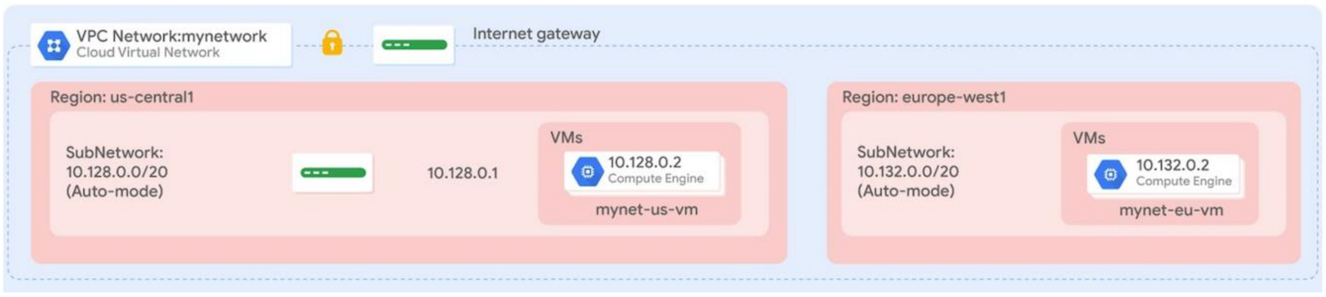
Automating the Deployment of Infrastructure Using Deployment Manager

Deployment Manager is an infrastructure deployment service that automates the creation and management of Google Cloud Platform resources. Write flexible template and configuration files and use them to create deployments that have a variety of Cloud Platform services, such as Cloud Storage, Compute Engine, and Cloud SQL, configured to work together.

In this lab, you create a Deployment Manager configuration with a template to automate the deployment of GCP infrastructure. Specifically, you deploy one auto mode network with a firewall rule and two VM instances, as shown in this diagram:



Objectives

In this lab, you learn how to perform the following tasks:

- Create a configuration for an auto mode network
- Create a configuration for a firewall rule
- Create a template for VM instances
- Create and deploy a configuration
- Verify the deployment of a configuration

Before you click the Start Lab button

Read these instructions. Labs are timed and you cannot pause them. The timer, which starts when you click Start Lab, shows how long Cloud resources will be made available to you.

This Qwiklabs hands-on lab lets you do the lab activities yourself in a real cloud environment, not in a simulation or demo environment. It does so by giving you new, temporary credentials that you use to sign in and access the Google Cloud Platform for the duration of the lab.

What you need

To complete this lab, you need:

- Access to a standard internet browser (Chrome browser recommended).
- Time to complete the lab.
  Note: If you already have your own personal GCP account or project, do not use it for this lab.

Task 1. Configure the network

A configuration describes all the resources you want for a single deployment.

Verify that the Deployment Manager API is enabled

1. In the GCP Console, on the **Navigation menu** (☰), click **APIs & services** > **Library**.
2. In the search bar, type **Deployment Manager**, and click the result for **Google Cloud Deployment Manager V2 API**.
3. Verify that the API is enabled.

Start the Cloud Shell Editor

To write the configuration and the template, you use the Cloud Shell Editor.

1. In the GCP Console, click **Activate Cloud Shell** ().
2. If prompted, click **Continue**.
3. Run the following commands:

```
mkdir dminfra
cd dminfra
```

4. In Cloud Shell, click **Launch code editor** ().
5. In the left pane of the code editor, expand the **dminfra** folder.

Create the auto mode network configuration

A configuration is a file written in YAML syntax that lists each of the resources you want to create and their respective resource properties. A configuration must contain a `resources:` section followed by the list of resources to create. Start the configuration with the **mynetwork** resource.

1. To create a new file, click **File** > **New File**.
2. Name the new file **config.yaml**, and then open it.
3. Copy the following base code into config.yaml:

```
resources:
# Create the auto-mode network
- name: [RESOURCE_NAME]
  type: [RESOURCE_TYPE]
  properties:
    #RESOURCE properties go here
```

Indentation is important in YAML.
True

False

This base configuration is a great starting point for any GCP resource. The **name** field allows you to name the resource, and the **type** field allows you to specify the GCP resource that you want to create. You can also define properties, but these are optional for some resources.

4. In config.yaml, replace `[RESOURCE_NAME]` with `mynetwork`
5. To get a list of all available network resource types in GCP, run the following command in **Cloud Shell**:

```
gcloud deployment-manager types list | grep network
```

The output should look like this (**do not copy; this is example output**):

```
compute.beta.subnetwork
compute.alpha.subnetwork
compute.v1.subnetwork
compute.beta.network
compute.v1.network
compute.alpha.network
```

For a normal Deployment Manager configuration, which subnetwork resource type would you use?
☐ ume these three options are available)
☐ pute.beta.subnetwork
☐ pute.alpha.subnetwork

compute.v1.subnetwork

Submit

Alternatively, you can find the full list of available resource types here.

6. Locate `compute.v1.network`, which is the type needed to create a VPC network using Deployment Manager.
7. In config.yaml, replace `[RESOURCE_TYPE]` with `compute.v1.network`
8. Add the following property to config.yaml:

```
autoCreateSubnetworks: true
```

By definition, an auto mode network automatically creates a subnetwork in each region. Therefore, you are setting **autoCreateSubnetworks** to **true**.

9. Verify that config.yaml looks like this, including the spacing/indentation:

```
resources:
# Create the auto-mode network
- name: mynetwork
  type: compute.v1.network
  properties:
    autoCreateSubnetworks: true
```

10. To save config.yaml, click **File** > **Save**.

Task 2. Configure the firewall rule

In order to allow ingress traffic instances in **mynetwork**, you need to create a firewall rule.

Add the firewall rule to the configuration

Add a firewall rule that allows HTTP, SSH, RDP, and ICMP traffic on **mynetwork**.

1. Copy the following base code into config.yaml (below the **mynetwork** resource):

```
# Create the firewall rule
- name: mynetwork-allow-http-ssh-rdp-icmp
  type: [RESOURCE_TYPE]
  properties:
    #RESOURCE properties go here
```

2. To get a list of all available firewall rule resource types in GCP, run the following command in **Cloud Shell**:

```
gcloud deployment-manager types list | grep firewall
```

The output should look like this (**do not copy; this is example output**):

```
compute.v1.firewall
compute.alpha.firewall
compute.beta.firewall
```

3. Locate `compute.v1.firewall`, which is the type needed to create a firewall rule using Deployment Manager.
4. In config.yaml, replace `[RESOURCE_TYPE]` with `compute.v1.firewall`
5. In config.yaml, add the following properties for the firewall rule:

```
  network: $(ref.mynetwork.selfLink)
  sourceRanges: ["0.0.0.0/0"]
  allowed:
  - IPProtocol: TCP
    ports: [22, 80, 3389]
  - IPProtocol: ICMP
```

These properties define:

- **network:** Network that the firewall rule applies to
- **sourceRange:** Source IP ranges that traffic is allowed from
- **IPProtocol:** Specific protocol that the rule applies to
- **ports:** Specific ports of that protocol

Because firewall rules depend on their network, you are using the **$(ref.mynetwork.selfLink)** reference to instruct Deployment Manager to resolve these resources in a dependent order. Specifically, the network is created before the firewall rule. By default, Deployment Manager creates all resources in parallel, so there is no guarantee that dependent resources are created in the correct order unless you use references.

6. Verify that config.yaml looks like this, including the spacing/indentation:

```
resources:
# Create the auto-mode network
- name: mynetwork
  type: compute.v1.network
  properties:
    autoCreateSubnetworks: true

# Create the firewall rule
- name: mynetwork-allow-http-ssh-rdp-icmp
  type: compute.v1.firewall
  properties:
    network: $(ref.mynetwork.selfLink)
    sourceRanges: ["0.0.0.0/0"]
    allowed:
    - IPProtocol: TCP
      ports: [22, 80, 3389]
    - IPProtocol: ICMP
```

7. To save config.yaml, click **File** > **Save**.

Task 3. Create a template for VM instances

Deployment Manager allows you to use Python or Jinja2 templates to parameterize your configuration. This allows you to reuse common deployment paradigms such as networks, firewall rules, and VM instances.

Create the VM instance template

Because you will be creating two similar VM instances, create a VM instance template.

1. To create a new file, click **File** > **New File**.
2. Name the new file **instance-template.jinja**, and then open it.
3. Copy the following base code into instance-template.jinja:

```
resources:
- name: [RESOURCE_NAME]
  type: [RESOURCE_TYPE]
  properties:
    #RESOURCE properties go here
```

4. In instance-template.jinja, replace `[RESOURCE_NAME]` with `{{ env["name"] }}`. Make sure to include the double brackets `{{}}`.
   This is an environment variable that will be provided by the configuration so that you can reuse the template for multiple instances.

5. To get a list of all available instance resource types in GCP, run the following command in **Cloud Shell**:

```
gcloud deployment-manager types list | grep instance
```

The output should look like this (**do not copy; this is example output**):

```
...
compute.v1.instance
compute.alpha.instance
```

6. Locate `compute.v1.instance`, which is the type needed to create a VM instance using Deployment Manager.
7. In instance-template.jinja, replace `[RESOURCE_TYPE]` with `compute.v1.instance`

Specify the VM instance properties

To create a VM instance in the correct zone and network, you need to define these as properties.

1. In instance-template.jinja, add the following properties for the VM instance:

```
     machineType:      zones/{{      properties["zone"]      }}/machineTypes/{{
properties["machineType"] }}
     zone: {{ properties["zone"] }}
     networkInterfaces:
      - network: {{ properties["network"] }}
        subnetwork: {{ properties["subnetwork"] }}
        accessConfigs:
        - name: External NAT
          type: ONE_TO_ONE_NAT
     disks:
      - deviceName: {{ env["name"] }}
        type: PERSISTENT
        boot: true
        autoDelete: true
        initializeParams:
          sourceImage:  https://www.googleapis.com/compute/v1/projects/debian-
cloud/global/images/family/debian-9
```

These properties define:

- **machineType:** Machine type and zone
- **zone:** Instance zone
- **networkInterfaces:** Network and subnetwork that VM is attached to
- **accessConfigs:** Required to give the instance a public IP address
- **disks:** The boot disk, its name and image

Most properties are defined as template properties, which you will provide values for from the top-level configuration (config.yaml).

2. Verify that instance-template.jinja looks like this, including the spacing/indentation:

```
resources:
- name: {{ env["name"] }}
  type: compute.v1.instance
  properties:
     machineType:      zones/{{      properties["zone"]      }}/machineTypes/{{
properties["machineType"] }}
     zone: {{ properties["zone"] }}
     networkInterfaces:
      - network: {{ properties["network"] }}
        subnetwork: {{ properties["subnetwork"] }}
        accessConfigs:
        - name: External NAT
          type: ONE_TO_ONE_NAT
     disks:
      - deviceName: {{ env["name"] }}
        type: PERSISTENT
        boot: true
        autoDelete: true
        initializeParams:
          sourceImage:  https://www.googleapis.com/compute/v1/projects/debian-
cloud/global/images/family/debian-9
```

3. To save instance-template.jinja, click **File** > **Save**.

Task 4. Deploy the configuration

Configure the instances and deploy the configuration.

Import the template

Templates are included in the `*.yaml` configuration using `import:`.

1. Copy the following into config.yaml (before `resources`):

```
imports:
- path: instance-template.jinja
```

The **import** statement defines the template that you want to use in your configuration. You can import multiple templates in one configuration. For example, you could create templates for the firewall rule and networks if you want to reuse those.

Configure VM instances in each network

Create the **mynet-us-vm** and **mynet-eu-vm** instances.

1. Add the mynet-us-vm instance to config.yaml (within the `resources` block):

```
# Create the mynet-us-vm instance
- name: mynet-us-vm
  type: instance-template.jinja
  properties:
    zone: us-central1-a
    machineType: n1-standard-1
    network: $(ref.mynetwork.selfLink)
    subnetwork: regions/us-central1/subnetworks/mynetwork
```

2. Add the mynet-eu-vm instance to config.yaml (within the `resources` block):

```
# Create the mynet-eu-vm instance
- name: mynet-eu-vm
  type: instance-template.jinja
  properties:
    zone: europe-west1-d
    machineType: n1-standard-1
    network: $(ref.mynetwork.selfLink)
    subnetwork: regions/europe-west1/subnetworks/mynetwork
```

The **zone**, **machineType**, and **subnetwork** are passed from this configuration to the template. This allows you to create only one template for multiple VM instances. Also, references to the network are used for the VM instances. This ensures that the network is created before the VM that is attached to that network.

3. To save config.yaml, click **File** > **Save**.

If you want to use a different operating system or different operating system version, which property
☐ e instance resource should you change?

☐ hineType

☐ rceImage

☐ ceName

type

Submit

Deploy the configuration

It's time to deploy your configuration from Cloud Shell.

1. In Cloud Shell, run the following command:

```
gcloud deployment-manager deployments create dminfra --config=config.yaml --
preview
```

The output should look like this (**do not copy; this is example output**):

```
NAME                                TYPE                   STATE
mynet-eu-vm                         compute.v1.instance    IN_PREVIEW
mynet-us-vm                         compute.v1.instance    IN_PREVIEW
mynetwork                           compute.v1.network     IN_PREVIEW
mynetwork-allow-http-ssh-rdp-icmp   compute.v1.firewall    IN_PREVIEW
```

The **--preview** flag gives you a preview of how your configuration is applied before creating it. Previewing a configuration causes Deployment Manager to start creating your deployment but then stop before actually creating any resources. The **--preview** flag is especially useful when you update a deployment.

2. Run the following command to create the deployment:

```
gcloud deployment-manager deployments update dminfra
```

The **update** command commits the preview. If you don't preview a configuration, you can directly run the following command:
gcloud deployment-manager deployments create dminfra --config=config.yaml

3. Wait for the resources to be created and listed in Cloud Shell.

   The output should look like this (**do not copy; this is example output**):

```
NAME                                TYPE                   STATE       ERRORS
INTENT
mynet-eu-vm                         compute.v1.instance    COMPLETED   []
mynet-us-vm                         compute.v1.instance    COMPLETED   []
mynetwork                           compute.v1.network     COMPLETED   []
mynetwork-allow-http-ssh-rdp-icmp   compute.v1.firewall    COMPLETED   []
```

If something goes wrong with the preview or creation of the deployment, try to use the error messages to troubleshoot the source of the issue. You must delete the Deployment Manager configuration before you can try deploying it again. This can be achieved with this command in Cloud Shell:

gcloud deployment-manager deployments delete dminfra

If you cannot troubleshoot the issue of your deployment, take a look at this finished configuration (config.yaml) and template (instance-template.jinja).

When Deployment Manager creates the resources, they are always created sequentually, one at a time.

True

False

Click Check my progress to verify the objective.

Create network, firewall rules and VM instances

Check my progress

Task 5. Verify your deployment

Verify your network in the GCP Console

1. In the GCP Console, on the **Navigation menu** (≡), click **VPC network** > **VPC networks**.
2. View the **mynetwork** VPC network with a subnetwork in every region.
3. On the **Navigation menu**, click **VPC network** > **Firewall Rules**.
4. Sort the firewall rules by **Network**.
5. View the **mynetwork-allow-http-ssh-rdp-icmp** firewall rule for **mynetwork**.

Verify your VM instances in the GCP Console

1. On the **Navigation menu** (≡), click **Compute Engine** > **VM instances**.
2. View the **mynet-us-vm** and **mynet-eu-vm** instances.
3. Note the internal IP address for **mynet-eu-vm**.
4. For **mynet-us-vm**, click **SSH** to launch a terminal and connect.
5. To test connectivity to **mynet-eu-vm**'s internal IP address, run the following command in the SSH terminal (replacing mynet-eu-vm's internal IP address with the value noted earlier):

```
ping -c 3 <Enter mynet-eu-vm's internal IP here>
```

This should work because both VM instances are on the same network and the firewall rule allows ICMP traffic!

Task 6. Review

In this lab, you created a Deployment Manager configuration and template to automate the deployment of GCP infrastructure. Templates can be very flexible because of their environment and template variables. Therefore, the benefit of creating templates is that they can be reused across many configurations.

Template variables are abstract properties that allow you to declare the value to be passed to the template in the `*.yaml` configuration file. You can change the value for each deployment in the `*.yaml` file without having to make changes to the underlying templates.
Environment variables allow you to reuse templates in different projects and deployments. Instead of representing properties of resources, they represent more global properties such as a Project ID or the name of the deployment. You can use the template that you created as a starting point for future deployments.