name.

Example:

```
green
```

m) Click **Submit**.

Step 9 Click **Next**.

Step 10 In the **VM Networking** tab, leave all of the fields at their default values.

Step 11 Click **Next**.

Step 12 In the **Security** tab, perform the following actions:

a) In the **Configure Security Policy** drop-down list, choose **No**.

Step 13 In the **Load Balancer** tab, from the drop-down list, choose **No**.

Step 14 In the **Firewall** tab, from the drop-down list, choose **No**.

Step 15 Click **Submit**.

Step 16 Click **OK**.

Step 17 To verify your request, choose the **Requests** tab.

a) Choose the request you submitted and click **view details**. Ensure the status is **Succesful**.

Step 18 (Optional) To edit a blueprint in the property group, choose **Infrastructure** > **Blueprints** > **Property Groups**.

a) In the **Property Group** pane, choose the property group you created (green-app-bp) and click **edit**.
b) In the **Edit Property Group** pane, choose the property group you want to edit and click on the pencil icon to edit a certain blueprint.
c) Once you have completed your edits, click **OK**.

Step 19 Attach the property group to the VMs, choose **Infrastructure** > **Blueprints**.

Step 20 In the **Blueprints** pane, click **New Blueprint**, from the drop-down list, choose **Virtual** > **vSphere (vCenter)**.

Step 21 In the **New Blueprint vSphere (vCenter)**pane, perform the following actions:

a) In the **Blueprint Information** tab, enter the information to create your blueprint and click **OK**. See VMware's documentation for details on how to create your machine blueprint.
b) In the **Build Information** tab, enter the information to create your property group and click **OK**. See VMware's documentation for details on how to create your machine blueprint.

Step 22 In the **Properties** tab, perform the following actions:

a) In the **Property Groups** field, choose your property group that you created (green-app-bp) and click **OK**.
b) Click on the magnifying glass icon for the newly created property group (green-app-bp).
c) In the **Property Group Custom Properties** dialog box, ensure that the properties match your property group and this makes a connection with the VM and the ACI networking.
d) In the **New Blueprint vSphere (vCenter)**pane, click **OK**.

Step 23 In the **Blueprints** pane, perform the following actions:

a) Choose your property group that you created (green-app-bp), hover and choose **Publish**.
b) Click **OK**.
c) Choose **Aministration** > **Catalog Management** > **Catalog Items**.

Step 24 In the **Catalog Items** pane, perform the following actions.

a) Find and choose the blueprint that you created (Green App Tier).

Step 25 In the **Configure Catalog Item** pane, perform the following actions.

a) In the **Details** tab, in the **Service** field, choose **VM Services**.
b) Check the check box for **New and noteworthy**.
c) Click **Update**.

You now have deployed a single-tier application using property groups.

Step 26 To verify the deployment of the single-tier application, log out of the administrator session and log back in as the tenant.

a) Click the **Catalog** tab.
b) In the **navigation** pane, choose **VM Services**.
c) In the **Work** pane, choose the blueprint you created.
d) In the **Catalog Item Details** pane, verify the properties of the blueprint and click **Request**.
e) In the **New Request** pane, click **Submit** and then **OK**.

This provisions a new virtual machine, ACI networking, and connects the two together.

Deploying a 3-Tier Application Using a Multi-Machine Blueprint

VMware vRealize multi-machine blueprints are groupings of one or more machine blueprints to be deployed simultaneously. A common use case is a three-tier web application, where the web, app, and database tiers are deployed together. From a networking perspective, you must push the application policy into Cisco Application Centric Infrastructure (ACI) to enable secure communication between tiers that need to communicate. This is achieved by creating a security policy and associating the relevant machines dynamically at deployment time.

When configuring a blueprint that will be used in a multi-machine blueprint, a security policy must be created. During the creation process, the consumer and provider must be provided. The provider is always the machine that you are building, and the consumer can be any other machine or network.

As an example, say that you have a MySQL database machine blueprint that provides a service on port 3306. The application tier machines need to access this database, but the web tier machines do not. Under the **Security Policy** section of the **Configure Property Group** workflow, you create a policy with the "app" tier as the consumer, listing port 3306 as permissible (everything else is denied by default) and the blueprint will automatically place the "db" tier as the provider.

The "app" tier also must provide a service; in this example a server is listening on port 8000. The web tier will then consume this service. The security policy must be specified in the "app" tier property group.

Note Machine prefixes generate a unique name for each virtual machine that is deployed. An example prefix for a tenant named "Green" could be "green-web-", plus three unique digits for each machine. The sequence would be: "green-web-001", "green-web-002", "green-web-003", and so on. It is important that you follow a similar scheme with your machine prefixes so that the Application Policy Infrastructure Controller (APIC) plug-in can accurately predict the name of the consumer endpoint group. Additionally, every machine must be on the same prefix number. For example, the names for a 3-tier app must be: green-db-001, green-app-001, and green-web-001. If any tier were not aligned, the security policy would fail to form a correct relationship. This is a requirement because vRealize does not provide the name of the sibling tiers, so the plug-in must infer the siblings' names based on its own name.

When configuring a security policy under a property group, the consumer name should be the second word of the machine prefix. For the example prefix "green-web-", the consumer name would be "web".

This section describes how to deploy a 3-tier application using a multi-machine blueprint.

Procedure

Step 1 Connect to the vRealize Automation appliance by pointing your browser to the following URL:

`https://appliance_address/vcac/org/tenant_id`

Step 2 Enter the tenant administrator username and password.

Step 3 Choose **Catalog**.

Step 4 Click **Configure Property Group**.

You will configure the database tier.

Step 5 Click **Request**.

Step 6 In the **Request Information** tab, enter a description of the request.

Step 7 Click **Next**.

Step 8 In the **Common** tab, perform the following actions:

a) In the **IaaS Host for vRealize** field, click **Add**.
b) Put a check in the box next to the desired IaaS host.
c) Click **Submit**.
d) In the **APIC Tenant** field, click **Add**.
e) Expand ***apic_name*** > **Tenants**.
f) Put a check in the box next to the desired tenant's name.

Example:

```
green
```

g) Click **Submit**.
h) In the **Property Group Name** field, enter a name for the property group.

Example:

```
green-db-mm
```

i) In the **VMM Domain/DVS** field, click **Add**.
j) Expand ***apic_name*** > **Vcenters** > ***vcenter_name***

k) Put a check in the box next to the desired vCenter's name.

Example:

```
green
```

l) Click **Submit**.

Step 9 Click **Next**.

Step 10 In the **VM Networking** tab, leave all of the fields at their default values.

Step 11 Click **Next**.

Step 12 In the **Security** tab, perform the following actions:

a) In the **Configure Security Policy** drop-down list, choose **Yes**.

b) In the **Consumer Network/EPG Name of Security Policy** field, enter the name of the consumer network, without the full machine prefix.

Example:

```
app
```

The database tier must have the application tier as the consumer.

c) In the **Starting Port Number in Security Policy** field, enter the starting port number.

Example:

```
3306
```

d) In the **Ending Port Number in Security Policy** field, enter the ending port number.

Example:

```
3306
```

e) For the other fields, leave their values at the defaults.

Step 13 Click **Next**.

Step 14 In the **Load Balancer** tab, leave the field at its default value.

Step 15 Click **Next**.

Step 16 In the **Firewall** tab, leave the field at its default value.

Step 17 Click **Submit**.

Step 18 Click **OK**.

Step 19 Click **Configure Property Group**.

This time, you will configure the application tier.

Step 20 Click **Request**.

Step 21 In the **Request Information** tab, enter a description of the request.

Step 22 Click **Next**.

Step 23 In the **Common** tab, perform the following actions:

a) In the **IaaS Host for vRealize** field, click **Add**.

b) Put a check in the box next to the desired IaaS host.

c) Click **Submit**.

d) In the **APIC Tenant** field, click **Add**.

e) Expand ***apic_name*** > **Tenants**.

f) Put a check in the box next to the desired tenant's name.

Example:

```
green
```

g) Click **Submit**.

h) In the **Property Group Name** field, enter a name for the property group.

Example:

```
green-app-mm
```

i) In the **VMM Domain/DVS** field, click **Add**.

j) Expand ***apic_name*** > **Vcenters** > ***vcenter_name***

k) Put a check in the box next to the desired vCenter's name.

Example:

```
green
```

l) Click **Submit**.

Step 24 Click **Next**.

Step 25 In the **VM Networking** tab, leave all of the fields at their default values.

Step 26 Click **Next**.

Step 27 In the **Security** tab, perform the following actions:

a) In the **Configure Security Policy** drop-down list, choose **Yes**.

b) In the **Consumer Network/EPG Name of Security Policy** field, enter the name of the consumer network, without the full machine prefix.

Example:

```
web
```

The application tier must have the web tier as the consumer.

c) In the **Starting Port Number in Security Policy** field, enter the starting port number.

Example:

```
8000
```

d) In the **Ending Port Number in Security Policy** field, enter the ending port number.

Example:

```
8000
```

e) For the other fields, leave their values at the defaults.

Step 28 Click **Next**.

Step 29 In the **Load Balancer** tab, leave the field at its default value.

Step 30 Click **Next**.

Step 31 In the **Firewall** tab, leave the field at its default value.

Step 32 Click **Submit**.

Step 33 Click **OK**.

Step 34 Click **Configure Property Group**.

You will configure the web tier.

Step 35 Click **Request**.

Step 36 In the **Request Information** tab, enter a description of the request.

Step 37 Click **Next**.

Step 38 In the **Common** tab, perform the following actions:

a) In the **IaaS Host for vRealize** field, click **Add**.
b) Put a check in the box next to the desired IaaS host.
c) Click **Submit**.
d) In the **APIC Tenant** field, click **Add**.
e) Expand ***apic_name*** > **Tenants**.
f) Put a check in the box next to the desired tenant's name.

Example:

```
green
```

g) Click **Submit**.
h) In the **Property Group Name** field, enter a name for the property group.

Example:

```
green-web-mm
```

i) In the **VMM Domain/DVS** field, click **Add**.
j) Expand ***apic_name*** > **Vcenters** > ***vcenter_name***
k) Put a check in the box next to the desired vCenter's name.

Example:

```
green
```

l) Click **Submit**.

Step 39 Click **Next**.

Step 40 In the **VM Networking** tab, leave all of the fields at their default values.

Step 41 Click **Next**.

Step 42 In the **Security** tab, leave the field at its default value.

Because this is a consumer policy, you do not need to configure the security policy.

Step 43 Click **Next**.

Step 44 In the **Load Balancer** tab, leave the field at its default value.

Step 45 Click **Next**.

Step 46 In the **Firewall** tab, leave the field at its default value.

Step 47 Click **Submit**.

Step 48 Click **OK**.

About Plan Types

The administrator creates the plan with their own values. The plan types are as follows:

	Shared Infrastructure	Virtual Private Cloud (VPC)
Isolated Networks	Yes	Yes
Firewall	Yes	Yes
Provider DHCP	Yes	Yes
Shared Load Balancer	Yes	Yes
Public Internet Access	Yes	Yes
Shared Services between Tenants	Yes	Yes
Bring your own address space (Private Address Space) and DHCP Server	No	Yes

About vRealize Service Categories and Catalog Items

This section describes the vRealize services categories and catalog items. The list of all catalog items they are grouped into services and each of these services are assigned an entitlement. ACI entitlement is assigned to certain users.

For more information, see ACI Administrator Services in vRealize, on page 24.

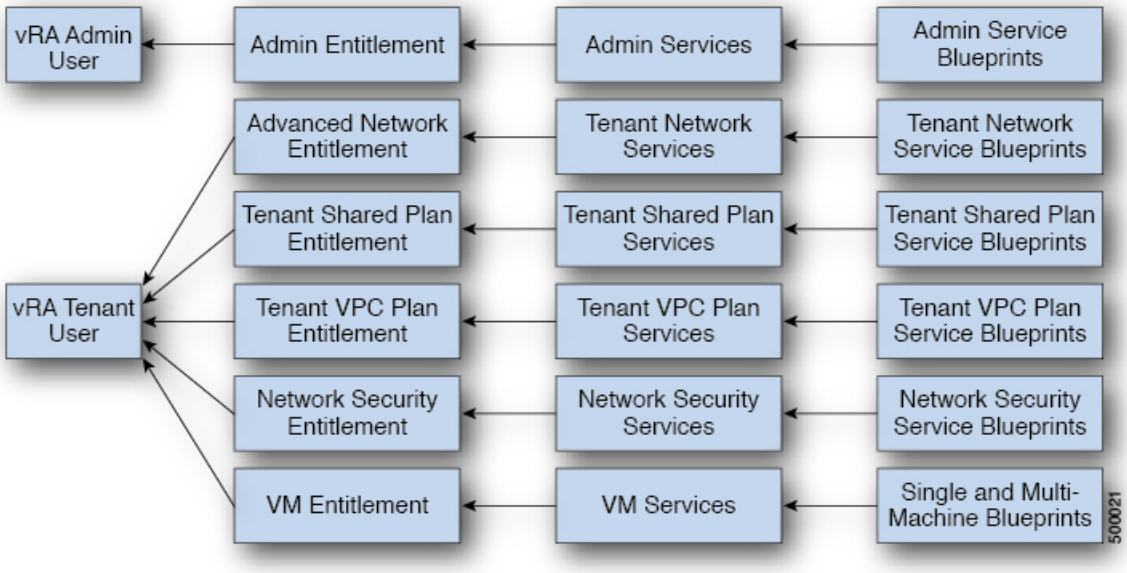
For more information, see ACI Tenant Services in vRealize, on page 27.

For more information, see Entitlements for ACI catalog-items in vRealize, on page 31.

Mapping of the ACI Plan Types to vRealize Service Categories

This section shows the mapping of the Cisco ACI plan types to vRealize service categories.

Figure 3: vRA - User, Entitlements, Services and Blueprints



vRA Catalog Category	List of Blueprints
Admin service blueprints	Add APIC with Admin credentials Add APIC with Tenant credentials Add Provider for Shared Service (Contract) Add or Update Tenant Add VIP Pool Add VMM Domain, AVS Local Switching with Vlan Encap Add VMM Domain, AVS Local Switching with Vxlan Encap Add VMM Domain, AVS No Local Switching Add VMM Domain, AVE Local Switching with Vlan Encap Add VMM Domain, AVE Local Switching with Vxlan Encap Add VMM Domain, AVE No Local Switching Add VMM Domain, DVS and Vlan Pool Add or Delete Bridge Domain in Tenant-common Add or Delete Consumer for Shared Service (Contract) Add or Delete L3 context (VRF) in Tenant-common Add or Delete Router Id Add or Delete Subnets in Bridge Domain for Tenant-Common Update FW Policy (DFW) association to AVS or AVE VMM Domain Configure Property Group Create FW Policy (DFW) and Associate to AVS or AVE VMM Domain Delete APIC Delete FW Policy (DFW) Delete Provider Shared Service (Contract) Delete Tenant Delete VIP Pool Delete VMM Domain, AVS or AVE, and VLAN, Multicast Pool Delete VMM Domain, DVS and Vlan Pool Generate and Add Certificate to APIC Rest API Update FW Policy (DFW) AVS or AVE Update Vlan Pool, AVS or AVE Update Multicast Pool, AVS Update VMM Domain DVS security domain mapping Update AVS or AVE VMM Domain Security Domain Mapping

vRA Catalog Category	List of Blueprints
Tenant Shared Plan service blueprints	Add a Useg Network - Shared Plan Add FW and LB to Tenant Network - Shared Plan Add FW to Tenant Network - Shared Plan Add Loadbalancer to Tenant Network - Shared plan Add Tenant Network - Shared plan Delete a Useg Network - Shared Plan Delete FW and LB from Tenant Network - Shared Plan Delete FW from Tenant Network - Shared Plan Delete Loadbalancer from Tenant Network - Shared Plan Delete Tenant Network - Shared plan
Tenant VPC Plan service blueprints	Add a Useg Network - VPC Plan Add FW and LB to Tenant Network - VPC Plan Add FW to Tenant Network - VPC Plan Add Loadbalancer to Tenant Network - VPC plan Add Tenant Network - VPC plan Delete a Useg Network - VPC Plan Delete FW and LB from Tenant Network - VPC Plan Delete Loadbalancer from Tenant Network - VPC Plan Delete Tenant Network - VPC plan
Network Security service blueprints	Add Security Policy (Contracts) Delete Security Policy (Contracts) Update Access List Security Rules
Tenant Network Service blueprints	Add or Delete Bridge domain in Tenant Add or Delete L3 Context (VRF) in Tenant Add or Delete Subnets in Bridge domain Add or Delete Useg Attribute Attach or Detach L3 external connectivity to Network Update Tenant Network

ACI Administrator Services in vRealize

This section describes the ACI Administrator Services in vRealize.

List of Admin Services Catalog Items for ACI Administrator Services

This section provides a list of the admin services catalog items for ACI administrator services.

Catalog Item	Description
Add APIC with Tenant Credentials	This creates the Application Policy Infrastructure Controller (APIC) handle with tenant credentials.
Add APIC with Admin Credentials	This creates the APIC handle with Admin credentials.
Add or Delete Bridge Domain in Tenant-common	This adds or deletes the bridge domain in tenant-common.
Add or Delete Consumer for Shared Service (Contract)	This adds or deletes consumer for shared service (Contract).
Add or Delete L3 context (VRF) in Tenant-common	This adds or deletes Layer 3 context (VRF) in tenant-common.

Catalog Item	Description
Add or Delete Subnets in Bridge Domain for Tenant-Common	This adds or deletes subnets in the bridge domain for tenant-common.
Add Provider for Shared Service (Contract)	This adds provider for shared service (Contract).
Add or Delete Router Id	This adds or deletes the router Id.
Add or Update Tenant	This adds or updates a tenant. If the tenant wants to use the Firewall between EPGs, set "Enable inter-EPG Firewall" to **Yes**. Also the number application tiers should be set. To use typical 3-tier web, app, db application the number of tiers should be set to **3**.
Add VIP Pool	This adds the Virtual IP Pool.
Configure Property Group	This configures the property group.
Delete APIC	This deletes the APIC.
Delete Provider Shared Service (Contract)	This deletes the provider shared service (Contract).
Delete Tenant	This deletes a tenant.
Delete VIP Pool	This deletes the Virtual IP Pool.
Generate and Add Certificate to APIC	This blueprints can be used to generate a certificate for a given user. This certificate then be used in the certificate based access to APIC.
REST API	This is the REST API.

This section provides a list of the admin services catalog items for ACI administrator services for the VMM domain type DVS.

Catalog Item	Description
Add VMM Domain, DVS and VLAN Pool	This adds VMM Domain, DVS, and VLAN Pool. Ensure all hosts of the data-center that has the APIC created DVS in vCenter, must have at least one physical NIC attached. This ensures that the port-groups of the DVS are available for virtual NIC placements.
Delete VMM Domain, DVS, and VLAN Pool	This deletes the VMM Domain, DVS and VLAN Pool.
Update Vlan Pool (encap blocks)	This updates the Vlan Pool (encap blocks).
Update VMM Domain DVS security domain mapping	This updates the VMM Domain DVS security domain mapping.

This section provides a list of the admin services catalog items for ACI administrator services for the VMM domain type Cisco AVS or Cisco ACI Virtual Edge (AVE).

Catalog Item	Description
Add VMM Domain, AVS or AVE Local Switching with Vlan Encap	This creates a VMM domain in Cisco APIC with VLAN as the default encapsulation mode. It also creates a VLAN pool and multicast address pool (in the case of mixed mode). This item also creates an associated Cisco AVS or Cisco ACI Virtual Edge with local switching in vCenter.
Add VMM Domain, AVS or AVE Local Switching with Vxlan Encap	This creates a VMM domain in Cisco APIC with VXLAN as the default encapsulation mode. It also creates a multicast address pool and VLAN pool (in the case of mixed mode). This item also creates an associated Cisco AVS or Cisco ACI Virtual Edge with local switching in vCenter.
Add VMM Domain, AVS or AVE No Local Switching	This adds VMM domain, multicast address pool in Cisco APIC and creates an associated Cisco AVS or Cisco ACI Virtual Edge with no local switching in vCenter.
Update Multicast Pool, AVS or AVE	This updates the multicast pool for Cisco AVS or Cisco ACI Virtual Edge VMM domain.
Update VLAN Pool, AVS or AVE	This updates the VLAN pool for the Cisco AVS or Cisco ACI Virtual Edge VMM domain.
Update AVS or AVE VMM Domain Security Domain Mapping	This updates the security domain mapping of the Cisco AVS or Cisco ACI Virtual Edge VMM domain.
Delete VMM Domain AVS or AVE, Vlan, Multicast Pool	This deletes the Cisco AVS or Cisco ACI Virtual Edge VMM Domain and VLAN Pools and Multicast Pool in Cisco APIC and deletes the associated Cisco AVS or Cisco ACI Virtual Edge in vCenter.
Create FW Policy (DFW) and Associate to AVS or AVE VMM Domain	This creates a Distributed Firewall policy and associates it to the Cisco AVS or Cisco ACI Virtual Edge VMM domain.
Update FW Policy (DFW) association to AVS or AVE VMM Domain	This associates/dissociates an existing Distributed Firewall policy to the Cisco AVS or Cisco ACI Virtual Edge VMM domain.
Update FW Policy (DFW)	This updates the existing Distributed Firewall Policy.
Delete FW Policy (DFW)	This deletes the existing Distributed Firewall Policy.

To submit a request:

1. Log in to the vRealize Automation as admin, choose **Catalog** > **Admin Services**.
2. Choose a request, enter the information in the fields and click **Submit**.

To view your request:

1. In the vRealize Automation GUI, choose **Requests**.
2. Choose the request you submitted and click **view details**.

ACI Tenant Services in vRealize

This section describes the ACI tenant services in the vRealize.

List of Network Security Catalog Items for ACI Tenant Services

This section provides a list of the Network Security catalog items for ACI tenant services.

Catalog Item	Description
Add Security Policy (Contracts)	This creates the security policy between tenant networks. For example: APIC contracts between consumer EPG and provider EPG.
Delete Security Policy (Contracts)	This deletes the security policy between tenant networks. For example: APIC contracts between consumer EPG and provider EPG.
Update Access List Security Rules	This adds or removes access list rules associated with a Security Policy Filter created in APIC (using Add Security Policy (Contracts)). The access list rules are of the format <source-port, destination-port, protocol, ethertype>. **Note** The Source and Dest Ports are not allowed for arp, icmp, icmpv6 rules. Ports are valid only for tcp and udp protocols. The access list rules are deployed and enforced in ACI fabric and they are stateless in nature. In addition this blueprint also has an option to update the stateful firewall rules on a Firewall appliance such as Cisco-ASA for a specific service graph that is provided as an input.

To submit a request:

1. Log in to the vRealize Automation as admin, choose **Catalog** > **Network Security**.
2. Choose a request, enter the information in the fields and click **Submit**.

To view your request:

1. In the vRealize Automation GUI, choose **Requests**.
2. Choose the request you submitted and click **view details**.

List of Tenant Network Services Catalog Items for ACI Tenant Services

The following table lists the Tenant Network Services catalog items for ACI tenant services. You must log in to the tenant portal with tenant administrator privileges to execute the Tenant Network Services catalog items.

Catalog Item	Description
Add or Delete Bridge Domain in Tenant	This adds or deletes the bridge domain in tenant.
Add or Delete L3 Context (VRF) in Tenant	This adds or deletes Layer 3 context (VRF) in tenant.
Add or Delete Subnets in Bridge domain	This adds or deletes subnets in the bridge domain.
Attach or Detach L3 external connectivity to Network	This attaches or detaches Layer 3 external connectivity to the network.
Update Tenant Network	This updates the tenant network.

The following table lists the Tenant Network Services catalog items for VMM domain of type Cisco AVS and Cisco ACI Virtual Edge only. You must log in to the tenant portal with tenant administrator privileges to execute the Tenant Network Services catalog items.

Catalog Item	Description
Add or Delete Useg Attribute	This adds or deletes an attribute for a microsegment EPG.

To submit a request:

1. Log in to the vRealize Automation as tenant admin, choose **Catalog** > **Tenant Network Services**.
2. Choose a request, enter the information in the fields and click **Submit**.

To view your request:

1. In the vRealize Automation GUI, choose **Requests**.
2. Choose the request you submitted and click **view details**.

List of Tenant Shared Plan Catalog Items for ACI Tenant Services

The following table lists the Tenant Shared Plan catalog items for ACI tenant services. You must log in to the tenant portal with tenant administrator privileges to execute the Tenant Shared Plan catalog items.

Catalog Items	Description
Add Tenant Network	This adds the tenant network in a shared plan.
Add FW and LB to Tenant Network - Shared Plan	This adds a firewall and load balancer to the tenant network in a shared plan.
Add FW to Tenant Network - Shared Plan	This adds a firewall to the tenant network in a shared plan.

Catalog Items	Description
Add Load Balancer to Tenant Network - Shared Plan	This adds load balancer to the tenant network in a shared plan.
Delete FW and LB from Tenant Network - Shared Plan	This deletes the firewall and load balancer from the tenant network in a shared plan.
Delete FW from Tenant Network - Shared Plan	This deletes the firewall from the tenant network in a shared plan.
Delete Load Balancer from Tenant Network - Shared Plan	This deletes load balancer from the tenant network in a shared plan.
Delete Tenant Network - Shared Plan	This deletes the tenant network in a shared plan.

The following table lists the Tenant Shared Plan catalog items for VMM domain of type Cisco AVS only. You must log in to the tenant portal with tenant administrator privileges to execute the Tenant Shared Plan catalog items.

Catalog Item	Description
Add a Useg Network - Shared Plan	This adds a microsegment EPG in a shared plan.
Delete a Useg network - Shared Plan	This deletes a microsegment EPG in a shared plan.

To submit a request:

1. Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.
2. Choose a request, enter the information in the fields and click **Submit**.

To view your request:

1. In the vRealize Automation GUI, choose **Requests**.
2. Choose the request you submitted and click **view details**.

Note Symptom: You might see errors in the VMware vCenter during the deletion of the service graph through the vRealize Automation (vRA) workflow.

Condition: During the deletion of the service graph, if a port group is deleted before service devices such as VPX or F5 are configured, then these errors are seen. This sequence cannot be controlled through vRA.

Workaround: There is no workaround. These errors are transitory and will stop once the reconfiguration of the service devices is done.

List of Tenant VPC Plan Catalog Items for ACI Tenant Services

The following table lists the Tenant Virtual Private Cloud (VPC) Plan catalog items for ACI tenant services. You must log in to the tenant portal with tenant administrator privileges to execute the Tenant VPC Plan catalog items

Catalog Item	Description
Add Tenant Network - VPC Plan	This adds the tenant network in a VPC plan.
Add FW and LB to Tenant Network - VPC Plan	This adds the firewall and load balancer to the tenant network in a VPC plan.
Add FW to Tenant Network - VPC Plan	This adds the firewall to the tenant network in a VPC plan.
Add Load-balancer to Tenant Network - VPC Plan	This adds the load balancer to tenant network in a VPC plan.
Delete FW and LB from Tenant Network - VPC Plan	This deletes the firewall and load balancer from tenant network in a VPC plan.
Delete Load-balancer from Tenant Network - VPC Plan	This deletes load balancer from tenant network in a VPC plan.
Delete Tenant Network - VPC Plan	This deletes the tenant network in a VPC plan.

The following table lists the Tenant VPC Plan catalog items for VMM domain of type Cisco AVS or Cisco ACI Virtual Edge only. You must log in to the tenant portal with tenant administrator privileges to execute the Tenant VPC Plan catalog items.

Catalog Item	Description
Add a Useg Network - VPC plan	This adds a microsegment EPG in a VPC plan.
Delete a Useg Network - VPC plan	This deletes a microsegment EPG in a VPC plan.

To submit a request:

1. Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.
2. Choose a request, enter the information in the fields and click **Submit**.

To view your request:

1. In the vRealize Automation GUI, choose **Requests**.
2. Choose the request you submitted and click **view details**.

List of VM Services Catalog Items for ACI Tenant Services

This section provides a list of the VM services catalog items for ACI tenant services.

This service category has the tenant catalog items based on single machine and multi-machine blueprints. For example, for typical three tier application, it contains 3 catalog items "Web", "App", "Db" using single-machine blueprints and 1 catalog item "Web-App-Db" using multi-machine blueprint.

Catalog Item	Description
App	This is the application VM.
Db	This is the database VM.

Catalog Item	Description
Test	This is the single-machine VM blueprint for testing property groups.
Web	This is the web VM.
Web-Db-App	This multi-machine blueprint creates a 3-tier application, load balancer attached to the Web tier and the security policy configuration.

To submit a request:

1. Log in to the vRealize Automation as admin, choose **Catalog** > **VM Services**.
2. Choose a request, enter the information in the fields and click **Submit**.

To view your request:

1. In the vRealize Automation GUI, choose **Requests**.
2. Choose the request you submitted and click **view details**.

Entitlements for ACI catalog-items in vRealize

This section describes the entitlements for ACI catalog-items in vRealize. Each service category must have an entitlement. Entitlement enables the catalog items to be available for the users.

You can create and manage entitlements to control the access to the catalog items, actions, and specify the approval policies to apply the catalog requests. You can update the priority of the entitlement to determine which approval policy applies to a particular request.

List of Entitlements for ACI Catalog Items

This section provides a list of the entitlements for ACI catalog items.

Name
VMs Entitlements
Admin Entitlements
Tenant Shared Plan Entitlements
Tenant VPC Plan Entitlements
Common Network Services Entitlements
Tenant Network Services Entitlements
Tenant-common Network Services
Network Security Entitlements

To edit an entitlement:

1. Log in to the vRealize Automation as admin, choose **Administration** > **Catalog Management** > **Entitlements**.
2. Choose an entitlement to edit, enter the information in the fields and click **Update**.

ACI Plug-in in vRealize Orchestrator

The service category and the catalog item maps to a workflow.

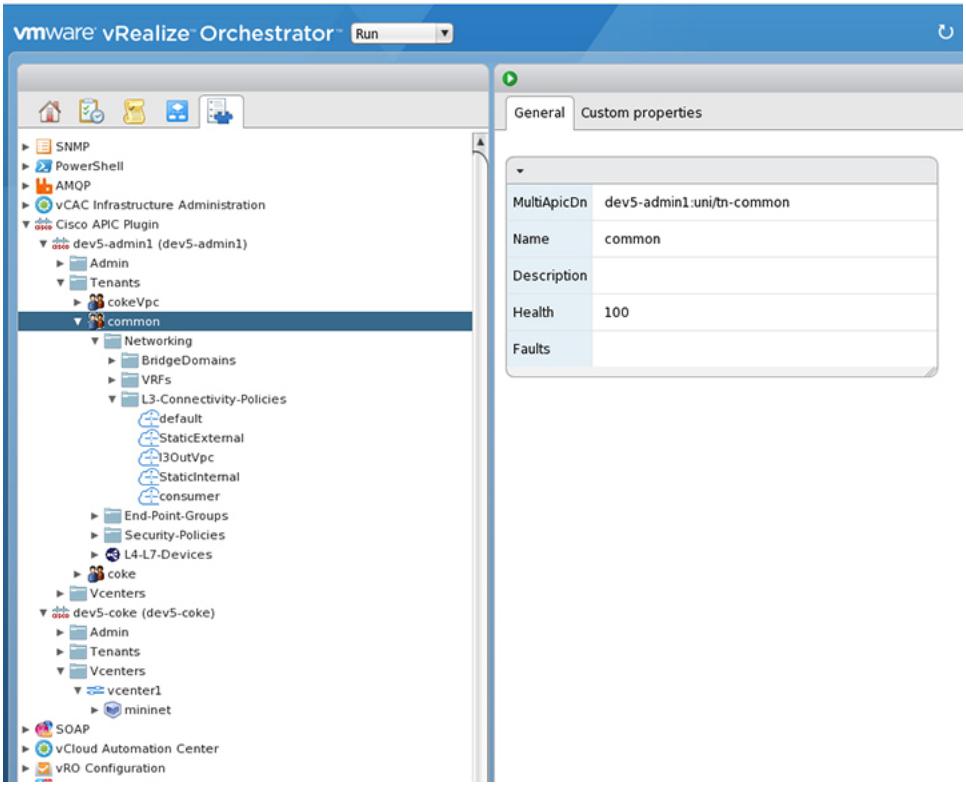
APIC Workflows

These are the service categories and the catalog items and each catalog items is implemented as a workflow in the vRealize Orchestrator and the catalog items parameter are exactly same as the workflow parameters.

Service Categories	Description
Admin Services	Admin catalog-items to be executed by the global administrator
Network Security	Catalog-items for configuring security policies
Tenant Network Services	For configuring network services (bridge-domain, subnets)
Tenant Shared Plan	For configuring EPG/networks, microsegment EPGs, consuming load balancer, and firewall services in shared mode
Tenant VPC Plan	For configuring EPG/networks, microsegment EPGs, consuming load balancer, and firewall services in VPC mode
VM Services	Single-machine and multi-machine blueprints configured with ACI property groups

APIC Inventory View

In the Inventory view of the vRealize Orchestrator GUI, the Cisco APIC Plugin is a read only view. The Cisco APIC Plugin for vRealize Orchestrator maps to the APIC. For example, if you look at an object in the vRealize Orchestrator GUI it provides the MultiApicDn in the Cisco APIC GUI.



About Load Balancing and Firewall Services

VLAN, virtual routing and forwarding (VRF) stitching is supported by traditional service insertion models, the Application Policy Infrastructure Controller (APIC) can automate service insertion while acting as a central point of policy control. The APIC policies manage both the network fabric and services appliances. The APIC can configure the network automatically so that traffic flows through the services. The APIC can also automatically configure the service according to the application's requirements, which allows organizations to automate service insertion and eliminate the challenge of managing the complex techniques of traditional service insertion.

Perimeter Firewall is typically used to provide state-full firewall services for all incoming external traffic to the application. Once the traffic passes the firewall, another typical service that is inserted is the load balancing. The external traffic is sent towards, a virtual IP. The load balancer terminates this traffic and load balances the incoming traffic among the available servers (such as web servers) behind the load balancers.

See the *Cisco APIC Layer 4 to Layer 7 Services Deployment Guide* for more information.

APIC vRealize plug-in can be used to create new multi-tier applications while inserting the load balancer and/or firewall services for the traffic between them or it can be used to insert the firewall and load-balancer services for traffic between existing application end-point groups. For creating a multi-tier application with L4-7 services, a property group has to be created using "Configure Property Group" catalog-item in the "Admin Services". In addition of L4-7 services between existing application end-point groups can be done by choosing the appropriate catalog-item from the "Tenant Shared Services" items.

Note In this release, only support for Shared-Plan is supported for Load balancer and Firewall services.

Prerequisites for Enabling Services

This section describes the prerequisites for enabling services.

You must perform the following tasks to deploy Layer 4 to Layer 7 services using the APIC vRealize plug-in:

- Device package for load balancer needs to be uploaded by APIC admin.

  Use the link to download the required Citrix, F5, and Cisco ASA device packages:

  http://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/application-centric-infrastructure/solution-overview-c22-734587.html

  Ensure the device package version is certified for the APIC release that you are using.

- Device cluster for load balancer, firewall needs to be created in tenant "common" by APIC-admin. Citrix and F5 are the supported vendors for load balancers. Cisco ASA is the supported vendor for firewall.
- For stand-alone firewall or load balancer service, a service graph template with single node must be configured. For the firewall and load balancer service, a service graph template with two nodes must be configured.
- For the abstract service graph, the firewall node (vnsAbsNode) must be named **FW**, and the load balancer node must be named **SLB**.
- For the load balancer only abstract service graph name (vnsAbsGraph) should be same as the load balancer device cluster (vnsLdevVip).
- For the load balancer only service, the consumer L3 connectivity policy must be configured in the "default" VRF of the tenant common.
- For the firewall, the consumer L3 connectivity policy must be configured in the separate VRF ("outside") of the tenant common.
- The firewall device needs to be deployed in the routed mode. For firewall device connectivity, two additional L3 connectivity policy must be configured. One must be configured in the "outside" VRF, and is used as the external connection to the firewall device. The other must be configured in the "default" VRF and is used as the internal connection to the firewall device. These two L3 connectivity policies, attached to the firewall enables the firewall to do the VRF stitching and re-direct the traffic appropriately between the VRFs. The administrator has to ensure that appropriate prefixes with the correct import and export flags are configured under the L3 external connectivity policies.
- The following convention should be used when configuring the L3 connectivity policies. For the L3 connectivity policy should be named as ***L3ExtName*** , the child L3 instance should be named as ***L3ExtName*****Inst**.
- The interface IP addresses that are used on the firewall and load balancer devices need to be configured in the abstract graph.
- For the 2-node abstract graph, an access list to permit all traffic needs to be configured for the firewall node.

Configuring the Services on APIC Using XML POST

Only the administrator can configure and post the XML POST. The template POSTs are located in the `apic-vrealize` package under the `services` directory.

Before you begin

- The device package file should be uploaded on the Application Policy Infrastructure Controller (APIC).

  See the *Cisco APIC Layer 4 to Layer 7 Device Package Development Guide* for more information.
- The tenant common should have the two bridge domains named "default" and "vpcDefault". Ensure that the subnets being used by the tenant who is consuming the load balancer are added to these bridge domains. Typically you would have created these bridge domains and subnets while setting up the DHCP infrastructure for vRealize tenants.
- For a non-Virtual Private Cloud (VPC) plan, the backend interface of the load balancer should be placed in the default EPG under the tenant common that was created above. For a VPC plan, the EPG should be "vpcDefault".
- Ensure that the VIP subnet is linked with L3. One VIP per EPG will be allocated from the VIP pool associated with the tenant.
- Prerequisites for the service scripts:
  - Python 2.7
  - Python libraries:
    - jinja2
    - yaml
    - glob
    - json
    - requests
    - xml
    - re

Procedure

Step 1 Use the following link to download the required device packages Citrix, F5, and ASA. Ensure that the device package version is certified for the APIC release that you are using. Store the device package zip files in this directory:

http://www.cisco.com/c/en/us/solutions/collateral/data-center-virtualization/application-centric-infrastructure/solution-overview-c22-734587.html

Step 2 Replace the `VENDOR-DEVICE-PACKAGE.zip` entries in the `shared.cfg` or `vpc.cfg` file with the correct device package files.

Step 3 Edit the `setup.yaml` file and change the variables to according to your setup.

The template variables in the `setup.yaml` file are:

```
TEMPLATE_VARS:
    VCENTER: "vcenter1"
    ASA_IP: "1.1.1.1"
    ASA_CLUSTER: "AsaCluster1"
    ASA_VM: "asav-service5"
    OUTSIDE_CTX: "outside"
    INSIDE_CTX: "default"
    FW_GRAPH: "FWOnlyGraph"
    FW_SLB_GRAPH: "FWAndSLBGraph"
    BD_WEB: "default"
    CITRIX_MGMT_IP: "1.1.1.1"
    FW_NODE: "FW"
    SLB_NODE: "SLB"
    CITRIX_GRAPH: "CitrixCluster1_L3"
    CITRIX_CLUSTER: "CitrixCluster1_L3"
    CITRIX_GRAPH: "CitrixCluster1_L3"
    CITRIX_VM: "NS-service4"
    F5_BD: "F5Cluster1_L3"
    F5_EPG: "F5Cluster1_L3"
    F5_CLUSTER: "F5Cluster1_L3"
    F5_MGMT_IP: "1.1.1.1"
    F5_GRAPH: "F5Cluster1_L3"
    F5_ABS_NODE: "SLB"
    # Use deleted to generate the "deleted" version of the posts
    # STATUS: "deleted"
    STATUS: ""
```

Step 4 Enter the following commands:

For Shared Plan:

Example:

```
../jinja.py setup.yaml tn-common-template.xml > tn-common.xml
../jinja.py setup.yaml Shared-Plan-Citrix-graph-template.xml > Shared-Plan-Citrix-graph.xml
../jinja.py setup.yaml Shared-Plan-F5-graph-template.xml > Shared-Plan-F5-graph.xml
```

For VPC Plan:

Example:

```
../jinja.py setup.yaml VPC-tn-common-template.xml > VPC-tn-common.xml
../jinja.py setup.yaml VPC-Plan-Citrix-LB-graph-template.xml > VPC-Plan-Citrix-LB-graph.xml
../jinja.py setup.yaml VPC-Plan-F5-LB-graph-template.xml > VPC-Plan-F5-LB-graph.xml
```

If you see python errors, ensure that the prerequisite python libraries are installed in the system.

Step 5 Edit the `shared.cfg` or `vpc.cfg` file and set the values for `hosts: <YOUR_APIC_IP>` and `passwd: <YOUR_APIC_ADMIN_PASSWD>`.

Sample of the `shared.cfg` file:

Example:

```
host:   <YOUR_APIC_IP>:443
name:   admin
passwd: <YOUR_APIC_ADMIN_PASSWD>
tests:
    - type: file
```

```
      path: /ppi/node/mo/.xml
#      file: asa-device-pkg-1.2.2.1.zip
#      Replace actual ASA Device package file in the line below
      file: ASA-DEVICE-PACKAGE.zip
      wait: 2
    - type: file
      path: /ppi/node/mo/.xml
#      file: CitrixNetscalerPackage.zip
#      Replace actual Citrix Device package file in the line below
      file: CITRIX-DEVICE-PACKAGE.zip
      wait: 2
    - type: file
      path: /ppi/node/mo/.xml
#      file: CitrixNetscalerPackage.zip
#      Replace actual F5 Device package file in the line below
      file: F5-DEVICE-PACKAGE.zip
      wait: 2
    - type: xml
      path:  /api/node/mo/.xml
      file: tn-common.xml
      wait: 0
    - type: xml
      path:  /api/node/mo/.xml
      file: Shared-Plan-Citrix-graph.xml
      wait: 0
    - type: xml
      path:  /api/node/mo/.xml
      file: Shared-Plan-F5-graph.xml
      wait: 0
```

Step 6 Post the templates.

For Shared Plan, enter the following command:

Example:

```
../request.py shared.cfg
```

For VPC Plan, enter the following command:

Example:

```
../request.py vpc.cfg
```

Deleting the Services Configuration

This section describes how to delete the services configuration. Only the administrator can configure and post the XML POST. The template POSTs are located in the `apic-vrealize` package under the `services` directory.

Procedure

Step 1 Edit the `shared.cfg` file and set the values for `hosts: <YOUR_APIC_IP>` and `passwd: <YOUR_APIC_ADMIN_PASSWD>`.

Step 2 Edit the `setup.yaml` file and set the `STATUS` variable to `deleted` to generate the deleted version of the posts.

Step 3 Run the following commands:

```
./jinja.py setup.yaml tn-common-template.xml > tn-common-del.xml
./jinja.py setup.yaml Shared-Plan-Citrix-graph-template.xml > Shared-Plan-Citrix-graph-del.xml
./jinja.py setup.yaml Shared-Plan-F5-graph-template.xml > Shared-Plan-F5-graph-del.xml
```

Step 4 Post the templates:

```
./request.py shared_del.cfg
```

About L3 External Connectivity

Layer 3 (L3) external connectivity is an Cisco Application Centric Infrastructure (ACI) feature to connect ACI fabric to an external network by L3 routing protocols, including static routing, OSPF, EIGRP, and BGP. By setting up L3 external connectivity for vRealize, it allows a tenant network to initiate outgoing traffic destined outside the fabric and to attract traffic from outside. The assumption of this feature is the tenant virtual machine IP addresses are visible outside the fabric without NAT, ACI L3 external connectivity does not include NAT.

Prerequisites for Configuring L3 External Connectivity for vRealize

To configure Layer 3 (L3) external connectivity for vRealize, you must meet the following prerequisites:

- Ensure you have logged in to the Application Policy Infrastructure Controller (APIC) GUI, on the menu bar, choose **TENANT** > **common**.
  - Create a l3ExtOut called "**default**", refer to BD "**default**".
  - Create l3extInstP name="**defaultInstP**" under the l3ExtOut. This is to be used by shared service tenants.

  See *Cisco APIC Basic Configuration Guide* for L3 external connectivity configuration.
- Ensure you have logged in to the APIC GUI, on the menu bar, choose **TENANT** > **common**.
  - Create a l3ExtOut called "**vpcDefault**", refer to BD "**vpcDefault**".
  - Create l3extInstP name="**vpcDefaultInstP**" under this l3ExtOut.

    This is to be used by VPC tenants.

  See *Cisco APIC Basic Configuration Guide* for configuring external connectivity for tenants.

  vRealize leverages the common l3ExtOut configuration with no special requirement other than the naming convention highlighted above

Administrator Experiences

Cisco ACI with Cisco AVS or Cisco ACI Virtual Edge

See the following documentation for general information about Cisco Application Virtual Switch (AVS) or Cisco ACI Virtual Edge:

- Cisco AVS—See the chapter "Cisco ACI with Cisco AVS" in the latest version of the Cisco ACI Virtualization Guide or the Cisco AVS guides on Cisco.com
- Cisco ACI Virtual Edge—See the Cisco ACI Virtual Edge documentation on Cisco.com.

Cisco AVS or Cisco ACI Virtual Edge VMM Domain Creation

You can create VMM domains for Cisco AVS or Cisco ACI Virtual Edge using VLAN or VXLAN encapsulation or with no local switching.

Beginning with Cisco APIC Release 2.1(1), you can mix encapsulation modes. That is, you can configure a VMM domain to use VLAN or VXLAN and later add EPGs that override the domain's default encapsulation. For details, see the section "Mixed-Mode Encapsulation Configuration" in the Cisco Application Virtual Switch Configuration Guide or the chapter "Mixed-Mode Encapsulation" in the Cisco ACI Virtual Edge Configuration Guide.

You also can create a Cisco AVS or Cisco ACI Virtual Edge VMM domain with no local switching. In local switching mode, the leaf forwards all traffic, and VXLAN is the only allowed encapsulation type. See the Cisco Application Virtual Switch Installation Guide or the Cisco ACI Virtual Edge Installation Guide.

After you create a Cisco AVS or Cisco ACI Virtual Edge VMM domain, you can update the domain's encapsulation pools and delete the Cisco AVS or Cisco ACI Virtual Edge and the VMM domain.

Creating a Cisco AVS or Cisco ACI Virtual Edge VMM Domain

This section shows how to create a Cisco AVS or a Cisco ACI Virtual Edge VMM Domain supporting no encapsulation, VLAN, or VXLAN encapsulation. When you choose the virtual switch (**Cisco AVS** or **Cisco AVE**) and the switching preference (**Local Switching** or **No Local Switching**), the vRealize GUI shows or hides mandatory or optional field inputs.

Before you begin

We recommend that you created an attachable access entity profile (AAEP) as part of day-0 operation of Cisco ACI.

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Add VMM Domain** and **AVS** or **AVE**.

Step 3 In the **New Request** dialog box, complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add a description and then click **Next**.
c) In the **Domain name** field, enter the VMM domain name.
d) For the **Virtual Switch** selector, choose **Cisco AVS** or **Cisco AVE**.

e) For the **Switching Preference** selector, choose **Lo Local Switching** or **Local Switching**.
f) If you chose **Local Switching**, for the **Encap mode** selector choose **VLAN** or **VXLAN**.

Encap mode is applicable only for **Local Switching**.

g) In the **AAEP Name** field, enter an attachable access entity profile (AAEP) name to associate it to the VMM domain.

If the AAEP that you enter doesn't exist, it is created.

h) For the **VLAN Ranges** to be allocated, click **Not set** and then add values to create VLANs.

For **Encap_Block_Role**, specify **external** or **internal**.

i) (Optional) In the **AVS Fabric-wide Multicast Address** or **AVE Fabric-wide Multicast Address**field, enter a valid multicast address between 224.0.0.0 and 239.255.255.255, inclusive, for the multicast address block range.
j) (Optional) In the **Multicast Address Start** field, enter the starting multicast address between 224.0.0.0 and 239.255.255.255, inclusive, for the multicast address block range.
k) Optional) In the **Multicast Address End** field, between 224.0.0.0 and 239.255.255.255, inclusive, for the multicast address block range.
l) In the **AAA Domain** area, click the green cross, choose a security domain, and then click **Next**.
m) In the **Vcenter IP (or Hostname)** field, enter the host name or IP address.

If you use the host name, you already must have configured a DNS policy on Cisco APIC. If you do not have a DNS policy configured, enter the IP address of the vCenter server.

n) From the **DVS Version** drop-down list, choose the DVS version.
o) In the **Username** field, enter the user name for logging in to the vCenter.
p) In the **Password** field, enter the password for logging into the vCenter.
q) In the **vCenter Datacenter** field, enter the data center name.

Note The name that you enter for the data center must match exactly the name in vCenter. The name is case-sensitive.

Verifying Cisco AVS or Cisco ACI Virtual Edge Creation in vCenter

Procedure

Step 1 Open a vSphere Client connection to a vCenter server.
Step 2 In vCenter, choose **Home** > **Inventory** > **Networking**view.
Step 3 Choose the data center.
Step 4 Under the data center, ensure that the Cisco AVS or the Cisco ACI Virtual Edge and its folder are created.

Verifying Creation of the Cisco AVS or Cisco ACI Virtual Edge VMM Domain on Cisco APIC

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Virtual Networking** > **Inventory**.

Step 3 In the **Inventory** navigation pane, choose **VMM Domains** > **VMware**.

Step 4 In the work pane, under **Properties**, in the **vCenter Domains** field, ensure that the newly created VMM domain is listed.

Update of Cisco AVS or Cisco ACI Virtual Edge VMM Domain Encapsulation Pools

After you create a Cisco AVS VMM or Cisco ACI Virtual Edge domain, you can update VLAN or multicast address pools. You should then verify the update.

Updating the VLAN Pool of a Cisco AVS or Cisco ACI Virtual Edge VMM Domain

Procedure

Step 1 Log in to the vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Update Vlan Pool, AVS** or **Update Vlan Pool, AVE**.

Note This update operation is only supported for dynamic VLAN pools. Static VLAN pools are not supported.

Step 3 View the Service Blueprint Information for the input fields and then click **Request**.

Step 4 In the **New Request** dialog box, complete the following steps:

a) Add the description and then click **Next**.
b) In the **Vlan Pool Name** field, enter the name of the existing VLAN pool.
c) In the **List of encap blocks** area, click the green cross next to **New**.
d) For each Encap block, in the **VlanStart** column, enter the starting VLAN.
e) In the **VlanEnd** column, enter the ending VLAN.
f) For **encapRole**, specify **external** or **internal**.
g) Tick the check box in **IsAddoperation** to add encap blocks to the VLAN pool.

Leave the check box unchecked to remove an entered encap block from a VLAN pool.

h) Click **Submit**.

What to do next

Complete the procedure Verifying the Update of the VLAN Pool of a Cisco AVS or Cisco ACI Virtual Edge VMM Domain in Cisco APIC, on page 42.

Verifying the Update of the VLAN Pool of a Cisco AVS or Cisco ACI Virtual Edge VMM Domain in Cisco APIC

Procedure

Step 1 Log in to Cisco APIC as the administrator.
Step 2 Choose **Fabric** > **Access Policies**.
Step 3 In the **Policies** navigation pane, expand the **Pools** folder.
Step 4 Expand the **VLAN** folder.
Step 5 Choose the VLAN pool.
Step 6 In the work pane, ensure that the VLAN pool is updated.

Updating the Multicast Address Pool of a Cisco AVS or Cisco ACI Virtual Edge VMM Domain

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.
Step 2 Choose **Update Multicast Pool, AVS or AVE**.
Step 3 View the Service Blueprint Information for the input fields and then click **Request**.
Step 4 In the **New Request** dialog box, complete the following steps:
a) In the **Multicast Pool Name** field, enter the name of the existing multicast address pool.
b) In the **List of Multicast Address Range** area, click the green cross next to **New**.
c) For each multicast address block, enter the starting multicast address between 224.0.0.0 and 239.255.255.255, inclusive, in the **MulticastAddressStart** column.
d) In the **MulticastAddressEnd** column, enter the ending multicast address between 224.0.0.0 and 239.255.255.255, inclusive.
e) Check the check box in the column **IsAddOperation** to add multicast address blocks to the multicast address pool.

Leave the check box unchecked to remove an entered multicast address block from the multicast address pool.

f) Click **Submit**.

What to do next

Complete the procedure Verifying the Update of a Multicast Address Pool on Cisco APIC , on page 42.

Verifying the Update of a Multicast Address Pool on Cisco APIC

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Fabric** > **Access Policies**.

Step 3 in the **Policies** navigation pane, expand the **Pools** folder.

Step 4 Expand the **Multicast Address** folder.

Step 5 Choose the multicast address pool.

Step 6 In the work pane, ensure that the multicast address pool is updated.

Deletion of Cisco AVS or Cisco ACI Virtual Edge and the VMM Domain

You can delete the Cisco AVS or Cisco ACI Virtual Edge and the VMM domain. After you do so, you should verify the deletion.

Deleting the Cisco AVS or Cisco ACI Virtual Edge and the VMM Domain

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Delete VMM Domain, AVS or AVE**.

Step 3 View the Service Blueprint Information for the input fields and then click **Request**.

Step 4 In the **New Request** dialog box, complete the following steps:

a) Add a description and then click **Next**.

b) In the **Domain name** field, enter the name of the VMM domain that you want to delete.

Note If the VMM domain has an associated multicast address pool (*Domain/AVS or AVE name_mcastpool*) or a VLAN pool (*Domain/AVS or AVE name_vlanpool*), it also will be deleted.

c) Click **Submit**.

What to do next

Complete the following procedures:

- Verifying Cisco AVS or Cisco ACI Virtual Edge Deletion in vCenter, on page 43
- Verifying VMM Domain Deletion on Cisco APIC, on page 44
- Verifying VLAN Pool Deletion on Cisco APIC, on page 44
- Verifying Multicast Address Pool Deletion on Cisco APIC, on page 44

Verifying Cisco AVS or Cisco ACI Virtual Edge Deletion in vCenter

Procedure

Step 1 Open a vSphere Client connection to a vCenter server.

Step 2 In vCenter, choose **Home** > **Inventory** > **Networking** view.

Step 3 Choose the data center.

Step 4 Under the data center, ensure that the Cisco AVS or Cisco ACI Virtual Edge and its folder are deleted.

Verifying VMM Domain Deletion on Cisco APIC

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Virtual Networking** > **Inventory**.

Step 3 In the **Inventory** navigation pane, expand the **VMM Domains** folder and the **VMware** folder.

Step 4 Under **VMware**, ensure that the deleted VMM domain is not present.

Verifying VLAN Pool Deletion on Cisco APIC

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Fabric** > **Access Policies**

Step 3 In the **Policies** navigation pane, expand the **Pools** folder.

Step 4 Choose the **VLAN** folder.

Step 5 In the work pane, under **Pools - VLAN**, ensure that the VLAN pool (*Domain/AVS name*_vlanpool) is deleted.

Verifying Multicast Address Pool Deletion on Cisco APIC

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Fabric** > **Access Policies**.

Step 3 In the **Policies** navigation pane, expand the **Pools** folder.

Step 4 Choose the **Multicast Address** folder.

Step 5 In the work pane, under **Pools - Multicast Address**, ensure that the multicast address pool (*Domain/AVS or AVE name*_mcastpool) is deleted.

Cisco AVS or Cisco ACI Virtual Edge VMM Domain Security Domain Mapping

You can update the security domain mapping for the Cisco AVS or Cisco ACI Virtual Edge VMM domain.

Updating the Security Domain Mapping of the Cisco AVS or Cisco ACI Virtual Edge VMM Domain

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Update AVS or AVE VMM Domain Security Domain Mapping** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.

b) In the **Request Information** pane, add a description and then click **Next**.

c) In the **AVS/VMM-domain name** field, enter the VMM domain name.

d) In the **AAA Domain list** table, click **New** and enter the AAA domain name.

For each entry, specify the existing security domain in the **aaaDomainName** column. Check the check box in the **IsAddOperation** column to add the AVS or AVE VMM domain to the AAA domain. If unchecked, the AVS or AVE VMM domain is removed from the AAA domain.

e) Click **Submit**.

What to do next

Complete the procedure Verifying the Security Domain Mapping of the Cisco AVS or Cisco ACI Virtual Edge VMM Domain, on page 45.

Verifying the Security Domain Mapping of the Cisco AVS or Cisco ACI Virtual Edge VMM Domain

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Virtual Networking** > **Inventory** > **VMM Domains** > **VMware**.

Step 3 Choose the VMM domain.

Step 4 In the work pane, under **Properties**, ensure that the **Security Domains** field has been updated.

Distributed Firewall Policy

You can create, update, and delete a Distributed Firewall (DFW) policy and update the DFW policy association with the Cisco AVS or Cisco ACI Virtual Edge VMM domain.

For detailed information about Distributed Firewall, see the one of the following:

- The section "Distributed Firewall in the Cisco ACI AVS Configuration Guide
- The chapter "Distributed Firewall" in the Cisco ACI Virtual Edge Configuration Guide

Creating a Distributed Firewall Policy

This section describes how to create a DFW policy and associate it with a Cisco AVS or Cisco ACI Virtual Edge VMM domain.

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Create FW Policy (DFW) and Associate to AVS or AVE VMM Domain** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **FW Policy Name** field, enter a name for the policy.
d) From the **Mode** drop-down list, choose **Learning**, **Enabled**, or **Disabled**.

- Learning—Cisco AVS or Cisco ACI Virtual Edge monitors all TCP communication and creates flows in a flow table but does not enforce the firewall. Learning mode lets you enable the firewall without losing traffic.
- Enabled—Enforces the Distributed Firewall. If you upgrade from an earlier version of Cisco AVS—one that does not support Distributed Firewall—and are upgrading Cisco AVS only, you must first upgrade all the Cisco AVS hosts in that VMM domain and then enable Distributed Firewall.
- Disabled—Does not enforce the Distributed Firewall and removes all flow information from the Cisco AVS or Cisco ACI Virtual Edge. Choose this mode only if you do not want to use the Distributed Firewall.

e) In the **VMM Name** field, enter the name of the existing Cisco AVS or Cisco ACI Virtual Edge VMM domain to which you want to associate the DFW policy and then click **Next**.
f) In the **Syslog Form** page, choose **Disabled** or **Enabled** from the **Administrative State** drop-down list.
g) Cisco AVS or Cisco ACI Virtual Edge reports the flows that are permitted or denied by the Distributed Firewall to the system log (syslog) server. Do the following:

- From the **Permitted flows** drop-down list, choose **yes** if you want Cisco AVS or Cisco ACI Virtual Edge to report permitted flows to the syslog server. Choose **no** if you do not want Cisco AVS or Cisco ACI Virtual Edge to report permitted flows to the syslog server.
- From the **Denied flows** drop-down list, choose **yes** if you want Cisco AVS or Cisco ACI Virtual Edge to report denied flows to the syslog server. Choose **no** if you do not want Cisco AVS or Cisco ACI Virtual Edge to report denied flows to the syslog server.

h) In the **Polling Interval (seconds)** area, enter an interval from 60 to 86,400 seconds.
i) From the **Log Level** drop-down list, choose a logging severity level that is greater than or equal to the severity level defined for the syslog server.
j) In the **Dest Group** area, enter an existing syslog monitoring destination group.
k) Click **Submit**.

What to do next

Complete the procedure Verifying Distributed Firewall Policy Creation on Cisco APIC, on page 46.

Verifying Distributed Firewall Policy Creation on Cisco APIC

This section describes how to verify the creation of a distributed firewall policy on Cisco APIC.

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Fabric** > **Access Policies**.

Step 3 In the **Policies** navigation pane, choose **Policies** > **Interface** > **Firewall**.

Step 4 In the work pane, under **Interface - Firewall**, confirm that the corresponding firewall policy is created.

Step 5 To view the distributed firewall policy association with a VMM domain, do the following:

a) Choose **Virtual Networking** > **Inventory** > **VMM Domains** > **VMware**.
b) Click the corresponding VMM domain.
c) In the work pane, click **VSwitch Policy**, and then confirm that the created distributed firewall policy is present in the **Firewall Policy** field.

Updating a Distributed Firewall Policy

This section describes how to update an existing DFW policy.

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Update FW Policy (DFW)** and complete the following steps:

In the service blueprint, some drop-down lists have a **<NO CHANGE>** option that you can choose if you do not want to change the configured value.

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **FW Policy Name** field, enter an updated name for the policy.
d) From the **Mode** drop-down list, choose **Learning**, **Enabled**, **Disabled**, or **<NO CHANGE>**. Click **Next**.
e) In the **Syslog Form** page, choose **Disabled**, **Enabled**, or **<NO CHANGE>** from the **Administrative State** drop-down list.
f) From the **Permitted flows** drop-down list, choose **yes**, **no**, or **<NO CHANGE>**.
g) From the **Denied flows** drop-down list, choose **yes**, **no**, or **<NO CHANGE>**.
h) In the **Polling Interval (seconds)** area, update the interval to a value from 60 to 86,400 seconds.

Note If you do not specify an interval, no update occurs.

i) From the **Log Level** drop-down list, choose a logging severity level that is greater than or equal to the severity level defined for the syslog server. Choose **<NO CHANGE>** if you do not want to change the log level.
j) In the **Dest Group** area, enter a new or existing syslog monitoring destination group.

Note If you do not enter a new or existing syslog monitoring destination group, no update occurs.

k) Click **Submit**.

Verifying a Distributed Firewall Policy Update on Cisco APIC

This section describes how to verify an update to a distributed firewall policy on Cisco APIC.

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Fabric** > **Access Policies**.

Step 3 In the **Policies** navigation pane, choose **Policies** > **Interface** > **Firewall**.

Step 4 In the work pane, under **Interface - Firewall**, double-click the required firewall policy and confirm that it is updated.

Deleting a Distributed Firewall Policy

This section describes how to delete a DFW policy.

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Delete FW Policy (DFW)** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **FW Policy Name** field, enter the name of the DFW policy that you want to delete.
d) Click **Submit**.

Verifying a Distributed Firewall Policy Deletion on Cisco APIC

This section describes how to verify the deletion of a distributed firewall policy on Application Policy Infrastructure Controller.

Procedure

Step 1 Log in to Cisco APIC.

Step 2 Choose **Fabric** > **Access Policies**.

Step 3 In the **Policies** navigation pane, choose **Policies** > **Interface** > **Firewall**.

Step 4 In the work pane, under **Interface - Firewall**, confirm that the deleted firewall policy is not present.

Updating a Distributed Firewall Policy Association with the Cisco AVS or Cisco ACI Virtual Edge VMM Domain

This section describes how to update a DFW policy that is associated with a Cisco AVS or Cisco ACI Virtual Edge VMM domain.

Procedure

Step 1 Log in to vRealize Automation as the administrator and then choose **Catalog**.

Step 2 Choose **Update FW Policy (DFW) association to AVS or AVE VMM Domain** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **FW Policy Name** field, enter a name for the policy.
d) In the **VMM Domain name** field, enter an existing Cisco AVS or Cisco ACI Virtual Edge VMM domain name.
e) From the **Operation** drop-down list, choose one of the following options:

- **add**—Associates the DFW policy with the Cisco AVS or Cisco ACI Virtual Edge VMM domain.
- **del**—Disassociates the DFW policy from the Cisco AVS or Cisco ACI Virtual Edge VMM domain.

f) Click **Submit**.

What to do next

Complete the procedure Verifying Microsegment Association Updates with Cisco AVS or Cisco ACI Virtual Edge VMM Domains on APIC, on page 71

Verifying a Distributed Firewall Policy Association with the Cisco AVS or Cisco ACI Virtual Edge VMM Domain on APIC

This section describes how to verify the association of a distributed firewall policy with Cisco AVS or Cisco ACI Virtual Edge on Cisco APIC.

Procedure

Step 1 Log in to Cisco APIC as the administrator.

Step 2 Choose **Virtual Networking** > **Inventory** > **VMM Domains** > **VMware**.

Step 3 Click the required VMM domain.

Step 4 In the **Work** pane, under **Properties**, confirm that the distributed firewall policy is associated with the VMM domain in the **Firewall Policy** field for vSwitch Policies.

Tenant Experiences in a Shared or Virtual Private Cloud Plan

Creating Networks in a Shared Plan

This section describes how to create a network in a shared plan.

Procedure

Step 1 Log in to the vRealize Automation as the tenant administrator, choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Shared Plan**.

Step 3 In the **Tenant Shared Plan** pane, choose **Add Tenant Network - Shared Plan** and perform the following actions:

a) View the Service Blueprint Information for the input fields and click **Request**.

b) In the **Request Information** pane, add the description and click **Next**.

c) In the **Step** pane, perform the following actions:

d) In the **NetworkEPG name** field, enter the name of the new shared network (new-shared-network).

e) In the **Domain/DVS** field, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** , and then select the DVS.

f) From the **encapMode** drop-down list, choose either **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only if the VMM domain type is Cisco AVS or Cisco ACI Virtual Edge (Local Switching). Selecting VLAN or VXLAN for VDS VMM Domain, may lead into unpredictable results.

g) In the **Application Tier Number** field, enter a numeric value from 1 to 10.

h) In the **Intra EPG Deny** field, select a value either **Yes** or **No**.

i) In the **Allow Microsegmentation** field, select a value, either **Yes** or **No**.

Note The **Allow Microsegmentation** field is applicable only if the VMM domain type is VDS VMM Domain.

j) In the **Use Default BD?** field, select a value either **Yes** or **No**.

If you selected **No**, choose a custom bridge domain by clicking on **Add**.

- Expand ***your_apic_user*** > **Tenants** > ***your_tenant*** > **Networking** > **BridgeDomains** > ***your_bridgedomain*** and select this bridge domain.

k) In the **Switching Mode** selector, choose **native** or **AVE**.

The **native** option is default switching; **AVE** is for Cisco ACI Virtual Edge switching.

l) Click **Submit**.

Verifying the Newly Created Network on VMware vRealize and APIC

This section describes how to verify the newly created network on VMware vRealize and Application Policy Infrastructure Controller (APIC) .

Procedure

Step 1 Log in to the vRealize Automation as the tenant administrator, choose **Request** and ensure your request status is successful.

Step 2 Log into the APIC GUI as the Tenant, choose **Tenants**.

Step 3 In the **navigation** pane, expand the **Tenant *name*** > **Application Profiles** > **default** > **Application EPGs** > **EPG new-shared-network**.

Step 4 In the **Properties** pane, ensure the **Received Bridge Domain** field is common/default.

Step 5 In the **navigation** pane, choose **Domains (VMs and Bare-Metals)**, ensure it is bound to VMware/*your_vmm_domain*.

Creating a Bridge Domain in a VPC Plan

This section describes how to create a bridge domain in a VPC plan.

Procedure

Step 1 Log in to the vRealize Automation as the tenant administrator, choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Network Services**.

Step 3 In the **Tenant Network Services** pane, choose **Add or Delete Bridge domain in Tenant** and perform the following actions:

a) View the Service Blueprint Information for the input fields and click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **Step** pane, perform the following actions:
d) In the **Add a bridge domain** field, choose **Yes**.
e) In the **Bridge Domain name** field, enter the bridge domain name (new-bd).
f) In the **Enable ARP Flooding** field, choose **No**.
g) In the **Enable flooding for L2 Unknown Unicast** field, choose **hardware-proxy**.
h) In the **Enable flooding for L3 Unknown Multicast** field, choose **flood**.
i) In the **L3 context (VRF)** field, click **Add**, expand ***your_apic*** > **Tenants** > ***your_tenant*** > **Networking** > **VRFs** and select the VRF (ctx1).
j) Click **Submit**.
k) In the **Operation** field, choose **Add**.
l) Click **Submit**.

Verifying the Newly Created Bridge Domain on APIC

This section describes how to verify the newly created bridge domain on Application Policy Infrastructure Controller (APIC).

Procedure

Step 1 Log into the APIC GUI as the tenant, choose **Tenants**.

Step 2 In the **navigation** pane, expand the **Tenant *name*** > **Networking** > **Bridge Domain** > ***your_newly_created_bd*** .

Step 3 In the **Properties** pane, ensure the fields are the same as in the VMware vRealize GUI.

Creating a Network and Associating to a Bridge Domain in a VPC Plan

This section describes how to create a network and associating to a bridge domain in a VPC Plan.

Procedure

Step 1 Log in to the vRealize Automation as the tenant administrator, choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant VPC Plan**.

Step 3 In the **Tenant VPC Plan** pane, choose **Add Tenant Network - VPC Plan** and perform the following actions:

a) View the Service Blueprint Information for the input fields and click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **Step** pane, perform the following actions:
d) In the **NetworkEPG name** field, enter the name of the new shared network (new-vpc-network).
e) In the **Domain/DVS** field, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** and select the DVS.
f) From the **encapMode** drop-down list, choose either **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only if the VMMdomain type is Cisco AVS or Cisco ACI Virtual Edge (Local Switching). Selecting VLAN or VXLAN for VDS VMM Domain, may lead into unpredictable results.

g) In the **Application Tier Number** field, enter a numeric value from 1-10.
h) In the **Intra EPG Deny** field, select a value either **Yes** or **No**.
i) In the **Allow Microsegmentation** field, select a value either **Yes** or **No**.

Note The **Allow Microsegmentation** field is applicable only if the VMMdomain type is VDS VMM Domain.

j) In the **Use Default BD?** field, select a value either **Yes** or **No**.

If you selected **No**, choose a custom bridge domain by clicking on **Add**.

- Expand ***your_apic_user*** > **Tenants** > ***your_tenant*** > **Networking** > **BridgeDomains** > ***your_bridgedomain*** and select this bridge domain.

k) In the **Subnet Prefix** field, enter the gateway IP address and the subnet mask (10.1.1.1/24).
l) Click **Submit**.

Verifying the Network and Association to the Bridge Domain in a VPC Plan on APIC

This section describes how to verify the newly created bridge domain on APIC.

Procedure

Step 1 Log into the APIC GUI as the Tenant, choose **Tenants**.

Step 2 In the **navigation** pane, expand the **Tenant *name*** > **Application Profiles** > **default** > **Application EPGs** > **EPG new-vpc-network**.

Step 3 In the **Properties** pane, ensure the Bridge Domain is *your_tenant*/bd1.

Step 4 In the **navigation** pane, choose **Domains (VMs and Bare-Metals)**, ensure it is bound to VMware/*your_vmm_domain*.

Step 5 In the **navigation** pane, expand the **Tenant *name*** > **Networking** > **Bridge Domain** > ***bd1*** > **Subnets**.

Step 6 In the Subnets pane, ensure the gateway IP address and subnet mask that you enter when creating a network and associating to a bridge domain in a VPC plan (10.1.1.1/24) and the scope is Private to VRF.

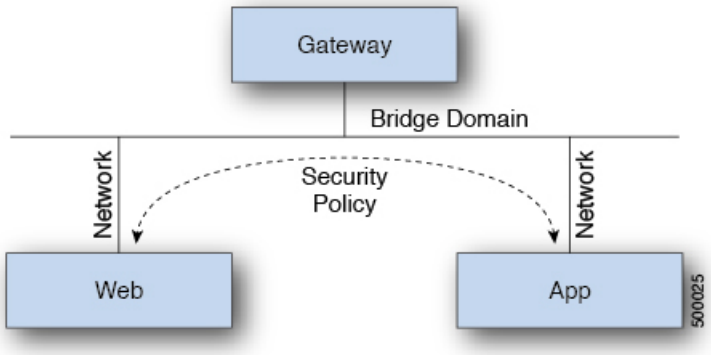
Step 7 On the menu bar, choose **Virtual Networking**.

Step 8 In the navigation pane, expand the **VMM Domains** > **VMware** > ***your_vmm_domain*** > **Controllers** > **vcenter1** > **DVS - *your_vmm_domain*** > **Portgroups** and ensure you see the port group with the tenant application profile EPG name.

Creating a Security Policy Within the Tenant

This section describes how to create a security policy within the tenant.

This figure shows that Web and App are in the same bridge domain, but there is no communication. Web and App are isolated, but they can communicate to their gateway. You need to create a security policy for Web and App to communicate.



Before you begin

Ensure you have set up two shared networks with two virtual machines (VMs).

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Network Security**.

Step 2 Choose **Add Security Policy (Contracts)**

Step 3 Choose **Request**.

Step 4 In the **Request Information** tab, enter a description of the request.

Step 5 Choose **Next**.

Step 6 In the **Step** tab, perform the following actions:

a) In the **Rule Entry List** field, enter the values and click **Save**.

This table shows the values for each Rule Entry:

Rule Entry List	Values
dstFormPort	• Blank • Unspecified • 1-65535
dstToPort	• Blank • Unspecified • 1-65535
protocol	• icmp • icmpv6 • tcp • udp • Blank
etherType	• IP • ARP

b) In the **Consumer Network/EPG name** field, click **Add** to locate and choose the consumer network/EPG. (web-host)
c) Click **Submit**.
d) In the **Provider Network/EPG name** field, click **Add** to locate and choose the provider network/EPG. (app-host)
e) Click **Submit**.

Step 7 Click **Submit**.

Step 8 Click **OK**.

Verifying the Security Policy Within the Tenant on APIC

This section describes how to verify the security policy within the tenant on APIC.

Procedure

Step 1 Log in to Cisco APIC and then choose **TENANTS**.

Step 2 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Security Policies** > **Contracts**.
a) Ensure the name nested under **Contracts** is the provider and consumer name. (app-host_ctrct_web-hosts)

Step 3 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Security Policies** > **Filters**.
a) Ensure the name nested under **Filters** is the provider and consumer name. (app-host_flt_web-hosts)

Step 4 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Application Profiles** > **default** > **Application EPGs** > **EPG web-hosts** > **Contracts**.

a) In the **work** pane, ensure the consumer is **Comsumed**.

Step 5 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Application Profiles** > **default** > **Application EPGs** > **EPG app-hosts** > **Contracts**.

a) In the **work** pane, ensure the provider is **Provided**.

Verifying the Connectivity of the Security Policy within the Tenant

This section describes how to verify the connectivity of the security policy within the tenant.

Procedure

Step 1 Log in to the virtual machine (web-host), from the command line, ping the other VM (app-host).

Step 2 Log in to the virtual machine (app-host), from the command line, ping the other VM (web-host).

This ensure the VMs are communicating with each other.

Consuming a Shared Service in the Common Tenant

This section describes consuming a shared service in the common tenant.

Before you begin

You must have an EPG in the common tenant that has a bridge domain relationship to "common/default".

Procedure

Step 1 Log in to the vRealize Automation as tenant, choose **Catalog** > **Network Security**.

Step 2 Choose **Add Security Policy (Contracts)**

Step 3 Choose **Request**.

Step 4 In the **Request Information** tab, enter a description of the request.

Step 5 Choose **Next**.

Step 6 In the **Step** tab, perform the following actions:

a) In the **Rule Entry List** field, enter the values and click **Save**.

This table shows the values for each Rule Entry:

Rule Entry List	Values
dstFormPort	• Blank • Unspecified • 1-65535

Rule Entry List	Values
dstToPort	• Blank • Unspecified • 1-65535
protocol	• icmp • icmpv6 • tcp • udp • Blank
etherType	• IP • ARP

b) In the **Consumer Network/EPG name** field, click **Add** to locate and choose the consumer network/EPG. (web-host)
c) Click **Submit**.
d) In the **Provider Network/EPG name** field, click **Add** to locate and choose the provider network/EPG. (SYSLOG-EPG)
e) Click **Submit**.

Step 7 Click **Submit**.

Step 8 Click **OK**.

Verifying the Security Policy in the Tenant Common on APIC

This section describes how to verify the security policy in the tenant common on APIC.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **TENANTS**.

Step 2 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Security Policies** > **Contracts**.
a) Ensure the name nested under **Contracts** is the provider and consumer name. (SYSLOG-EPG_ctrct_web-hosts)

Step 3 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Security Policies** > **Filters**.
a) Ensure the name nested under **Filters** is the provider and consumer name. (SYSLOG-EPG_flt_web-hosts)

Step 4 In the **navigation** pane, expand **Tenant *your_tenant*** > **Networking** > **Application Profiles** > **default** > **Application EPGs** > **EPG web-hosts** > **Contracts**.
a) In the **work** pane, ensure the consumer is **Comsumed**.

Step 5 In the **navigation** pane, expand **Tenant** ***your_tenant*** > **Networking** > **Application Profiles** > **default** > **Application EPGs** > **EPG SYSLOG-EPG-hosts** > **Contracts**.

a) In the **work** pane, ensure the provider is **Provided**.

Verifying the Connectivity of the Security Policy in the Tenant Common

This section describes how to verify the connectivity of the security policy in the tenant common.

Procedure

Step 1 Log in to the virtual machine (web-host), from the command line, ping the other VM (SYSLOG-EPG).

Step 2 Log in to the virtual machine (SYSLOG-EPG), from the command line, ping the other VM (web-host).

This ensure the VMs are communicating with each other.

Updating Security Policies (Access Control Lists)

This section describes how to update security policies (access control lists).

Procedure

Step 1 Log in to the vRealize Automation as tenant, choose **Catalog** > **Network Security**.

Step 2 Choose **Update Security policies (Access Control Lists)**

Step 3 Choose **Request**.

Step 4 In the **Request Information** tab, enter a description of the request.

Step 5 Choose **Next**.

Step 6 In the **Step** tab, perform the following actions:

a) In the **apic security filter name** field, click **Add** to locate and choose a filter that been pushed by vRealize.

b) In the **Rule Entry List** field, enter the values and click **Save**. You must recreate the rule entry list.

Note This updating security policies access control lists will push new rules in including over writing existing rule of the same name.

This table shows the values for each Rule Entry:

Rule Entry List	Values
dstFormPort	• Blank • Unspecified • 1-65535

Rule Entry List	Values
dstToPort	• Blank • Unspecified • 1-65535
protocol	• icmp • icmpv6 • tcp • udp • Blank
etherType	• IP • ARP

c) In the **Update firewall access-list** field, if the access-list being use by a firewall, click **Yes** otherwise click **No**.
d) Click **Submit**.

Step 7 Click **OK**.

Step 8 To verify your request, choose the **Requests** tab.
a) Choose the request you submitted and click **view details**. Ensure the status is **Succesful**.

Deleting Security Policies (Access Control Lists)

This section describes how to delete security policies (access control lists).

Procedure

Step 1 Log in to the vRealize Automation as tenant, choose **Catalog** > **Network Security**.

Step 2 Choose **Delete Security policies (Access Control Lists)**

Step 3 Choose **Request**.

Step 4 In the **Request Information** tab, enter a description of the request.

Step 5 Choose **Next**.

Step 6 In the **Step** tab, perform the following actions:
a) In the **Comsume Network/EPG name** field, click **Add** to locate and choose the provider network/EPG. (web-host)
b) In the **Provider Network/EPG name** field, click **Add** to locate and choose the provider network/EPG. (app-host)
c) Click **Submit**.

Step 7 Click **OK**.

Step 8 To verify your request, choose the **Requests** tab.

a) Choose the request you submitted and click **view details**. Ensure the status is **Succesful**.

Creating the Network in the VPC Plan

This section describes how to create the network in the VPC plan.

Procedure

Step 1 Log in to the vRealize Automation Appliance as the tenant, choose **Catalog** > **Tenant VPC Plan** > **Add Tenant Network - VPC plan** and click **Request**.

Step 2 In the **Request Information** pane, perform the following actions:

a) In the **Description** field, enter the description.

b) Click **Next**.

Step 3 In the **Step** pane, perform the following actions:

a) In the **Network/EPG name** field, enter the Network/EPG name. (web-hosts-vpc)

b) In the **Domain Type** field, from the drop-down list, choose either **VmmDomain (Dynamic Binding)** for connecting to virtual machines or **PhysDomain (Static Binding)** for connecting to physical infrastructure. Cisco recommends choosing **VmmDomain (Dynamic Binding)** to use the full features of the vRealize plug-in.

c) In the **Domain/DVS** field, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** , and then select the DVS.

d) From the **encapMode** drop-down list, choose either **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only if the VMM domain type is Cisco AVS or Cisco ACI Virtual Edge (Local Switching). Selecting VLAN or VXLAN for VDS VMM Domain, may lead into unpredictable results.

e) In the **Application Tier Number** field, enter a numeric value from 1 to 10.

f) In the **Intra EPG Deny** field, select a value either **Yes** or **No**.

g) In the **Allow Microsegmentation** field, select a value either **Yes** or **No**.

Note The **Allow Microsegmentation** field is applicable only if the VMM domain type is VDS VMM Domain.

h) In the **Use Default BD?** field, select a value either **Yes** or **No**.

If you selected **No**, choose a custom bridge domain by clicking on **Add**.

- Expand ***your_apic_user*** > **Tenants** > ***your_tenant*** > **Networking** > **BridgeDomains** > ***your_bridgedomain*** and select this bridge domain.

i) In the **Subnet prefix** field, enter the gateway IP address and the subnet mask. (192.168.1.1/24)

The subnet prefix is the subnet that this VPC will have available to any hosts.

j) Click **Submit**.

k) Click **OK**.

Step 4 Choose **Requests**.

Step 5 Choose the request you submitted and click **view details**.

Step 6 Ensure that your request status is **Successful**.

Verifying the Network in the VPC Plan on APIC

This section describes how to verify the network in the VPC plan on APIC.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > ***your_tenant*** .

Step 2 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **Application EPGs** > **EPG web-hosts-vpc**

Step 3 In the properties pane, in the Bridge Domain field, verify your tenant name and bd1 is present. (green/bd1)

Step 4 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **Application EPGs** > **EPG web-hosts-vpc** > **Domains (VMs and Bare-Metals)**.

Step 5 Ensure the state is formed and the domain profile is VMware/*vmmdomain_you_specified*.

Step 6 In the navigation pane, choose **Tenant *your_tenant*** > **Networking** > **Bridge Domains** > **bd1** > **Subnets**.

Step 7 Under **Subnets**, ensure the subnet prefix that you specified is present.

Verifying the Network in the VPC Plan on vCenter

This section describes how to verify the network in the VPC plan on vCenter.

Procedure

Step 1 Log in to vSphere Web Client GUI, choose the Networking icon.

Step 2 In the navigation pane, choose ***vCenter_IP/Host*** > **Datacenter** > ***green*** > ***distributed_virtual_switch*** > ***port_group*** and ensure it is present.

The *port_group* name is in the following format: Tenant Name|Application Profile Name|Application EPG Name.

Updating a Tenant Network Association with the VMM Domain

This section describes how to update a tenant network association with the VMM domain.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Network services**.

Step 3 Choose **Update Tenant Network** and perform the following actions:

a) View the Service Blueprint Information for the input fields and click **Request**.
b) In the **Request Information** pane, add the description and click **Next**.
c) In the **Tenant name** field, input the name of corresponding tenant.
d) In the **Network/EPG** field, click **Add**, expand ***your_apic*** > **Tenants** > ***your_tenant*** > **End-Point-Groups**, and then select the EPG.
e) From the **Domain Type** drop-down list, choose the domain type. The domain type is **VmmDomain (Dynamic Binding)** for VMware VDS or Cisco AVS or Cisco ACI Virtual Edge.
f) In the **Domain/DVS field**, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** , and then select the DVS to associate the tenant network (EPG) to the VMM domain.
g) From the **encapMode** drop-down list, choose **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only when associating an EPG to a VMM domain of the Cisco AVS or Cisco ACI Virtual Edge (Local Switching) type. That association is performed in the following step.

h) From the **Operation** drop-down list, choose **add** to associate the tenant network with the VMM domain or choose **delete** to disassociate the tenant network from the VMM domain.
i) In the **Switching Mode** selector, choose **native** or **AVE**.

The **native** option is default switching, and **AVE** is for Cisco ACI Virtual Edge.

j) Click **Submit**.

Verifying Tenant Network Association with VMM Domains on APIC

This section describes how to verify a tenant Network association with VMM domains on APIC.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > **your_tenant**.

Step 2 In the **navigation** pane, choose **Tenant** ***your_tenant*** > **Application Profiles** > **default** > **Application EPGs** > **your_tenant_network** > **Domains (VMs and Bare-Metals)**.

Step 3 Confirm that any associations with VMM domains are correct.

Microsegmentation

This section describes microsegmentation in shared and VPC plans and explains the usage-related service blueprints.

Note Starting with the Cisco APIC vRealize Plug-In 2.0(1) release, the service blueprints related to microsegmentation are supported only for Cisco AVS VMM domains.

Microsegmentation with Cisco ACI

Microsegmentation with the Cisco ACI provides the ability to automatically assign endpoints to logical security zones called endpoint groups (EPGs) based on various attributes.

For detailed information about Microsegmentation, see the chapter "Microsegmentation with Cisco ACI" in the *Cisco ACI Virtualization Guide*.

Microsegmentation in a Shared Plan

You can create, update, and delete a microsegment in a shared plan.

Creating a Microsegment in a Shared Plan

This section describes how to create a microsegment in a shared plan.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and then choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Shared Plan**.

Step 3 Choose **Add a Useg Network - Shared Plan** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.

b) In the **Request Information** pane, add a description and then click **Next**.

c) In the **Tenant name** field, enter the name of the corresponding tenant.

d) In the **Network/EPG name** field, enter the name of the microsegment (uSeg) that you want to create.

e) From the **Domain Type** drop-down list, choose the domain type. For the Cisco AVS or Cisco ACI Virtual Edge VMM domain, the domain type is **VmmDomain (Dynamic Binding)**.

f) In the **Domain/DVS** field, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** , and then and select the DVS (Cisco AVS or Cisco ACI Virtual Edge VMM domain) to associate the uSeg to the VMM domain.

g) From the **encapMode** drop-down list, choose **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only if the **VMMdomain** type is Cisco AVS or Cisco ACI Virtual Edge (Local Switching).

h) In the **Application Tier Number** field, enter the number of the tier to which the uSeg belongs. The default tier number is 1. The tier number that you enter must be less than or equal to the number of application tiers that were created as part of the tenant creation via the service blueprint **Add or Update Tenant** option.

For example, if you enter tier number 2, the uSeg will be placed in BD (common/cmnbd2), which is part of VRF (common/default). See the following table for reference.

Tier Number	BD	VRF
1	common/default	common/default
2	common/cmnbd2	common/default
3	common/cmnbd3	common/default

i) From the **Intra EPG Deny** drop-down list, choose **Yes** to enforce intra-EPG isolation. Choose **No** if you do not want to enforce intra-EPG isolation.

Intra-EPG isolation is not supported in AVS or Cisco ACI Virtual Edge VLAN mode, DVS-VXLAN mode, or for Microsoft VMM domains. If you enforce intra-EPG isolation for those modes or domains, ports might go into blocked state.

j) In the **Ip Criteria** table, click **New** and enter the IP criteria (or IP attribute). The following columns apply to each entry:

- **Name**—Name of the IP criteria (or IP attribute).
- **Description**—Description of the IP criteria.
- **IP**—For IP addresses, specify the address or the subnet (for example, 1.1.1.1 or 1.1.1.0/30).

k) In the **Mac Criteria** table, click **New** and enter the MAC criteria (or MAC attribute). The following columns apply to each entry:

- **Name**—Name of the MAC criteria (or MAC attribute).
- **Description**—Description of the MAC criteria.
- **MAC**—For MAC addresses, specify the address (for example, 00:50:56:44:44:5D).

l) In the **VM Criteria** table, click **New** and enter the VM criteria (or VM attribute). The following columns apply to each entry:

- **Name**—Name of the VM criteria (or VM attribute).
- **Type**—The following table lists the supported attribute types, their mapping in APIC, and examples. (The MAC attribute and IP attribute have precedence 1 and 2, respectively.)

Type in vRealize	Type in APIC (Mapping)	Precedence	Examples
vnic	VNic Dn	3	00:50:56:44:44:5D
vm	VM Identifier	4	vm-821
vmName	VM Name	5	HR_VDI_VM1
hv	Hypervisor Identifier	6	host-43
domain	VMM Domain	7	AVS-SJC-DC1
datacenter	Datacenter	8	DCI
customLabel	Custom Attribute	9	SG_DMZ
guestOS	Operating System	10	Windows 2008

- **Operator**—The following table lists the supported operators and their mapping in APIC.

Operator in vRealize	Operator in APIC (Mapping)
equals	Equals
contains	Contains

Operator in vRealize	Operator in APIC (Mapping)
startsWith	Starts With
endsWith	Ends With

- **AttributeName**—Enter an attribute name. In the VM Criteria table, the **AttributeName** applies only to the **customLabel** attribute type.
- **VmmDomain_vC_VmName**—In the VM Criteria table, it is applicable only for the type **vnic**, operator **equals**. The format to input is <VmmDomain>/<vC>/<VmName>, where <VmmDomain> (AVS VMM domain) and <vC> (vCenter) belong to a controller instance. For example: vmmdomain1/vcenter1/VM1.
- **Value**—Enter the attribute type value. Examples of each attribute type are listed in the preceding Type table.

m) Click **Submit**.

What to do next

Complete the procedure Verifying Microsegmentation Creation in a Shared Plan on APIC, on page 64.

Verifying Microsegmentation Creation in a Shared Plan on APIC

This section describes how to verify that microsegmentation creation in a shared plan has been successful on Application Policy Infrastructure Controller.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > ***your_tenant*** .

Step 2 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs**.

Step 3 In the **uSeg EPGs** pane, double-click the required uSeg to view its properties.

Step 4 In the **Properties** pane, confirm that the configuration is correct.

Step 5 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs** > ***your_useg*** > **Domains (VMs and Bare-Metals)**.

Step 6 Confirm that the state is formed and that the domain profile is VMware/*vmmdomain_you_specified*.

Deleting a Microsegment in a Shared Plan

This section describes how to delete a microsegment.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and then choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Shared Plan**.

Step 3 Choose **Delete a Useg Network - Shared Plan** and then complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add a description and then click **Next**.
c) In the **Tenant name** field, confirm that the tenant name is hard coded to the corresponding tenant.
d) In the **Network/EPG** field, click **Add**, expand ***priapic*** > **Tenants** > ***appurtenant*** > **Useg-End-Point-Groups**, and then select the microsegment EPG.
e) Click **Submit**.

What to do next

Complete the procedure Verifying Microsegmentation Deletion on APIC, on page 65.

Verifying Microsegmentation Deletion on APIC

This section describes how to verify microsegmentation deletion on Application Policy Infrastructure Controller.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > ***your_tenant*** .

Step 2 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs**.

Step 3 In the **uSeg EPGs** pane, confirm that the deleted uSeg is not present.

Microsegmentation in a VPC Plan

You can create, update, and delete a microsegment in a VPC plan.

Creating a Microsegment in a VPC Plan

This section describes how to create a microsegment in a VPC plan.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and then choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant VPC Plan**.

Step 3 Choose **Add a Useg Network - VPC Plan** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add a description and then click **Next**.
c) In the **Tenant name** field, enter the name of the corresponding tenant.
d) In the **Network/EPG name** field, enter the name of the microsegment (uSeg) that you want to create.
e) From the **Domain Type** drop-down list, choose the domain type.
f) In the **Domain/DVS** field, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** , and then select the DVS (Cisco AVS or Cisco ACI Virtual Edge VMM domain) to associate the uSeg to the VMM domain.
g) From the **encapMode** drop-down list, choose **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only if the VMM domain type is Cisco AVS or Cisco ACI Virtual Edge (Local Switching).

h) In the **Subnet** field, enter the gateway IP address and the subnet mask (1.1.1.1/24).

i) In the **Application Tier Number** field, enter the number of the tier to which the uSeg belongs. The default tier number is 1. The tier number that you enter must be less than or equal to the number of application tiers that were created as part of the tenant creation through the service blueprint **Add or Update Tenant** option.

For example, for a tenant named *coke*, if you enter tier number 2, the uSeg is placed in BD (coke/bd2), which is part of VRF (coke/ctx1). See the following table for reference.

Tier Number	BD	VRF
1	coke/bd1	coke/ctx1
2	coke/bd2	coke/ctx1
3	coke/bd3	coke/ctx1

j) From the **Intra EPG Deny** drop-down list, choose **Yes** to enforce intra-EPG isolation. Choose **No** if you do not want to enforce intra-EPG isolation.

Intra-EPG isolation is not supported in Cisco AVS or Cisco ACI Virtual Edge VLAN mode, DVS-VXLAN mode, or for Microsoft VMM domains. If you enforce intra-EPG isolation for those modes or domains, ports may go into blocked state.

k) In the **Ip Criteria** table, click **New** and enter the IP criteria (or IP attribute). The following columns apply to each entry:

- **Name**—Name of the IP criteria (or IP attribute).
- **Description**—Description of the IP criteria.
- **IP**—For IP addresses, specify the address or the subnet (for example, 1.1.1.1 or 1.1.1.0/30).

l) In the **Mac Criteria** table, click **New** and enter the MAC criteria (or MAC attribute). The following columns apply to each entry:

- **Name**—Name of the MAC criteria (or MAC attribute).
- **Description**—Description of the MAC criteria.
- **MAC**—For MAC addresses, specify the address (for example, 00:50:56:44:44:5D).

m) In the **VM Criteria** table, click **New** and enter the VM criteria (or VM attribute). The following columns apply to each entry:

- **Name**—Name of the VM criteria (or VM attribute).
- **Description**—Description of the VM criteria.
- **Type**—The following table lists the supported attribute types, their mapping in APIC, and examples. (The MAC attribute and IP attribute have precedence 1 and 2, respectively.)

Type in vRealize	Type in APIC (Mapping)	Precedence	Examples
vnic	VNic Dn	3	00:50:56:44:44:5D
vm	VM Identifier	4	vm-821
vmName	VM Name	5	HR_VDI_VM1
hv	Hypervisor Identifier	6	host-43
domain	VMM Domain	7	AVS-SJC-DC1
datacenter	Datacenter	8	DCI
customLabel	Custom Attribute	9	SG_DMZ
guestOS	Operating System	10	Windows 2008

- **Operator**—The following table lists the supported operators and their mapping in APIC.

Operator in vRealize	Operator in APIC (Mapping)
equals	Equals
contains	Contains
startsWith	Starts With
endsWith	Ends With

- **AttributeName**—Enter an attribute name. In the VM Criteria table, the **AttributeName** applies only to the **customLabel** attribute type.
- **VmmDomain_vC_VmName**—In the VM Criteria table, it is applicable only for the type **vnic**, operator **equals**. The format to input is <VmmDomain>/<vC>/<VmName> where <VmmDomain> (AVS VMM domain) and <vC> (vCenter) belong to a controller instance. For example: vmmdomain1/vcenter1/VM1.
- **Value**—Enter the attribute type value. Examples of each attribute type are listed in the preceding Type table.

n) Click **Submit**.

What to do next

Complete the procedure Verifying Microsegmentation Creation in a VPC Plan on APIC, on page 67.

Verifying Microsegmentation Creation in a VPC Plan on APIC

This section describes how to verify microsegmentation creation in a VPC plan on Application Policy Infrastructure Controller.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > ***your_tenant*** .

Step 2 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs**.

Step 3 In the **uSeg EPGs** pane, double-click the required uSeg to view its properties.

Step 4 In the **Properties** pane, confirm that the configuration is correct.

Step 5 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs** > ***your_useg*** > **Domains (VMs and Bare-Metals)**.

Step 6 Confirm that the state is formed and that the domain profile is VMware/*vmmdomain_you_specified*.

Step 7 In the navigation pane, choose **Tenant *your_tenant*** > **Networking** > **Bridge Domains** > ***corresponding_bd*** > **Subnets**.

Step 8 Under **Subnets**, confirm that the subnet prefix that you specified is present.

Deleting a Microsegment in a VPC Plan

This section describes how to delete a microsegment.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and then choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant VPC Plan**.

Step 3 Choose **Delete a Useg Network - VPC Plan** and then complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.

b) In the **Request Information** pane, add a description and then click **Next**.

c) In the **Tenant name** field, confirm that the tenant name is hard coded to the corresponding tenant.

d) In the **Network/EPG** field, click **Add**, expand ***your_apic*** > **Tenants** > ***your_tenant*** > **Useg-End-Point-Groups** and select the uSeg EPG.

e) Click **Submit**.

What to do next

Complete the procedure Verifying Microsegmentation Deletion on APIC, on page 65.

Updating Microsegment Attributes

This section describes how to update an existing microsegment.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and then choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Network services**.

Step 3 Choose **Add or Delete Useg Attribute** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.
b) In the **Request Information** pane, add a description and then click **Next**.
c) In the **Network/EPG** field, click **Add**, expand ***your_apic*** > **Tenants** > ***your_tenant*** > **Useg-End-Point-Groups** and select the uSeg EPG.
d) In the **Tenant name** field, enter the name of the corresponding tenant.
e) If you want to add IP criteria, in the **Add Ip Criteria** table, click **New** and enter the IP criteria (or IP attribute). The following columns apply to each entry:

- **Name**—Name of the IP criteria (or IP attribute).
- **Description**—Description of the IP criteria.
- **IP**—For IP addresses, specify the address or the subnet (for example, 1.1.1.1 or 1.1.1.0/30).

f) If you want to add Mac criteria, in the **Add Mac Criteria** table, click **New** and enter the MAC criteria (or MAC attribute). The following columns apply to each entry:

- **Name**—Name of the MAC criteria (or MAC attribute).
- **Description**—Description of the MAC criteria.
- **MAC**—For MAC addresses, specify the address (for example, 00:50:56:44:44:5D).

g) If you want to add VM criteria, in the **Add Vm Criteria** table, click **New** and enter the VM criteria (or VM attribute). The following columns apply to each entry:

- **Name**—Name of the VM criteria (or VM attribute).
- **Type**—The following table lists the supported attribute types, their mapping in APIC, and examples. (The MAC attribute and IP attribute have precedence 1 and 2, respectively.)

Type in vRealize	Type in APIC (Mapping)	Precedence	Examples
vnic	VNic Dn	3	00:50:56:44:44:5D
vm	VM Identifier	4	vm-821
vmName	VM Name	5	HR_VDI_VM1
hv	Hypervisor Identifier	6	host-43
domain	VMM Domain	7	AVS-SJC-DC1
datacenter	Datacenter	8	DCI
customLabel	Custom Attribute	9	SG_DMZ
guestOS	Operating System	10	Windows 2008

- **Operator**—The following table lists the supported operators and their mapping in APIC.

Operator in vRealize	Operator in APIC (Mapping)
equals	Equals

Operator in vRealize	Operator in APIC (Mapping)
contains	Contains
startsWith	Starts With
endsWith	Ends With

- **AttributeName**—Enter an attribute name. In the VM Criteria table, the **AttributeName** applies only to the **customLabel** attribute type.
- **Value**—Enter the attribute type value. Examples of each attribute type are listed in the preceding Type table.
- **VmmDomain_vC_VmName**—In the VM Criteria table, it is applicable only for the type **vnic**, operator **equals**. The format to input is <VmmDomain>/<vC>/<VmName>, where <VmmDomain> (AVS VMM domain) and <vC> (vCenter) belong to a controller instance. For example: vmmdomain1/vcenter1/VM1.

h) If you want to delete existing IP criteria, in the **Delete IP Criteria** table, click **New** and enter the name of the IP criteria (or IP attribute) to delete.
i) If you want to delete existing Mac criteria, in the **Delete Mac Criteria** table, click **New** and enter the name of the MAC criteria (or MAC attribute) to delete.
j) If you want to delete existing VM criteria, in the **Delete Vm Criteria** table, click **New** and enter the name of the VM criteria (or VM attribute) to delete.
k) Click **Submit**.

What to do next

Complete the procedure Verifying a Microsegmentation Attributes Update on APIC, on page 70.

Verifying a Microsegmentation Attributes Update on APIC

This section describes how to verify that microsegmentation attributes have been updated on Application Policy Infrastructure Controller.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > ***your_tenant*** .
Step 2 In the navigation pane, choose **Tenant *your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs**.
Step 3 In the **uSeg EPGs** pane, double-click the required uSeg to view its properties.
Step 4 In the **Properties** pane, confirm that the attributes in the **uSeg Attributes** field have been updated.

Updating a Microsegment Association with the Cisco AVS or Cisco ACI Virtual Edge VMM Domain

This section describes how to update a microsegment that is associated with a Cisco AVS or Cisco ACI Virtual Edge VMM domain.

Procedure

Step 1 Log in to vRealize Automation as the tenant administrator and then choose **Catalog**.

Step 2 In the **navigation** pane, choose **Tenant Network services**.

Step 3 Choose **Update Tenant Network** and complete the following steps:

a) View the Service Blueprint Information for the input fields and then click **Request**.

b) In the **Request Information** pane, add the description and click **Next**.

c) In the **Tenant name** field, enter the name of the corresponding tenant.

d) In the **Network/EPG** field, click **Add**, expand ***your_apic*** > **Tenants** > ***your_tenant*** > **Useg-End-Point-Groups** and select the uSeg EPG.

e) From the **Domain Type** drop-down list, choose the domain type. For the Cisco AVS or Cisco ACI Virtual Edge VMM domain, the domain type is **VmmDomain (Dynamic Binding)**.

f) In the **Domain/DVS** field, click **Add**, expand ***your_apic*** > **vCenters** > ***your_vcenter*** and then select the DVS (Cisco AVS or Cisco ACI Virtual Edge VMM domain) to associate the uSeg to the VMM domain.

g) From the **encapMode** drop-down list, choose **Auto**, **VLAN**, or **VXLAN** for the encapsulation mode.

Note The **encapMode** field is applicable only when associating an EPG to a VMM domain of the Cisco AVS or Cisco ACI Virtual Edge (Local Switching) type. That association is performed in the following step.

h) From the **Operation** drop-down list, choose **add** to associate the microsegment with the Cisco AVS or Cisco ACI Virtual Edge domain. Choose **delete** to disassociate the microsegment from the Cisco AVS or Cisco ACI Virtual Edge VMM domain.

i) Click **Submit**.

What to do next

Complete the procedure Verifying Microsegment Association Updates with Cisco AVS or Cisco ACI Virtual Edge VMM Domains on APIC, on page 71.

Verifying Microsegment Association Updates with Cisco AVS or Cisco ACI Virtual Edge VMM Domains on APIC

This section describes how to verify updates to microsegment associations with Cisco AVS or Cisco ACI Virtual Edge VMM domains on Cisco APIC.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **Tenants** > ***your_tenant*** .

Step 2 In the navigation pane, choose **Tenant** ***your_tenant*** > **Application Profiles** > **default** > **uSeg EPGs** > ***your_useg*** > **Domains (VMs and Bare-Metals)**.

Step 3 Confirm that any associations with VMM domains are correct.

Creating the VMs and Attaching to Networks Without Using the Machine Blueprints

This section describes how to verify the creating machines (VMs) and attaching to networks without using the machine blueprints.

Procedure

Step 1 Log in to vSphere Web Client GUI, choose the **Networking** icon.

Step 2 In the pane, choose ***vCenter_IP/Host*** > **Datacenter** > **Unmanaged** and choose the virtual machine you want to attach ACI network to.

Step 3 In the **Summary** pane, in the **VM Hardware** section, click **Edit Settings**.

Step 4 In the **Edit Settings** dialog box, choose the network adapter that you want to connect to the ACI network and from the drop-down list, choose the port group you created. (green|default|web-hosts-vpc (green))

Step 5 Click **OK**.
Now this VM can take advantage of the ACI networking.

About Adding the Load Balancer to the Tenant Network

This section covers the configuration steps to add a load balancer service to a tenant network (APIC's EPG). This release only supports shared plan for load balancer. In subsequent releases we will have support for VPC plan.

In this plan, the load balancer is deployed in tn-common thereby offering consumption model for vRA and APIC tenant using shared infrastructure.

Figure 4: Shared Plan - Load Balancer Overview

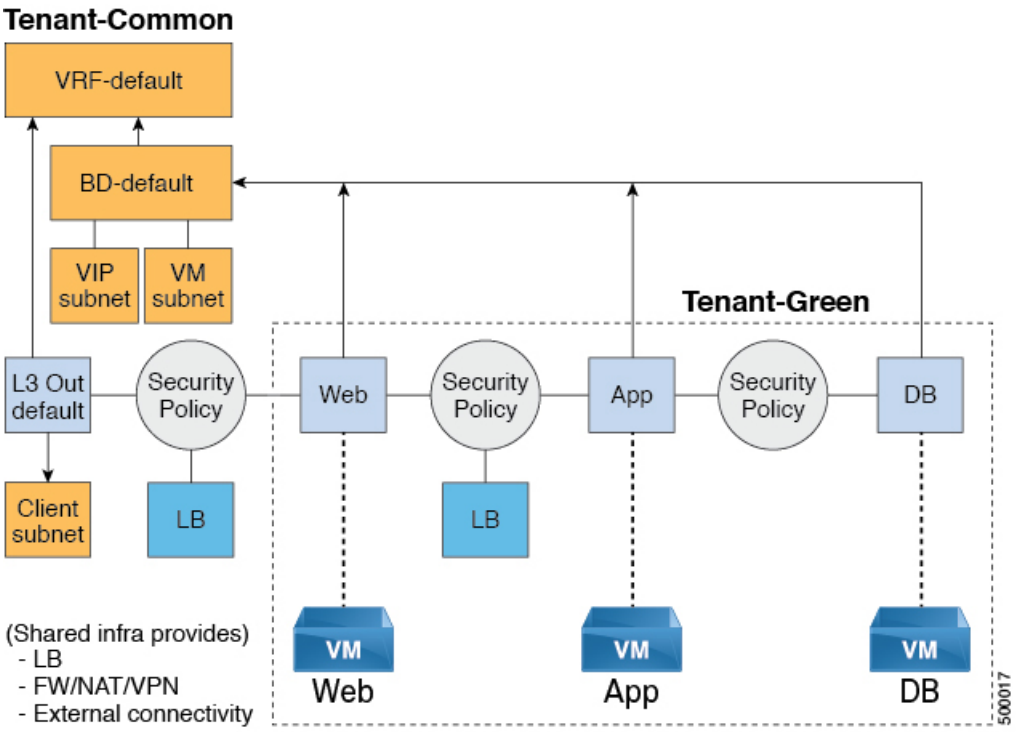
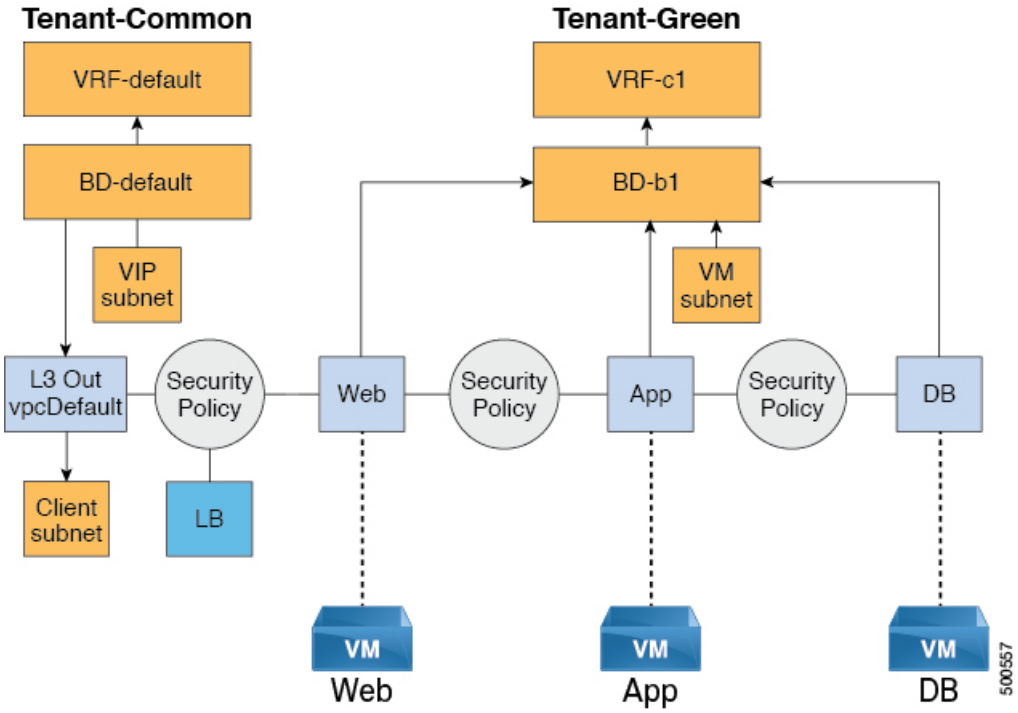


Figure 5: VPC Plan - Load Balancer Only



Configuration Prerequisites on APIC

This section describes the configuration prerequisites on APIC.

- Device package for load balancer needs to be uploaded by APIC admin.
- Device cluster for load balancer needs to be created in tn-common or tenant "common" by APIC-admin. Citrix and F5 are the supported vendors for load balancers.
- Shared Plan load balancer service graph templates for Citrix and F5 needs to be created in tn-common by APIC-admin.

Adding the VIP Pool

This section describes how to add the VIP Pool.

Before you begin

Before vRA-Tenant can consumer Load balancer services, vRA admin needs to create a Virtual-IP pool per vRA tenant, using the "Add VIP pool" service blueprint in Admin catalog.

For example for Tenant-Red, VIP pool is 6.1.1.1 to 6.1.1.30 and for Tenant-Green, VIP pool is 6.1.2.1 to 6.1.2.30.

Note The VIP pool should be in one of the subnets defined under BD "default" in the tenant "common"

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Admin Services**.

Step 2 Choose **Add VIP Pool** and perform the following actions:

a) In the **Tenant** field, enter the Tenant name.
b) In the **VIP address start** field, enter the VIP address start.
c) In the **VIP Address End** field, enter the VIP address end.
d) In the **Internal VIP for Inter-EPG in VPC plan** field, select Yes or No.
e) Click **Submit**.

Deleting the VIP Pool

This section describes how to delete the VIP Pool.

This blueprint is to do necessary cleanup of VIP pool, once all the load balancer services consumed in the tenant are deleted.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Admin Services**.

Step 2 Choose **Delete VIP Pool**, perform the following action items.

a) In the **Tenant** field, click **Add**, expand ***your_apic*** > **Tenants** and select the tenant.
b) In the **VIP address start** field, enter the VIP address start.
c) In the **VIP Address End** field, enter the VIP address end.
d) In the **Internal VIP for Inter-EPG in VPC plan** field, select Yes or No.
e) Click **Submit**.

Adding the Load Balancer to the Tenant-Network in a Shared Plan

vRA-Tenant can add a load balancer (LB) to Tenant-Network. The required parameters are Network-Name, LB device cluster, LB-endpoint (protocol, port), Vendor Type, and Consumer EPG or L3out. As part of this workflow, all the required service graph instance and contract (security policy) with chosen Tenant-Network as Provider-EPG is created. The consumer of this load balanced endpoint could be L3out in tenant common, or it could be another Tenant-Network belonging to the tenant.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.
Step 2 Choose **Add Load Balancer to Tenant Network - Shared Plan**, click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Adding the Load Balancer to the Tenant-Network in a VPC Plan

This section describes how to add the load balancer to the tenant-network in a VPC Plan.

Note In a VPC plan, the Inter-EPG load balancer is not supported. Only the load balancer between L3out and First-Tier (Web) is supported in release 1.2(2x).

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.
Step 2 Choose **Add Load Balancer to Tenant Network - VPC Plan**, click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Deleting the Load Balancer from the Tenant-Network in a Shared Plan

You can delete the load balancer service (lb-port, lb-protocol) from an existing tenant network or endpoint group.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.
Step 2 Choose **Delete Load Balancer to Tenant Network - Shared Plan** and click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Deleting the Load Balancer from the Tenant-Network in a VPC Plan

You can delete the load balancer service (lb-port, lb-protocol) from an existing tenant network or endpoint group.

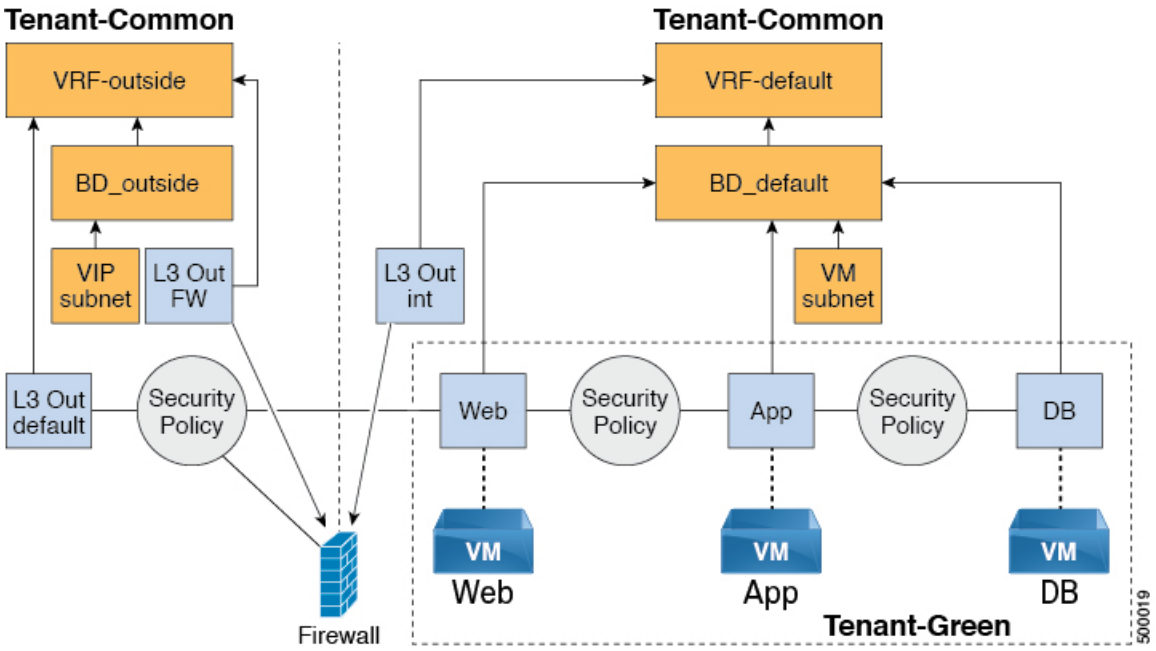
Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.
Step 2 Choose **Delete Load Balancer to Tenant Network - VPC Plan** and click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Configuring the Firewall

This section discusses the configuration steps to add a firewall service to a tenant network (the Application Policy Infrastructure Controller's endpoint group).

Figure 6: Shared Plan - Perimeter Firewall Only Overview



Note The perimeter firewall only service is not supported in VPC Plan. In VPC plan, the firewall service can be configured between EPGs.

Adding the Firewall to the Tenant-Network in a Shared Plan

You can add the firewall to an existing tenant network or endpoint group. The consumer of the firewall must have a Layer 3 out connectivity policy configured in another VRF for example, "outside" VRF.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.

Step 2 Choose **Add FW to Tenant Network - Shared Plan** and click **Request**.

Step 3 Enter the requested information in the fields.

Step 4 Click **Submit**.

Deleting the Firewall from the Tenant-Network in a Shared Plan

You can delete the firewall from an existing tenant network or endpoint group.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.

Step 2 Choose **Delete FW from Tenant Network - Shared Plan** and click **Request**.

Step 3 Enter the requested information in the fields.

Step 4 Click **Submit**.

Configuring the Firewall and Load Balancer

This section covers the configuration steps to add a firewall and load balancer service to a tenant network (the Application Policy Infrastructure Controller's endpoint group).

In this plan, the firewall and load balancer devices are deployed in the "common" tenant, there by offering consumption model for vRealize Automation (vRA) and the APIC tenant using the shared infrastructure.

Figure 7: Shared Plan - Firewall and Load Balancer Overview

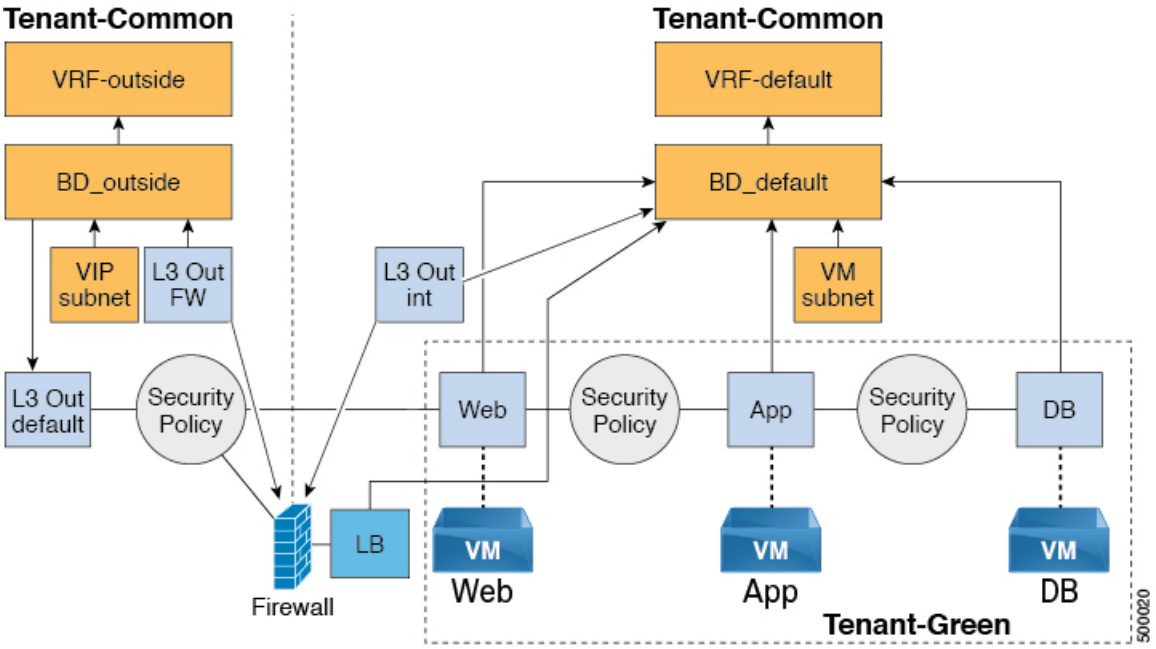
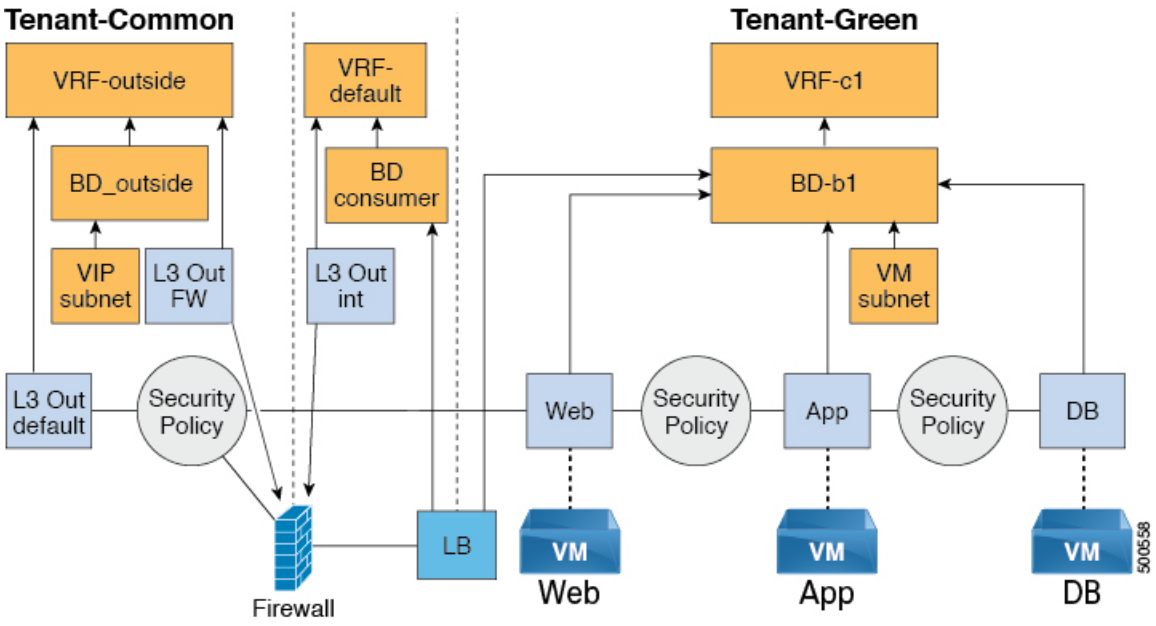


Figure 8: VPC Plan - Perimeter Firewall and Load Balancer



Adding the Firewall and Load Balancer to the Tenant-Network in a Shared Plan

The virtual IP address pool must be added to the tenant before using the firewall and load balancer service.

See Adding the VIP Pool, on page 74.

The firewall and load balancer can be added to an existing tenant network or endpoint group. The consumer of the firewall must have a Layer 3 out connectivity policy configured in the "outside" VRF.

Before you begin

For both Firewall and Load-Balancer only services have to be met before a firewall and load balancer service can be deployed.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.

Step 2 Choose **Add FW and LB to Tenant Network - Shared Plan** and click **Request**.

Step 3 Enter the requested information in the fields.

Step 4 Click **Submit**.

Adding the Firewall and Load Balancer to the Tenant-Network in a VPC Plan

This section describes how to add the firewall and load balancer to the Tenant-Network in a VPC Plan.

Note Whenever a firewall and load balancer (LB) workflow is executed then external leg of LB is pointing to "default" Bridge Domain (BD). Customers should always deploy internal leg of firewall in "default" BD under tn-common. This ensures that both the firewall and load balancer point to same BD and traffic flows in an uninterrupted way.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.
Step 2 Choose **Add FW and LB to Tenant Network - VPC Plan** and click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Deleting the Firewall and Load Balancer from the Tenant-Network in a Shared Plan

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant Shared Plan**.
Step 2 Choose **Delete FW and LB from Tenant Network - Shared Plan** and click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Deleting the Firewall and Load Balancer from the Tenant-Network in a VPC Plan

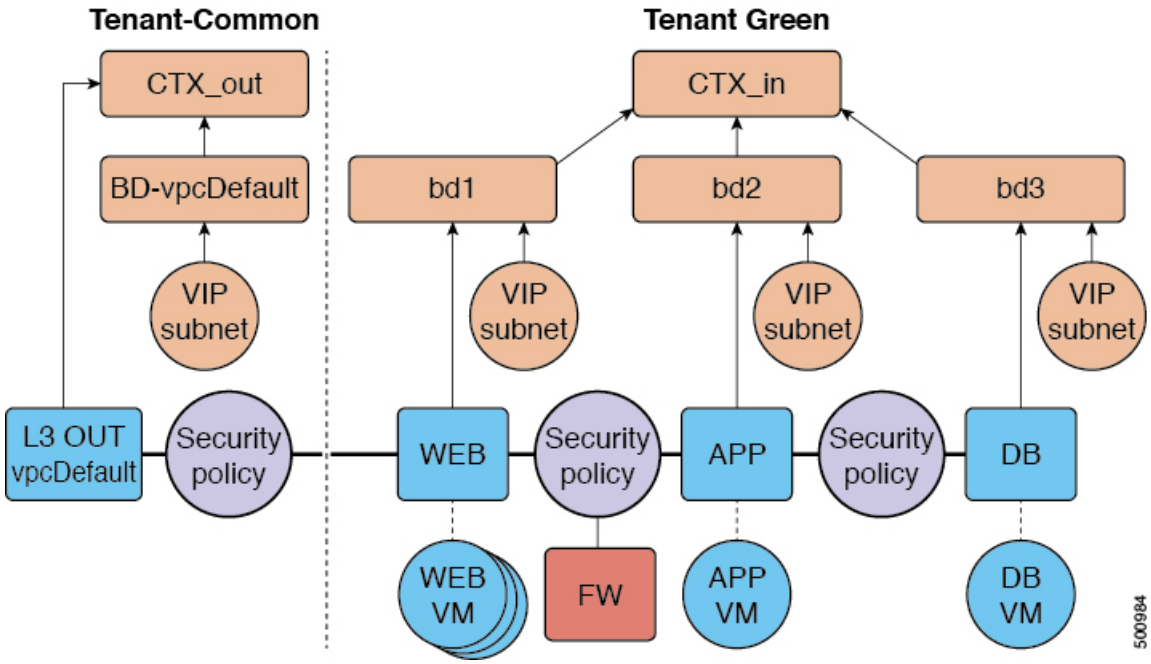
Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.
Step 2 Choose **Delete FW and LB from Tenant Network - VPC Plan** and click **Request**.
Step 3 Enter the requested information in the fields.
Step 4 Click **Submit**.

Configuring the Inter-EPG Firewall

This section describes how to configure the inter-EPG firewall service to a tenant network (the Application Policy Infrastructure Controller's endpoint group).

Figure 9: VPC Plan - Inter EPG FW



Adding the Firewall to the Tenant-Network in a VPC Plan

This section describes how to add the firewall to an existing tenant network or endpoint group (EPG). When adding the tenant, "Enable Inter-EPG Firewall" should be set to "yes" and the number of tiers used in the application should be configured. When configuring the network (EPG) tier number should be set. In this scenario, the firewall is configured between a provider EPG and consumer EPG.

Procedure

Step 1 Log into the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.

Step 2 Choose **Add FW to Tenant Network - VPC Plan** and click **Request**.

Step 3 Enter the requested information in the fields.

Step 4 Click **Submit**.

Deleting the Firewall from the Tenant-Network in a VPC Plan

This section describes how to delete the firewall from an existing tenant network or endpoint group (EPG).

Procedure

Step 1 Log into the vRealize Automation as admin, choose **Catalog** > **Tenant VPC Plan**.

Step 2 Choose **Delete FW from Tenant Network - VPC Plan** and click **Request**.

Step 3 Enter the requested information in the fields.

Step 4 Click **Submit**.

Attaching an External L3 Network Internet Access

This section describes how to attach an external Layer 3 (L3) Network Internet Access.

Before you begin

- You can choose any name for the L3 policy.
- External L3 policy instance must be named [L3OutName|InstP].

Procedure

Step 1 Log in to the vRealize Automation as tenant, choose **Catalog** > **Tenant Network service**.

Step 2 Choose **Attach or Detach L3 external connectivity to Network**

Step 3 Choose **Request**.

Step 4 In the **Request Information** tab, enter a description of the request.

Step 5 Choose **Next**.

Step 6 In the **Step** tab, perform the following actions:

a) In the **Rule Entry List** field, enter the values and click **Save**.

This table shows the values for each Rule Entry:

Rule Entry List	Values
dstFormPort	• Blank • Unspecified • 1-65535
dstToPort	• Blank • Unspecified • 1-65535
protocol	• icmp • icmpv6 • tcp • udp • Blank
etherType	• IP • ARP

b) In the **L3out Policy** field, click **Add** to locate and choose the L3 connectivity policy in the common tenant. (default)
c) In the **Network/EPG name** field, click **Add** to locate and choose the network/EPG in the common tenant. (web-host)
d) In the **EPG/Network plan type** field, click **Add** to locate and choose the network/EPG in the common tenant. (web-host)
e) In the **Operation** field, click **Add** to add a Layer3 Out.

Step 7 To verify your request, choose the **Requests** tab.
a) Choose the request you submitted and click **view details**. Ensure the status is **Succesful**.

Verify the Security and L3 Policy on the APIC

This section describes how to verifying the security and Layer 3 (L3) policy on APIC.

Procedure

Step 1 Log in to Cisco APIC as the tenant, and then choose **TENANTS** > **common**.
Step 2 In the **navigation** pane, expand **Tenant Common** > **Networking** > **Security Policies** > **Contracts**.
a) Nested under **Contracts** there should be a new contract with the *end_user_tenant name*-L3ext_ctrct_*network_name* that you connected to. (green-L3ext_ctrct_web-hosts)
b) Expand the *end_user_tenant name*-L3ext_ctrct_*network_name*. (green-L3ext_ctrct_web-hosts)
c) Choose the *end_user_tenant name*-L3ext_ctrct_*network_name*. (green-L3ext_ctrct_web-hosts)
d) In the **Property** pane, in the **Filter** field, click the filter. (green-L3ext_filt_web-hosts)
e) In the **Properties** pane, you can see the filter is mapped to vRealize.
Step 3 In the **navigation** pane, expand **Tenant Common** > **Networking** > **External Routed Networks** > **default** > **Networks** > **defaultInstP**.
a) In the **Properties** pane, in the **Provided Contracts** field, you should see the *end_user_tenant name*-L3ext_ctrct_*network_name*. (green-L3ext_filt_web-hosts)
b) In the **Consumed Contracts** field, you should see the *end_user_tenant name*-L3ext_ctrct_*network/EPG_name*. (green-L3ext_filt_web-hosts)
Step 4 On the menu bar choose **TENANTS** > ***your_tenant*** .
Step 5 In the **navigation** pane, expand **Tenant *your_tenant*** > **Application Profile** > **default** > **Application EPGs** > **EPG web-hosts** > **Contracts**.
a) In the **Contracts** pane, you can verify the contract and consumes a contract is present.

Verifying the Network Connectivity

This section describes how to verify the network connectivity.

Procedure

Log in to the virtual machine (web-host), from the command line, ping the other VM.

Application Deployment Scenarios

The following table shows the supported deployment scenarios:

Deployment Scenario	Description
Web > **L3out**	Web Tier to L3 external connectivity policy connected using security policy (L3out configured in "default" VRF)
Web > **Firewall** > **L3out**	Web Tier with Firewall and L3out (L3out configured in "outside" VRF)
Web > **Load Balancer** > **L3out**	Web Tier with Load balancer connected to L3out (L3out configured in "default")
Web > **Load Balancer and Firewall** > **L3out**	Web Tier with Load balancer and Firewall service connected to L3out (L3out configured in "outside")
Application > **Web**	App tier to Web tier, connected using security policy
Database > **Application**	Db tier to App tier, connected using security policy
Application > **Load Balancer** > **Web**	App tier to Web tier using Load balancer. Traffic from Web tier towards App tier is load balanced.
Application > **Firewall** > **Web**	App tier to Web tier using firewall.

In a multi-tenant deployment, there are some restrictions in the service deployment configuration. The administrator must decide whether the applications in this deployment will use firewall services or a load balancer-only service at the first (web) tier.

The following table shows the supported combinations of services in the shared plan:

Deployment Type	FW + LB > L3out	LB only > L3out	FW > L3out	LB between EPGs	FW between EPGs
Firewall only or Firewall and Load balancer	Yes		Yes	Yes	Yes
Load Balancer only		Yes		Yes	

In case of multi-tenancy, you should use a dedicated service device for each tenant.

About Property Groups

Property groups are a vRealize Automation (vRA) construct that provide virtual machine customization. Using property groups, vRA can invoke workflows in vRealize Orchestration (vRO) at given stage of virtual machine's life cycle. This virtual machine extension capability is used by Application Policy Infrastructure Controller (APIC) vRealize to invoke APIC vRA workflows and configure APIC policies.

APIC vRealize supports a number of application deployment scenarios. In a multi-tier application, the APIC security policy or the load balancing or firewall services can be inserted between tiers. This is achieved by the following steps:

1. Execute the **Configure Property Group** catalog-item in the **Admin Services** catalog to create a property group.
2. Use the **Security Policy**, **Load Balancer**, and **Firewall** tabs to customize the property group.
3. Enable the property group in the single-machine blueprint at the **Infrastructure** > **Blueprints** > **Single Machine Blueprint** level in vRealize.

About Service Blueprints

This section describes the service blueprints.

In vRealize there are two sets of blueprints one is a machine blueprints that is for compute for installing, setting up VMs, and spinning VMs. There is a single- and a multi-machine blueprint for launching single-tier application workload or multi-tier application workload that is called machine blueprint for networking workflows.

Admin workflow:

- Create APIC handles
- Create VMM domains
- Create Tenants
- Create subnets in common
- Create Layer 4-7 devices

Tenant workflow:

- Create EPGs
- Create contracts
- Provide contracts
- Consume contracts
- Consume L3Outs
- Consume Layer 4-7 devices

Integration with vRealize Network Profiles (IPAM)

vRealize IP address management (IPAM) uses the network profiles concept to assign a pool of addresses to one or more networks. You can assign network profiles to ACI backed networks in the same fashion as a regular vRealize network.

To integrate with the vRealize IPAM:

Procedure

Step 1 Ensure the subnet exists to the bridge domain.

See **Add or Delete Subnets in Bridge Domain for Tenant-Common**.

Step 2 Create a network profile.

See VMware's documentation for creating a network profile.

Step 3 This depends on if your blueprint generates a new network or not:

If you use the same network for each machine blueprint:

Under your vCenter reservation find the EPG (Network Path) and assign the network profile to it.

a) In the vCenter, navigate to **Infrastructure** > **Reservations**.
b) Find "Your Reservation", hover and click **Edit**.
c) Navigate to **Network** > **Find desired Network Path (EPG)**, from the drop-down list, choose the Network Profile and click **Ok**.

If you generate a network per VM:

Add a property to your property group with the network profile as the value.

a) In the vCenter, navigate to **Infrastructure** > **Blueprints** > **Property Groups**.
b) Find "Your Blueprint", hover and click **Edit**.
c) Click **+ New Property**.
d) Set the Name to "*VirtualMachine.NetworkX.NetworkProfileName*".

   where *X* is the VM NIC number (in the range [0-9]).

e) Set the Value to the name of the Network Profile you created.
f) Click the green tick icon to confirm and click **Ok**.

New applications will be assigned an address from this pool.

Step 4 Use guest customizations to assign the IP address to the server.

See VMware's documentation for guest customizations.

Documentation of APIC Workflows in vRealize Orchestrator

To get documentation on the APIC methods and types, the vRO API search can be used.

1. Log in to the vRO GUI, choose **Tools** > **API Search**

2. Enter **APIC**.

   This shows the list of all APIC methods and types.

List of Methods in ApicConfigHelper Class

This section provides a list of methods in `ApicConfigHelper` class.

- This adds an APIC host to the repository and does a login to the APIC:

```
ApicHandle addHost(String hostName,
       String hostIp0,
       String hostIp1,
       String hostIp2,
       String  userName,
       String pwd,
       int port,
       boolean noSsl,
       String role,
       String tenantName)
```

- This gets the APIC handle give the APIC name:

```
ApicHandle getApicHandle(String hostName)
```

- This gets the list of APIC handles for a given <role, username>:

```
List<ApicHandle> getApicHandleByRole(String role, String userName)
```

- This removes an APIC host from the repository:

```
boolean removeHost(String inApicName)
```

- This creates Tenant endpoint group and association to vmmDomain in APIC:

```
ApicResponse addNetwork(ApicHandle handle,
       String tenantName,
       String apName,
       String epgName,
       String bdName,
       String ctxName,
       String subnet,
       String domName,
       boolean vmm,
       boolean vpc,
       boolean intraEpgDeny,
       boolean allowUseg,
       String  encapMode)
```

- This updates the domain of the endpoint group by adding or deleting:

```
ApicResponse updateNetwork(ApicHandle handle,
       String tenantName,
       String apName,
       String epgName,
       String domName,
       boolean vmm,
       boolean add,
       String encapMode)
```

- This adds or deletes subnets to the bridge domain in the virtual private cloud (VPC) tenant:

```
ApicResponse updateSubnets(ApicHandle handle,
       String tenantName,
       String bdName,
```

```
        fvSubnet subnetList[],
        boolean add)
```

- This adds or deletes the bridge domain to or from the tenant:

```
ApicResponse updateBD(ApicHandle handle,
        String tenantName,
        String bdName,
        String ctxName,
        boolean arpFlooding,
        String l2UnknownUnicast,
        String l3UnknownMulticast,
        boolean add)
```

- This adds or deletes the context (Ctx) to or from the tenant:

```
ApicResponse updateCtx(ApicHandle handle,
        String tenantName,
        String ctxName,
        boolean add)
```

- This adds or deletes the following based on add or delete:

```
ApicResponse addOrDeleteLBToNetwork(ApicHandle handle,
        String tenantName,
        String apName,
        String epgName,
        String bdName,
        String ctxName,
        boolean vpc,
        String planName,
        String lbVendor,
        String ldevName,
        String graphName,
        boolean sharedLb,
        String protocol,
        String port,
        String consumerDn,
        String snipIntAddress,
        String snipIntNetMask,
        String snipExtAddress,
        String snipExtNetMask,
        String snipNextHopGW,
        boolean addOperation)
```

- This opens a connection to the URL, sends the postBody string to the URL location, and returns result:

```
ApicResponse addOrDelFWReq(ApicHandle handle,
        String tenantName,
        String apName,
        String epgName,
        String ctrctName,
        String graphName,
        vzEntry entryList[],
        String consumerDn,
        boolean addOp,
        boolean updateOp)
```

- This adds the firewall service to an endpoint group in the shared and VPC plan:

```
ApicResponse addFWToNetwork(ApicHandle handle,
        String tenantName,
        String apName,
        String epgName,
        boolean vpc,
        String fwVendor,
```

```
        String ldevName,
        String graphName,
        vzEntry entryList[],
        String fwL3extExternal,
        String fwL3extInternal,
        boolean skipFWReq,
        String consumerDn)
```

- This deletes the firewall from the endpoint group in the shared and VPC Plan:

```
ApicResponse deleteFWFromNetwork(ApicHandle handle,
        String tenantName,
        String apName,
        String epgName,
        boolean vpc,
        String graphName,
        String ctrctName,
        String protocol,
        String startPort,
        boolean skipFWReq,
        String consumerDn)
```

- This implements the REST API to APIC:

```
String apicRestApi(ApicHandle handle,
        String apiUrl,
        String method,
        String postBody)
```

- This adds or deletes the router ID in a tenant:

```
ApicResponse addOrDelRouterId(ApicHandle handle,
        String rtrId,
        boolean addOp)
```

- This deletes the tenant endpoint group and the association:

```
ApicResponse deleteNetwork(ApicHandle handle,
        String tenantName,
        String apName,
        String epgName)
```

- This creates the tenant, bridge domain and the context (Ctx) in APIC:

```
ApicResponse addTenant(ApicHandle handle,
        String tenantName,
        String bdName,
        String ctxName,
        String aaaDomain)
```

- This deletes the tenant in APIC:

```
ApicResponse deleteTenant(ApicHandle handle,
        String tenantName)
```

- This adds VlaNS, vmmDomP, vmmCtrlP, vmmUsrAccp and required relation objects to the APIC:

```
ApicResponse addVmmDomain(ApicHandle handle,
        String dvsName,
        String vcenterIP,
        String userName,
        String passwd,
        String datacenter,
        String vlanPoolName,
        int vlanStart,
```

```
        int vlanEnd,
        String aaaDomain)
```

- This deletes VlanNS and vmmDomP objects from the APIC:

```
ApicResponse deleteVmmDomain(ApicHandle handle,
        String domName,
        String vlanPoolName)
```

- This adds or deletes encap blocks in the VLAN pool:

```
ApicResponse updateVlanPool(ApicHandle handle,
        String vlanPoolName,
        fvnsEncapBlk encapList[])
```

- This adds the security policy (contract entry):

```
ApicResponse addSecurityPolicySet(ApicHandle handle,
        String tenant,
        String ap,
        String srcEpg,
        String dstEpg,
        vzEntry entryList[],
        boolean createFlg
        )
```

- This updates the security policy (contract entry):

```
ApicResponse updateSecurityFilters(ApicHandle handle,
        String tenant,
        String filterName,
        vzEntry entryList[]
        )
```

- This adds or removes the consumer contract interface:

```
ApicResponse updateSharedSvcConsumer(ApicHandle handle,
        String tenant,
        String ap,
        String consumerEpg,
        vzBrCP contract,
        boolean add
        )
```

- This updates the security policy (contract entry):

```
ApicResponse updateL3outPolicy(ApicHandle handle,
        String tenant,
        String ap,
        String dstEpg,
        vzEntry entryList[],
        l3extOut l3out,
        boolean vpc,
        boolean add
        )
```

- This deletes all the security policy (contracts):

```
ApicResponse deleteSecurityPolicy(ApicHandle handle,
        String tenant,
        String ap,
        String srcEpg,
        String dstEpg
        )
```

- This creates VIP address block in the tn-common:

```
ApicResponse addVipPool(ApicHandle handle,
       String planName,
       String addrStart,
       String addrEnd)
```

- This deletes VIP address block in the tn-common:

```
ApicResponse deleteVipPool(ApicHandle handle,
       String planName,
       String addrStart,
       String addrEnd)
```

- This adds or deletes the security domain associations:

```
ApicResponse updateVmmDomain(ApicHandle handle,
       String domName,
       aaaDomainRef aaaList[])
```

- This deletes a shared service provider (endpoint group) from a contract:

```
ApicResponse deleteSharedServiceProvider(ApicHandle handle,
       String tenant,
       String ap,
       String srcEpg,
       String dstEpg,
       vzBrCP contract)
```

- This creates a Cisco AVS VMM domain and adds related objects to the APIC:

```
ApicResponse addAvsVmmDomain(ApicHandle handle,
       String dvsName,
       String aepName,
       String vcenterIP,
       String userName,
       String passwd,
       String dvsVersion,
       String datacenter,
       String mcastIP,
       String poolName,
       String rangeStart,
       String rangeEnd,
       String aaaDomain,
       int domType,
       String secondRangeStart,
       String secondRangeEnd,
       String secondPoolName)
```

- This updates the pools (VLAN, Multicast Address) relevant to a Cisco AVS VMM domain:

```
ApicResponse updateAvsVlanMcastPool(ApicHandle handle,
       String poolName,
       fvnsEncapBlk encapList[],
       int poolType)
```

- This deletes a Cisco AVS VMM domain:

```
ApicResponse deleteAvsVmmDomain(ApicHandle handle,
       String domName,
       String poolName,
       int poolType)
```

- This deletes a Cisco AVS VMM domain which is in mixed mode:

```
ApicResponse deleteAvsVmmDomainMixedmode(ApicHandle handle,
       String domName )
```

- This creates Distributed Firewall for a Cisco AVS VMM domain:

```
ApicResponse createFWPol(ApicHandle handle,
       String polName,
       String vmmName,
       String polMode,
       String pInterval,
       String logLevel,
       String adminState,
       String destGrpName,
       String inclAction,
       int caseVal)
```

- This updates Distributed Firewall association with a Cisco AVS VMM domain:

```
ApicResponse updateFWPolMapping(ApicHandle handle,
       String polName,
       String vmmName,
       Boolean opValue)
```

- This deletes Distributed Firewall:

```
ApicResponse deleteFWPol(ApicHandle handle,
       String polName)
```

- This adds or deletes attribute(s) for a Microsegment EPG:

```
ApicResponse addOrDelUsegAttr(ApicHandle handle,
       String tenantName,
       String apName,
       String epgName,
       String criteriaName,
       fvVmAttrV addFvVmAttrList[],
       fvMacAttr addFvMacAttrList[],
       fvIpAttr addFvIpAttrList[],
       fvVmAttr delFvVmAttrList[],
       fvMacAttr delFvMacAttrList[],
       fvIpAttr delFvIpAttrList[])
```

- This adds a microsegment EPG:

```
ApicResponse addUsegEpg(ApicHandle handle,
       String tenantName,
       String apName,
       String epgName,
       String bdName,
       String ctxName,
       String subnet,
       String domName,
       String criteriaName,
       boolean vmm,
       boolean vpc,
       boolean intraEpgDeny,
       fvVmAttrV fvVmAttrList[],
       fvMacAttr fvMacAttrList[],
       fvIpAttr fvIpAttrList[],
       String encapMode)
```

Writing Custom Workflows Using the APIC Plug-in Method

This section describes how to write custom workflows using the Application Policy Infrastructure Controller (APIC) plug-in method. Tenants might have unique requirements for their logical network topology that are not covered by the out-of-box designs. Existing Cisco APIC workflows can be combined together into a custom workflow that enables limitless network designs.

All workflows expect a set of input parameters, and workflows that create new objects will export a set of output parameters. Output parameters can be chained into the input parameter of the next workflow.

The following example procedure creates a custom workflow that builds a new network, and then directly passes the newly created network into the input of the attach Layer 3 workflow.

Procedure

Step 1 Log in to the vRealize Orchestrator.

Step 2 Switch to the **Design** mode.

Step 3 In the Navigation pane, create a folder named "Custom Workflows".

Step 4 Choose the **Custom Workflows** folder.

Step 5 In the Work pane, click the **New workflow** button.

Step 6 In the **Workflow name** dialog box, enter a name for the workflow.

Example:

```
Create_Network_Attach_L3
```

Step 7 Click **OK**.

Step 8 Choose the **Schema** tab.

Step 9 In the Navigation pane, expand **All Workflows** > **Administrator** > **Cisco APIC workflows** > **Tenant Shared Plan**

Step 10 Drag and drop **Add Tenant Network - Shared Plan** onto the blue arrow in the Work pane.

Step 11 In the **Do you want to add the activity's parameters as input/output to the current workflow?** dialog box, click **Setup...**.

Step 12 In the **Promote Workflow Input/Output Parameters** dialog box, click **Promote**.

Leave all of the values at their defaults.

Step 13 In the Navigation pane, expand **All Workflows** > **Administrator** > **Cisco APIC workflows** > **Advanced Network Services**.

Step 14 Drag and drop **Attach or Detach L3 external connectivity to Network** onto the blue arrow that is to the right of the **Add Tenant Network** object in the Work pane.

Step 15 In the **Do you want to add the activity's parameters as input/output to the current workflow?** dialog box, click **Setup...**.

Step 16 In the **Promote Workflow Input/Output Parameters** dialog box, click **Promote**.

Leave all of the values at their defaults.

Step 17 Choose the **Inputs** tab.

The screen displays the inputs for the workflow. You can verify that the inputs are all exposed and that the created endpoint group is an output parameter.

Step 18 Choose the **Schema** tab.

Step 19 In the Work pane, click **Validate** to verify that the custom workflow is valid.

Step 20 Click **Close**.

Step 21 Click **Run** to test the workflow.

Step 22 In the **Start Workflow** dialog box, click **Submit** to start the workflow.

Multi-Tenancy and Role based Access Control Using Security Domains

APIC and vRA both supports multi-tenancy natively. vRA tenant user is mapped one-to-one with a APIC tenant user and thus Tenant names need to match exactly on both systems.

For every vRA tenant, APIC admin needs to ensure that an user account and required security domains and roles are created in APIC as part of Day-0 operation.

As a next step, vRA-Admin would execute Add Tenant service blueprint (part of Admin catalog), to create/update Tenant in APIC and associate it with the right security Domain. For eg: Tenant-Green on vRA is mapped to Tenant-Green in APIC with association to Security Domain "Domain-Green" enabled for "User-Green".

By associating tenant to right security domains, Role based access control is enforced and it allows for granular as well stricter Tenant policy enforcement.

Adding the Tenant

This section describes how to add the tenant.

In this blueprint, a tenant identified by input parameter "Tenant" is created in APIC with association the security domain that is provided as second input.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Admin Services**.

Step 2 Choose **Add Tenant**, enter the information in the fields and click **Submit**.

Deleting the Tenant

This section describes how to delete the tenant from APIC.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Admin Services**.

Step 2 Choose **Delete Tenant**, enter the information in the fields and click **Submit**.

APIC Credentials for Workflows

As part of ACI-integration with vRA, this release supports pairing up vRA with a ACI fabric managed by a APIC-cluster.

The network service blueprints are categorized into Admin and Tenant workflows and accordingly vRA admin has to setup APIC connection handles for APIC-Admin credential as well as APIC-Tenant credential for every vRA-Tenant.

As part of plug-in, the right handles (Admin vs Tenant) are auto-selected implicitly based on the workflow context and the privileges needs to create and managed objects in APIC. This provides stronger access control and isolation among tenants.

Adding APIC with Admin Credentials

This section describes how to add APIC with admin credentials.

All the blueprints and workflows that are part of catalog items in Admin portal are performed using the Admin-credential.

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Network Security**.

Step 2 Choose **Add APIC with Admin Credentials**, enter the information in the fields and click **Submit**.

Step 3 To access APIC using certificates, set the "Use certificate authentication" to **yes** and enter the **Certificate Name** and **Private Key** parameters.

Adding APIC with Tenant Credentials

This section describes how to using tenant admin credentials (security domain).

Procedure

Step 1 Log in to the vRealize Automation as admin, choose **Catalog** > **Admin Services**.

Step 2 Choose **Add APIC with Tenant credentials**, enter the information in the fields and click **Submit**.

Step 3 To access APIC using certificates, set the "Use certificate authentication" to **yes** and enter the **Certificate Name** and **Private Key** parameters.

Troubleshooting

This section describes the troubleshooting techniques.

Collecting the Logs to Report

This section describes how to collect the log files from the vRealize Appliance to report.

Procedure

To collect the log files, enter the following commands:

```
tar xvfz apic-vrealize-1.2.1x.tgz
cd apic-vrealize-1.2.1x
cd scripts/
./get_logs.sh
Usage:  get_logs.sh  [-u] [-p <password>] [-s <vra_setup>]
       -p    password (can be skipped for default passwd)
       -s    vra_setup
       -u    un-compress (ie., don't create .tar.gz file)

Example:
./get_logs.sh -p ***** -s vra-app
…
VMware vRealize Automation Appliance
Compressing Logs
logs/
logs/app-server/
logs/app-server/catalina.out
logs/app-server/server.log
logs/configuration/
logs/configuration/catalina.out
Logs saved in vra_logs_201511251716.tar.gz
```

Installing the ACI Helper Scripts

This section describes how to install the helper scripts. The ACI helper scripts provide the following:

- Restarts the vco-server and vco-configurator
- Uninstalls the APIC plug-in

Procedure

To install the helper scripts, enter the following commands:

```
cd scripts
./install_apic_scripts.sh
Usage:  install_apic_scripts.sh  [-p <password>] [-s <vra_setup>]
       -p    password
       -s    vra_setup

Example:
./install_apic_scripts.sh -p ***** -s vra-app
Copying APIC scripts 'rmapic', 'restart' to vra: vra-app
```

Removing the APIC Plug-in

This section describes how to remove the APIC plug-in.

Procedure

Step 1 Log into the VMware vRealize Orchestrator as administrator.

Step 2 Run the Delete APIC workflow for all APIC handles.

Step 3 Install the ACI helper scripts, which can be found in Installing the ACI Helper Scripts , on page 96.

Step 4 Log in to the VRA appliance as root, using SSH:**`$ssh root@vra_ip.`**

Step 5 Change the permissions to the **`rmapic`** bash script to be executable:

```
$ chmod a+x rmapic
```

Step 6 Execute the **`rmapic`** bash script to remove the APIC plug-in:

```
$ ~/rmapic
```

Step 7 To verify that the plug-in has been uninstalled, log in to the VMware appliance using the Firefox browser: `https://appliance_address:8283/vco-controlcenter`

Step 8 Under the **Plug-Ins** section, click **Manage Plug-Ins**.

Step 9 Verify that the Cisco APIC Plug-in is no longer listed under **Plug-In**.

Plug-in Overview

vRA Blueprints input parameters	vRO Javascript Object Name	APIC Managed Object Name
Tenant	ApicTenant	com.cisco.apic.mo.fvTenant
Bridge Domain	ApicBridgeDomain	com.cisco.apic.mo.fvBD
VRF	ApicL3Context	com.cisco.apic.mo.fvCtx
Tenant Network (EPG)	ApicEPG	com.cisco.apic.mo.fvAEPg
Security Policy (Contracts)	ApicSecurityPolicy	com.cisco.apic.mo.vzBrCP
Security Filters	ApicSecurityFilter	com.cisco.apic.mo.vzFilter
Security Rules	ApicSecurityRule	com.cisco.apic.mo.vzEntry
AAA Domain	ApicAAADomain	com.cisco.apic.mo.aaaDomain
VMM Domain	ApicVmmDomain	com.cisco.apic.mo.vmmDomP

vRA Blueprints input parameters	vRO Javascript Object Name	APIC Managed Object Name
VMM Controller	ApicVmmController	com.cisco.apic.mo.vmmCtrlrP
Physical Domain	ApicPhysicalDomain	com.cisco.apic.mo.physDomP
L4-L7 Device Cluster	ApicLogicalLBDevice	com.cisco.apic.mo.vnsLDevVip
L3 external connectivity	ApicL3Connectivity	com.cisco.apic.mo.l3extOut

Configuring a vRA Host for the Tenant in the vRealize Orchestrator

This section describes how to configure a vRA host for the tenant in the vRealize Orchestratorr (vRO).

Note There will be one vRA host handle already created by default. This is for the global tenant and is used for administration purposes and to create the IaaS host handle.

Procedure

Step 1 Log in to the VMware vRealize Orchestrator as administrator.

Step 2 Once the VMware vRealize Ochestrator GUI appears, from the drop-down list, choose **Run** from the menu bar.

Step 3 In the **Navigation** pane, choose the **Workflows** icon.

Step 4 Choose **Adminstrator@*vra_name*** > **Library** > **vRealize Automation** > **Configuration** > **Add a vRA host**.

Step 5 Right-click **Add a vRA host** and choose **Start Workflow**.

Step 6 In the **Start Workflow: Add a vRA host** dialog box, perform the following actions:

a) In the **Host Name** field, enter the host's name.
b) In the **Host URL** field, enter the host's URL.
c) For **Autotmatically install SSL certificates**, choose **Yes**.
d) In the **Connection timeout** field, enter "30".
e) In the **Operation timeout** field, enter "60".
f) For **Session Mode**, choose **Shared session**.
g) In the **Tenant** field, enter the tenant's name.
h) In the **Authentication username** field, enter your tenant administrator username.
i) In the **Authentication pwd** field, enter your tenant administrator password.
j) Click **Submit**.

Configuring an IaaS Host in the vRealize Orchestrator

This section describes how to configure an IaaS host in the vRealize Orchestratorr (vRO).

Procedure

Step 1 Log in to the VMware vRealize Orchestrator as administrator.

Step 2 Once the VMware vRealize Ochestrator GUI appears, from the drop-down list, choose **Run** from the menu bar.

Step 3 In the **Navigation** pane, choose the **Workflows** icon.

Step 4 Choose **Adminstrator@*vra_name*** > **Library** > **vRealize Automation** > **Configuration** > **Add the Iaas host of a vRA host**.

Step 5 Right-click **Add the Iaas host of a vRA host** and choose **Start Workflow**.

Step 6 In the **Start Workflow: Add the Iaas host of a vRA host** dialog box, perform the following actions:

a) In the **vRA Host** drop-down list, choose the default vRA host that was created by the system. Do not choose the tenant handle.
b) In the **Host Name** field, leave the auto-filled name as is.
c) In the **Host URL** field, enter the vRA host's URL.
d) In the **Connection timeout** field, enter "30".
e) In the **Operation timeout** field, enter "60".
f) For **Session Mode**, choose **Shared session**.
g) In the **Authentication username** field, enter your IaaS administrator username.
h) In the **Authentication pwd** field, enter your IaaS administrator password.
i) In the **Workstation for NTLM authentication** field, enter your IaaS host name.
j) In the **Domain for NTLM authentication** field, enter your IaaS domain name.
k) Click **Submit**.