Configuring Internal Connectivity for Google Cloud Workloads

Internal Connectivity Workflow

The following sections describe how to configure Google Cloud sites infra, intersite connectivity, and a simple deployment use case. The workflow includes:

- Select the EPG you create in the previous section
- Configuring route leaking between cloud VRFs
- Creating or importing a Google cloud user tenant and EPGs and applying contracts to enable communication between sites

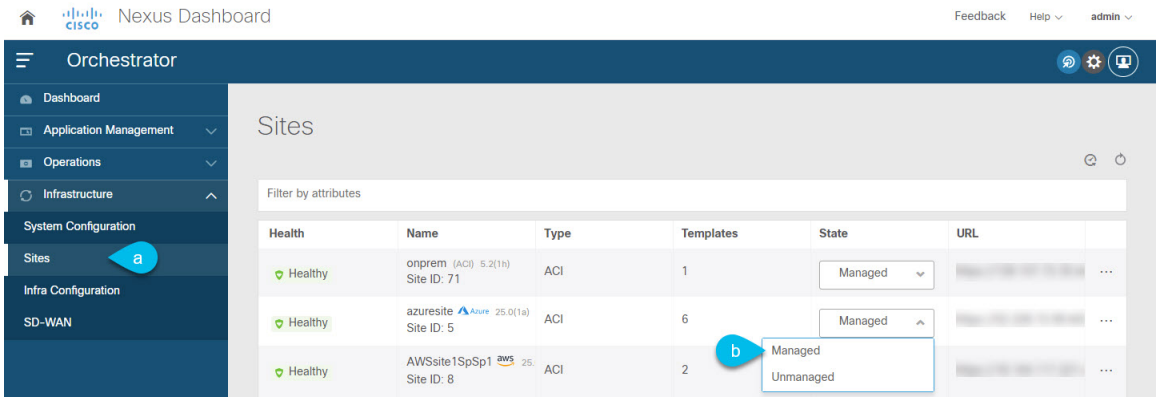
Importing Google Cloud User Tenant

If you are importing an existing tenant follow the procedure below. If you wish to create a new tenant, refer to this section Creating Google Cloud User Tenant.

Step 1 From the Nexus Dashboard's **Service Catalog**, open the Nexus Dashboard Orchestrator service.

You will be automatically logged in using the Nexus Dashboard user's credentials.

Step 2 In the Nexus Dashboard Orchestrator GUI, manage the sites.



a) From the left navigation menu, select **Infrastructure** > **Sites**.
b) In the main pane, change the **State** from `Unmanaged` to `Managed` for each fabric that you want the Nexus Dashboard Orchestrator to manage.

Step 3 Import the existing cloud tenant.

a) In the **Sites** page, click the actions (**...**) menu next to the site you enabled for management and select **Import Tenants**.
b) In the **Import Tenants** dialog, select the tenant you want to import and click **OK**.

Step 4 Verify that the tenant's external connectivity infra configuration was imported successfully.

For external connectivity to be imported, it has to be configured on all the regions in which hub is instantiated.

a) Navigate to **Infrastructure** > **Site Connectivity** page.
b) Click **Configure**.
c) In the **General Settings** page, select the **External Devices** tab.

Verify that the external device is present

d) In the **General Settings** page, select the **IPSec Tunnel Subnet Pools** tab.

Verify that the external connectivity subnet pool is present.

e) In the left sidebar, select the site from which you imported the tenant.

In the site's settings, select the **External Connectivity** tab and confirm that the external network is present.

Note Do not deploy infra configuration from Nexus Dashboard at this time and proceed to the next section to import the external VRF.

Creating a Tenant

The following sections describe how to create a managed tenant or unmanaged tenant.

Setting Up the Google Cloud Project for a User Tenant

Perform the procedures in this section to set up the Google Cloud project for a user tenant, where that user tenant is either a managed or an unmanaged tenant.

Step 1 Create a Google Cloud project for the user tenant, if necessary.

Each user tenant is mapped one-to-one to a Google Cloud project. If you do not have a Google Cloud project created yet for your user tenant, follow these procedures to create a Google Cloud project.

a) Log into your Google account.
b) Navigate to **IAM & Admin** > **Manage resources**.
c) Using the **Select organization** drop-down list at the top of the page, choose the organization where you want to create a project.
d) Click **+ CREATE PROJECT**.
e) In the **New Project** window that appears, enter a project name and select a billing account as applicable.

A project name can contain only letters, numbers, single quotes, hyphens, spaces, or exclamation points, and must be between 4 and 30 characters.

f) Enter the parent organization or folder in the **Location** field.

That resource will be the hierarchical parent of the new project.

g) Click **CREATE**.

Step 2 In Google Cloud, enable the appropriate service APIs in the service account associated with this user tenant.

a) In the Google Cloud GUI, log into the Google Cloud project that is associated with this user tenant. The **Dashboard** for the project is displayed.
b) In the search bar at the top of the **Dashboard**, search for **APIs & Services**, then click the result from that search to access the **APIs & Services** window.
c) In the **APIs & Services** window, click the **+ ENABLE APIS AND SERVICES** tab.

The **API Library** window appears.

d) In the **Search for APIs & Services** field, search for and enable the necessary services.

For each of the services in the list below:

1. Search for the API or service in the **Search for APIs & Services** field.
2. Click on the search result to display the page for that API or service.
3. Click the **ENABLE** button in that API or service page.

Following are the APIs and services that you must search for and enable:

- Compute Engine API
- Cloud Deployment Manager V2 API
- Cloud Pub/Sub API
- Cloud Resource Manager API
- Service Usage API
- Cloud Logging API

Each API or service takes several minutes to enable. You will have to navigate back to the **APIs & Services** window after you enable each API or service.

Note that the following additional APIs and services should be enabled automatically when you enable all of the APIs and services listed above:

- Identity and Access Management (IAM) API
- IAM Service Account Credentials API
- Cloud OS Login API
- Cloud DNS API
- Recommender API

If they are not enabled automatically, enable them manually.

Step 3 Set the necessary permissions for this user tenant in Google Cloud.

a) In the Google Cloud GUI, log into the Google Cloud project that is associated with this user tenant. The **Dashboard** for the project is displayed.

b) In the left nav bar, click on **IAM & Admin**, then choose **IAM**.

The **IAM** window appears with several service accounts displayed.

c) Locate the appropriate service account.

d) Set the permissions for this service account.

1. Click the pencil icon on the row for this service account.

   The **Edit Permissions** window is displayed.

2. Click **+ ADD ANOTHER ROLE**, then choose **Editor** as the role.

   You are returned to the **IAM** window with the service accounts displayed.

3. Click **+ ADD ANOTHER ROLE** again, then add the remaining necessary roles for this service account.

   Following is the full list of roles that you must assign to this service account, including the Cloud Functions Service Agent that you added in the first step of this process:

   - Editor
   - Role Admin
   - Project IAM Admin

4. After you have added all the necessary roles, click **SAVE**.

   You are returned to the **IAM** window with the service accounts displayed and the necessary roles assigned to this service account.

Generating and Downloading Private Key Information from Google Cloud for an Unmanaged Tenant

If you are creating an unmanaged tenant, you must first generate and download the necessary private key information from Google Cloud.

Note You do not have to follow the steps in this procedure if you are creating a managed tenant.

Step 1 In Google Cloud, select the Google Cloud project that will be associated with this unmanaged tenant, if you have not selected it already .

Step 2 In the left nav bar, click on **IAM & Admin**, then choose **Service Accounts**.

The service accounts for this Google Cloud project are displayed.

Step 3 Select an existing service account or click **+ CREATE SERVICE ACCOUNT** to create a new one.

Information on this service account is displayed, with the **Details** tab selected by default.

Step 4 Click the **KEYS** tab.

Step 5 Click **ADD KEY** > **Create New Key**.

A window appears, providing an option to create a private key for this service account.

Step 6 Leave the **JSON** key type selected, then click **Create**.

A window appears, saying that the private key has been saved to your computer.

Step 7 Locate the JSON file that was downloaded to your computer and move it to a secure location on your computer.

This JSON file will contain the key information that you need to fill in the fields for the unmanaged tenant.

Creating Google Cloud User Tenant

Before you begin

You must make certain configurations in Google Cloud before creating a Google Cloud user tenant in the Nexus Dashboard Orchestrator:

- For either a managed or an unmanaged tenant, you must first set up a project in Google Cloud. See Setting Up the Google Cloud Project for a User Tenant for those instructions.
- For an unmanaged tenant, you must then generate the necessary private key information and download the JSON file from Google Cloud. See Generating and Downloading Private Key Information from Google Cloud for an Unmanaged Tenant.

Step 1 Log in to your Nexus Dashboard Orchestrator.

Step 2 In the left navigation menu, choose "Tenants".

Step 3 Choose "Add Tenant".

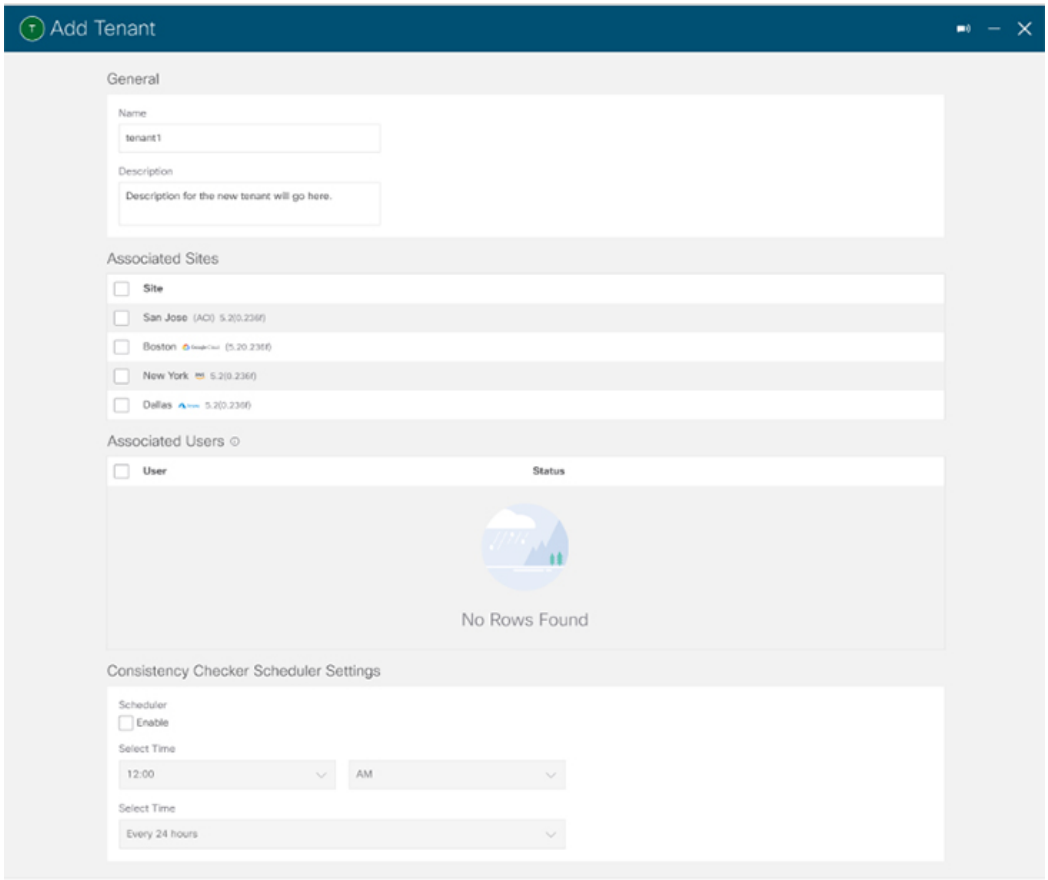
Step 4 Under **General**, provide a tenant name and an optional description.

The tenant name must be in the following format:

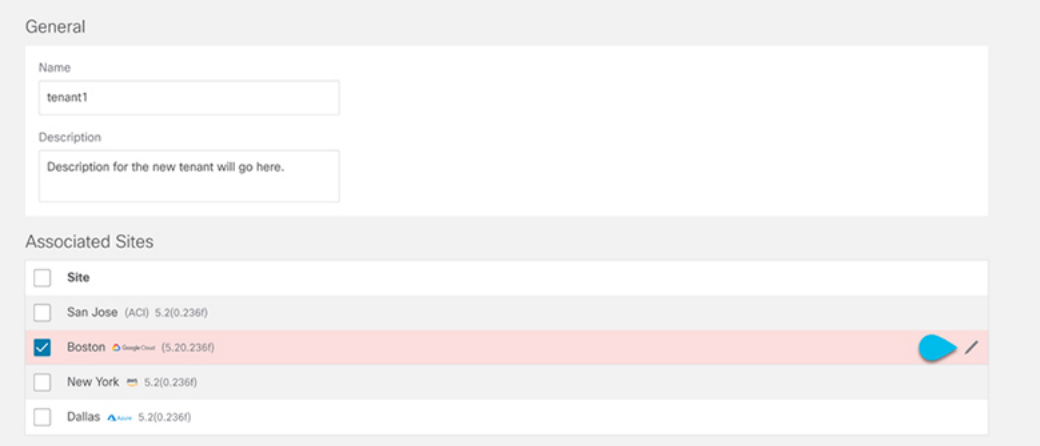
```
[a-z]([-a-z0-9]*[a-z0-9])?
```

This means that the first character must be a lowercase letter, and all the following characters can be hyphens, lowercase letters, or digits, except the last character, which cannot be a hyphen.

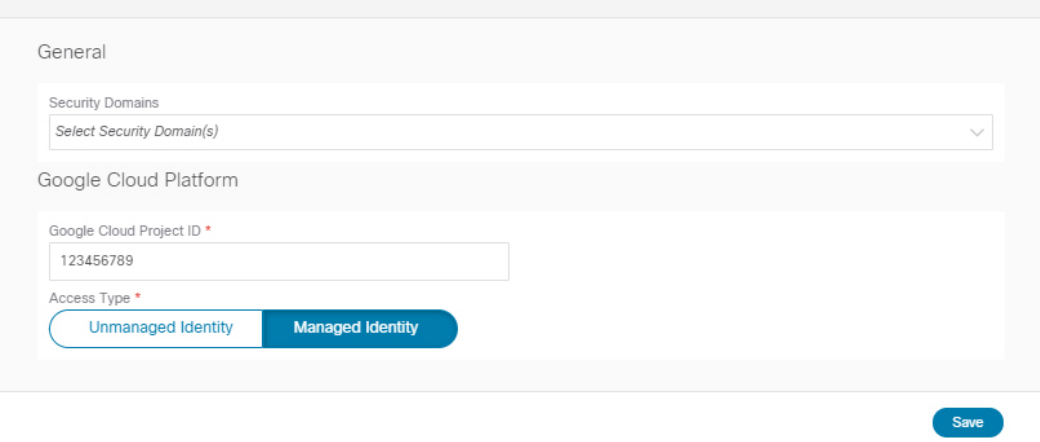
Step 5 From the **Associated Sites** area, choose the Google Cloud site where you want to create the tenant.



Step 6 After selecting your Google Cloud site, click on the edit icon to specify your account information.



Step 7 Fill in all the mandatory information.

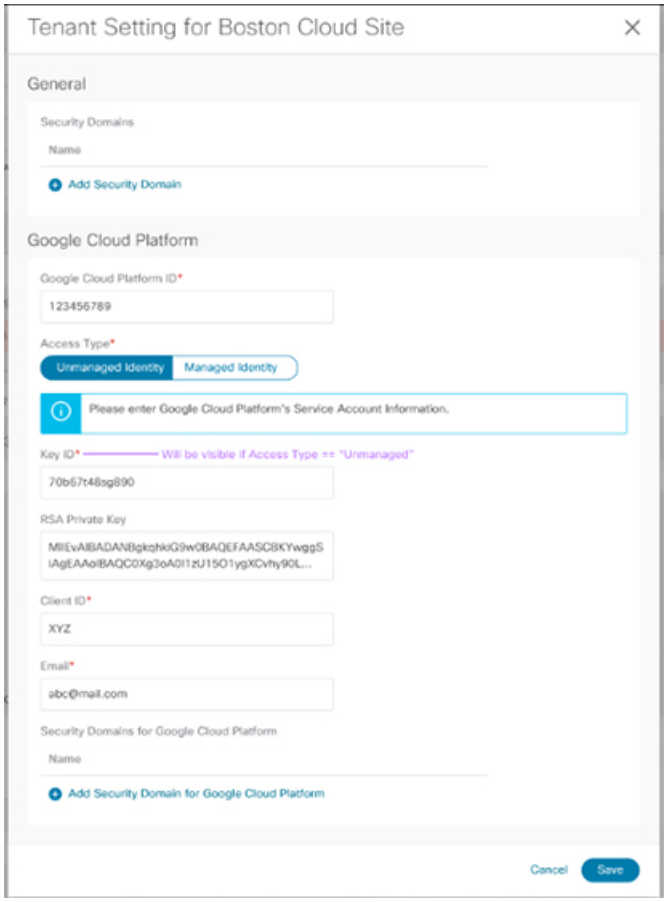


- **Google Cloud Platform ID**: Provide the ID of the Google Cloud user account you have created for this tenant.
- **Access type**: You will have two options under Access type:
  - Choose **Managed Identity** if you want to allow the Cloud APIC VM to manage the cloud resources.

    For either a managed or an unmanaged tenant, you must first set up a project in Google Cloud. See Setting Up the Google Cloud Project for a User Tenant for those instructions.
  - Choose **Unmanaged Identity** if you want to manage the cloud resources via a specific application. In this case you must also provide the application's credentials to the Cloud APIC.
    - For either a managed or an unmanaged tenant, you must first set up a project in Google Cloud. See Setting Up the Google Cloud Project for a User Tenant for those instructions.
    - For an unmanaged tenant, you must then generate the necessary private key information and download the JSON file from Google Cloud. See Generating and Downloading Private Key Information from Google Cloud for an Unmanaged Tenant.

    The **Key Id** and **Client Id** fields appear if you choose **Unmanaged Identity** as the access type.

- **Key Id**: Enter the information from the `private_key_id` field in the JSON file that you downloaded in Generating and Downloading Private Key Information from Google Cloud for an Unmanaged Tenant.
- **Client Id**: Enter the information from the `client_id` field in the JSON file that you downloaded in Generating and Downloading Private Key Information from Google Cloud for an Unmanaged Tenant.
- **Email**: Enter the email address associated with your Google Cloud project.



Step 8 Choose **Save** after filling in the configuration for the Google Cloud.

What to do next

If you are creating a managed tenant, you must now set the necessary permissions in Google Cloud for the managed tenant. Go to Setting the Necessary Permissions in Google Cloud for a Managed Tenant for those procedures.

Setting the Necessary Permissions in Google Cloud for a Managed Tenant

If you are creating a managed tenant, you must now set the necessary permissions in Google Cloud.

Note You do not have to follow the steps in this procedure if you are creating an unmanaged tenant.

Step 1 In the Google Cloud GUI, log into the Google Cloud project that is associated with this managed tenant.

The **Dashboard** for the project is displayed.

Step 2 In the left nav bar, click on **IAM & Admin**, then choose **IAM**.

The **IAM** window appears with several service accounts displayed.

Step 3 Locate the service account that was created in the project that is associated with the infra account.

Step 4 Copy the service account name.

Step 5 Add this service account name as an IAM user in the user tenant project.

Step 6 Set the permissions for this service account.

a) Click the pencil icon on the row for this service account.

The **Edit Permissions** window is displayed.

b) Click **+ ADD ANOTHER ROLE**, then choose **Cloud Functions Service Agent** as the role.

You are returned to the **IAM** window with the service accounts displayed.

c) Click **+ ADD ANOTHER ROLE** again, then add the remaining necessary roles for this service account.

Following is the full list of roles that you must assign to this service account, including the Cloud Functions Service Agent that you added in the first step of this process:

- Cloud Functions Service Agent
- Compute Instance Admin (v1)
- Compute Network Admin
- Compute Security Admin
- Logging Admin
- Pub/Sub Admin
- Storage Admin

d) After you have added all the necessary roles, click **SAVE**.

You are returned to the **IAM** window with the service accounts displayed and the necessary roles assigned to this service account.

Creating Schema, Template and VRFs for your Google Cloud Site

Step 1 In the Main menu, click **Schemas**.

Step 2 On the Schema screen, click the **Add Schema** button.

Step 3 On the Untitled Schema screen, replace the text `Untitled Schema` at the top of the page with a name for the schema that you intend to create (for example, `schema-1`).

Step 4 Configure the first template.

If your Google cloud site has BGP-EVPN intersite connectivity, choose **ACI Multi-Cloud** template type; if the site has BGP-IPv4 connectivity, choose **Cloud Local**.

Step 5 In the left pane, mouse over **Template 1** and click the notepad icon. Then change the template's name (for example, `template1-gcp`).

Step 6 Navigate to your cloud template.

Step 7 Choose **Add VRF** under VRFs, then enter the display name and description for the VRF.

Step 8 Click on the VRF that you just created.

The Template Properties and Site Local Properties are displayed on the right side of your screen.

Step 9 Under Site Level Properties, choose **Add Region**.

In the pop-up, select the region that you want.

Step 10 After selecting the region, choose **Add CIDR**.

Enter the CIDR information for the VRF.

- Choose **Primary** if you are adding a primary CIDR.
- Choose **Secondary** if you are adding a secondary CIDR.

Step 11 Enter the Subnet and Subnet Group Label.

When creating a subnet, you will use the **Subnet Group Label** to assign a unique label to a specific subnet group. For more details on configuring CIDR, subnets, and subnet group labels, see "Understanding VPCs and Subnets Under Google Cloud and Cloud Context Profiles Under Cloud APIC" in the Cisco Cloud APIC for Google Cloud User Guide.

Step 12 Choose **Save**.

Creating Cloud EPGs

We recommend creating cloud objects in a separate template and schema from the Infra tenant configuration (such as external VRFs) you have already done.

Use the following procedure to create a new schema for the Cloud APIC site. For this use-case example, we will configure a single schema and one template.

You are in the Nexus Dashboard Orchestrator for this entire procedure.

Step 1 In the Main menu, click **Schemas**.

Step 2 On the Schema screen, click the **Add Schema** button.

Step 3 On the Untitled Schema screen, replace the text `Untitled Schema` at the top of the page with a name for the schema that you intend to create (for example, `schema-1`).

Step 4 Create a template.

If your Google cloud site has BGP-EVPN intersite connectivity, choose **ACI Multi-Cloud** template type; if the site has BGP-IPv4 connectivity, choose **Cloud Local**.

a) In the left pane, mouse over **Template 1** and click the notepad icon. Then change the template's name, for example in Google Cloud case `template1-gcp`.
b) In the middle pane, click the area **To build your schema please click here to select a tenant**.
c) In the right pane, access the **Select A Tenant** dialog box and choose the tenant you want. This is the tenant you imported Importing Google Cloud User Tenant or created in Creating Google Cloud User Tenant.

Step 5 After choosing the tenant, create an **Application Profile** in the template.

You will need to associate the cloud EPG you create with an application profile.

Step 6 Create and configure a **Cloud EPG**.

a) Select **Create Object** > **Cloud EPGs**.
b) From the **Application Profile** dropdown, select the profile you created in the previous step.
c) From the **Virtual Routing and Forwarding** dropdown, select the cloud VRF you created.
d) In the right-hand properties sidebar, select the cloud VRF you created for this EPG.

Step 7 Assign the template you just created to the Google Cloud site.

Step 8 Configure the cloud EPG's site-local properties.

a) In the left sidebar, select the template under a site to which it is assigned.
b) In the template's site-local properties, select `Cloud Site` for **Route Reachability**.

Applying contract between the cloud EPGs

This section describes how to apply a contract to allow communication between the endpoints with in your cloud site. One thing to keep in mind regarding Google Cloud contracts is that the contracts should be deployed bi-directionally for bi-directional traffic.

Before you begin

You must have multiple cloud EPGs Creating Cloud EPGs already configured in your cloud site.

Step 1 In the **Main menu**, select **Application Management** > **Schemas**.

Step 2 Create a contract and assign it to the cloud EPG.

a) Select the schema and the template that contains your existing cloud EPG.
b) Create the contract you will use for this use case.

If you already have an existing contract you want to apply for communication between the Cloud EPGs, you can skip this step.

Otherwise, create a contract and the required filters as you typically would for any inter-EPG communication in Cisco ACI fabrics.

c) Assign the contract to the cloud EPG.

You can decide which of the two EPGs will be the `provider` and which will be the `consumer` based on your specific use case.

Step 3 Select the other EPG.

a) From the right property side bar , choose **Add contract**.
b) In the contract window, select which contract you want to assign.
c) Select the same contract you assigned in previous step.
d) Click **Save**

Step 4 Deploy the templates.

Configuring Route Leaking between Two Cloud VRFs

This use case focuses on route leaking between two internal cloud VRFs. You must have multiple cloud VRFs already configured in your cloud site. If you want to configure route leaking between a cloud VRF an external VRF (for example, to enable external connectivity for your Google Cloud site to another site), see Configuring Route Leaking Between Cloud VRF and External VRF

.

Step 1 In the **Main menu**, select **Application Management** > **Schemas**.

Step 2 Configure route leaking from Cloud VRF-1 to a cloud VRF-2.

The following steps show how to configure the following route leaking:

a) Open the schema where you created the Infra tenant template containing the first cloud VRF.
b) In the left sidebar under **SITES**, select that specific template associated to the cloud site.
c) In the site-local properties, select the cloud VRF defined in the template.
d) In the VRF's right-hand properties sidebar, click **+Add Leak Route**.

The **Add Leak Routes** dialog will open.

e) In the **Add Leak Routes** dialog's settings area, click **Select a VRF** and choose a cloud VRF.
f) In the **Add Leak Routes** dialog, choose **Leak All** routes.

After selecting **Leak All**, the subnet IP will be populated with `0.0.0.0/0` to leak all routes.

g) Click **Save** to save the route leak configuration.
h) Select the template and click **Deploy** to deploy the configuration.

Step 3 Configure route leaking from a cloud VRF-2 to the cloud VRF-1.

a) Open the schema which contains the template that defines your cloud VRF.
b) In the left sidebar under **SITES**, select the specific cloud site.

c) In the site-local properties, select the cloud VRF.
d) In the VRF's right-hand properties sidebar, click **+Add Leak Route**.

   The **Add Leak Routes** dialog will open.

e) In the **Add Leak Routes** dialog's settings area, click **Select a VRF** and choose the internal VRF.

   The goal of this step is to leak routes between the cloud VRFs

f) In the **Add Leak Routes** dialog, choose **Leak All** routes.
g) Click **Save** to save the route leak configuration.
h) Select the template and click **Deploy** to deploy the configuration.