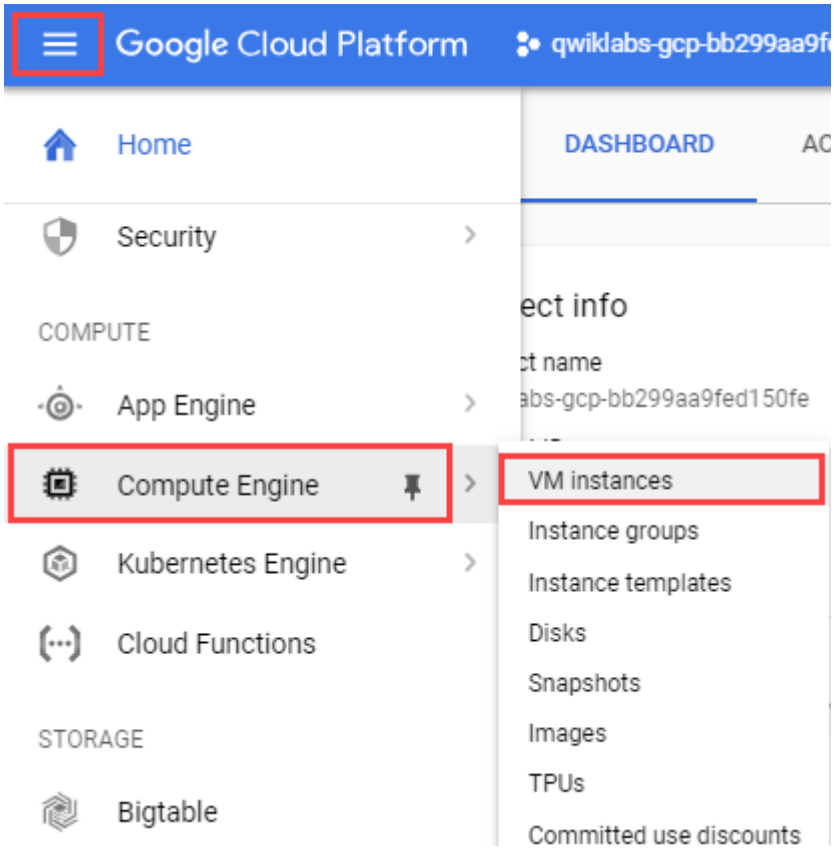
Create the web servers

Create two web servers (**blue** and **green**) in the **default** VPC network. Then, install **nginx** on the webservers and modify the welcome page to distinguish the servers.

Create the blue server

Create the **blue** server with a network tag.

1.In the Console, navigate to **Navigation menu** (☰) > **Compute Engine** > **VM instances**.



2.Click **Create Instance**.

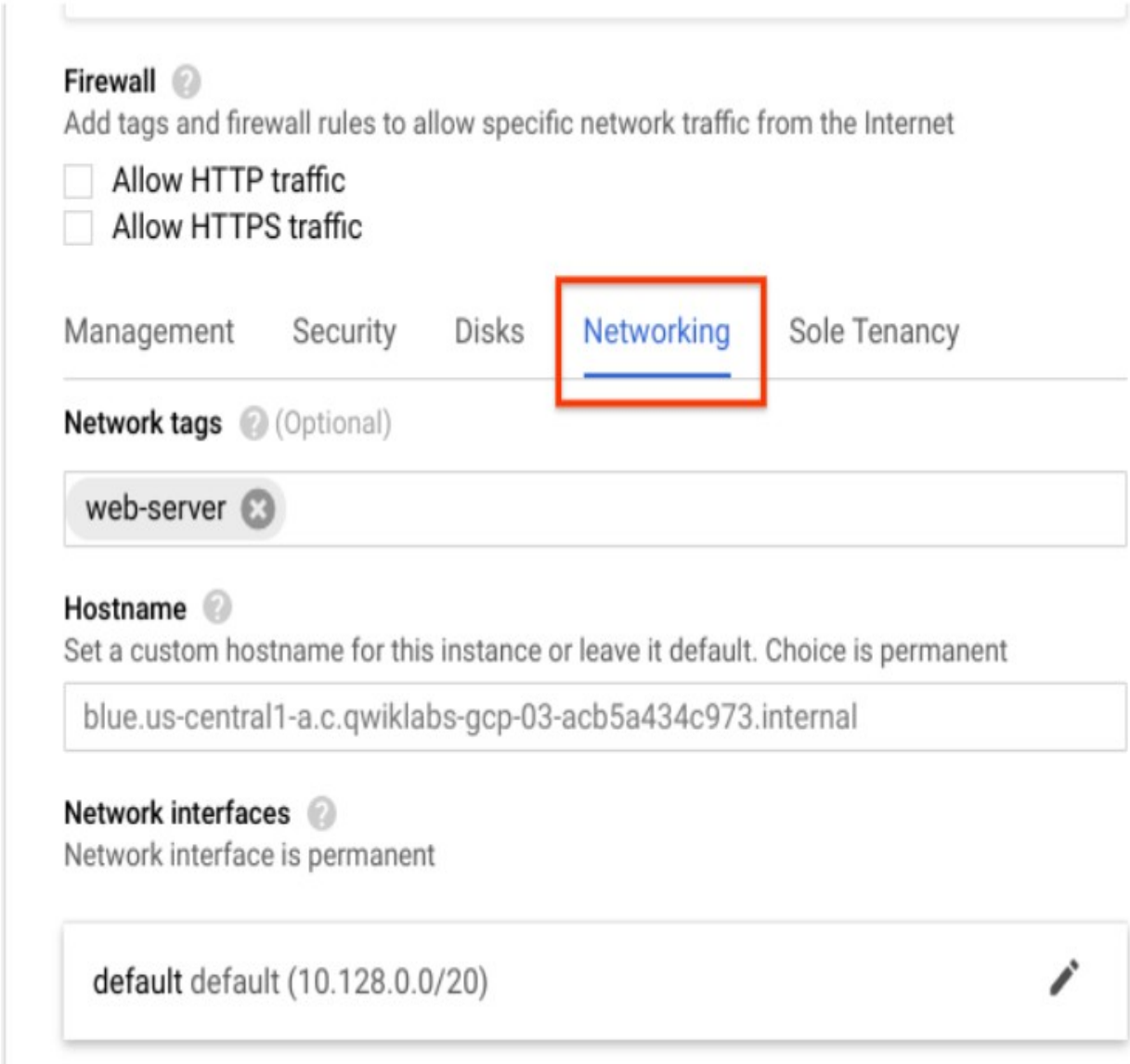
3.Set the following values, leave all other values at their defaults:

Property	Value (type value or select option as specified)
Name	blue
Region	us-central1 (Iowa)
Zone	us-central1-a

For more information on available regions and zones, refer here.

4.Click **Management, disks, networking, sole tenancy**.

5.Click **Networking**.



6.For **Network tags**, type **web-server**.

Note: Networks use network tags to identify which VM instances are subject to certain firewall rules and network routes. Later in this lab, you create a firewall rule to allow HTTP access for VM instances with the **web-server** tag. Alternatively, you could check the **Allow HTTP traffic** checkbox, which would tag this instance as **http-server** and create the tagged firewall rule for tcp:80 for you.

7.Click **Create**.

Test Completed Task

Click **Check my progress** to verify your performed task. If you have completed the task successfully you will granted with an assessment score.

Create the green server

Create the **green** server without a network tag.

1.Still in the Console, in the **VM instances** dialog, click **Create instance**.

2.Set the following values, leave all other values at their defaults:

Property	Value (type value or select option as specified)
Name	green
Region	us-central1 (Iowa)
Zone	us-central1-a

3.Click **Create**.

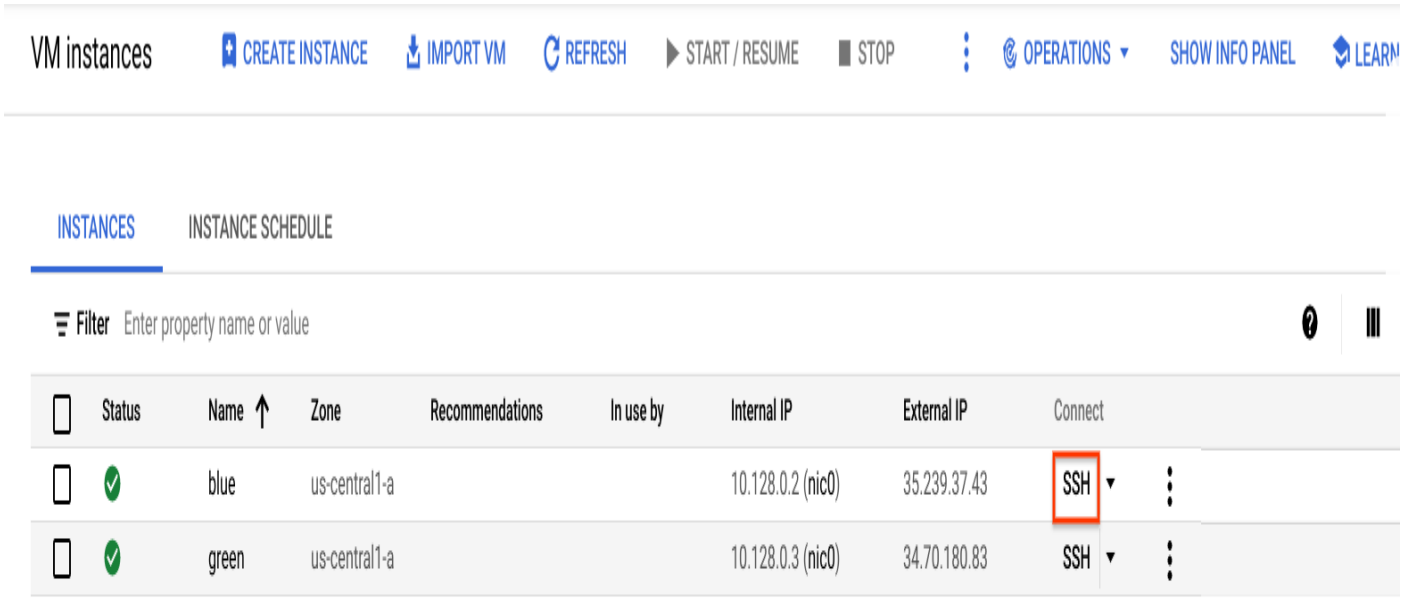
Test Completed Task

Click **Check my progress** to verify your performed task. If you have completed the task successfully you will granted with an assessment score.

Install nginx and customize the welcome page

Install nginx on both VM instances and modify the welcome page to distinguish the servers.

1.Still in the **VM instances** dialog, for **blue**, click **SSH** to launch a terminal and connect.



2.In the SSH terminal to blue, run the following command to install nginx:

```
sudo apt-get install nginx-light -y
```

content_copy

3.Open the welcome page in the nano editor:

```
sudo nano /var/www/html/index.nginx-debian.html
```

```
content_copy
```

4.Replace the <h1>Welcome to nginx!</h1> line with <h1>Welcome to the blue server!</h1>.

5.Press **CTRL+o**, **ENTER**, **CTRL+x**.

6.Verify the change:

```
cat /var/www/html/index.nginx-debian.html
content_copy
```

The output should contain the following (**do not copy; this is example output**):

```
...
<h1>Welcome to the blue server!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>
...
content_copy
```

7.Close the SSH terminal to **blue**:

```
exit
content_copy
```

Repeat the same steps for the **green** server:

8.For **green**, click **SSH** to launch a terminal and connect.

9.Install nginx:

```
sudo apt-get install nginx-light -y
content_copy
```

10.Open the welcome page in the nano editor:

```
sudo nano /var/www/html/index.nginx-debian.html
content_copy
```

11.Replace the <h1>Welcome to nginx!</h1> line with <h1>Welcome to the green server!</h1>.

12.Press **CTRL+o**, **ENTER**, **CTRL+x**.

13.Verify the change:

```
cat /var/www/html/index.nginx-debian.html
content_copy
```

The output should contain the following (**do not copy; this is example output**):

```
...
<h1>Welcome to the green server!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>
...
content_copy
```

14. Close the SSH terminal to **green**:

```
exit
content_copy
```

Test Completed Task

Click **Check my progress** to verify your performed task. If you have completed the task successfully you will granted with an assessment score.

Create the firewall rule

Create the tagged firewall rule and test HTTP connectivity.

Create the tagged firewall rule

Create a firewall rule that applies to VM instances with the **web-server** network tag.

1.In the Console, navigate to **Navigation menu** (☰) > **VPC network** > **Firewall**.

2.Notice the **default-allow-internal** firewall rule.

The **default-allow-internal** firewall rule allows traffic on all protocols/ports within the **default** network. You want to create a firewall rule to allow traffic from outside this network to only the **blue** server, by using the network tag **web-server**.

3.Click **Create Firewall Rule**.

4.Set the following values, leave all other values at their defaults and click **Create**:

Property	Value (type value or select option as specified)
Name	allow-http-web-server
Network	default
Targets	Specified target tags
Target tags	web-server
Source filter	IP Ranges
Source IP ranges	0.0.0.0/0
Protocols and ports	Specified protocols and ports, and then *check* tcp, *type:* 80; and *check* Other protocols, *type:* icmp.

Make sure to include the **/0** in the **Source IP ranges** to specify all networks.

5.Click **Create**.

Test Completed Task

Click **Check my progress** to verify your performed task. If you have completed the task successfully you will granted with an assessment score.

Create a test-vm

Create a **test-vm** instance using the Cloud Shell command line.

Create a **test-vm** instance, in the us-central1-a zone:

```
gcloud compute instances create test-vm --machine-type=f1-micro --subnet=default --zone=us-central1-a
content_copy
```

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

```
NAME     ZONE         MACHINE_TYPE  PREEMPTIBLE  INTERNAL_IP  EXTERNAL_IP    STATUS
test-vm  us-central1-a  f1-micro                 10.142.0.4   35.237.134.68  RUNNING
content_copy
```

You can easily create VM instances from the Console or the gcloud command line.

Test Completed Task

Click **Check my progress** to verify your performed task. If you have completed the task successfully you will granted with an assessment score.

Test HTTP connectivity

From **test-vm** curl the internal and external IP addresses of **blue** and **green**.

1.In the Console, navigate to **Navigation menu** (☰) > **Compute Engine** > **VM instances**.

2.Note the internal and external IP addresses of **blue** and **green**.

3.For **test-vm**, click **SSH** to launch a terminal and connect.

4.To test HTTP connectivity to **blue**'s internal IP, run the following command, replacing **blue**'s internal IP:

```
curl <Enter blue's internal IP here>
content_copy
```

You should see the Welcome to the blue server! header.

5.To test HTTP connectivity to **green**'s internal IP, run the following command, replacing **green**'s internal IP:

```
curl -c 3 <Enter green's internal IP here>
```
content_copy

You should see the Welcome to the green server! header.

default-allow-internal firewall rule, as **test-vm** is on the same VPC network as the web servers **default** network).

6.To test HTTP connectivity to **blue**'s external IP, run the following command, replacing **blue**'s external IP:

```
curl <Enter blue's external IP here>
```
content_copy

You should see the Welcome to the blue server! header.

7.To test HTTP connectivity to **green**'s external IP, run the following command, replacing **green**'s external IP:

```
curl -c 3 <Enter green's external IP here>
```
content_copy

This should not work! The request hangs.

8.Press **CTRL+c** to stop the HTTP request.

As expected, you are only able to HTTP access the external IP address of the **blue** server as the **allow-http-web-server** only applies to VM instances with the **web-server** tag.

You can verify the same behavior from your browser by opening a new tab and navigating to http://[External IP of server].

Explore the Network and Security Admin roles

Cloud IAM lets you authorize who can take action on specific resources, giving you full control and visibility to manage cloud resources centrally. The following

roles are used in conjunction with single-project networking to independently control administrative access to each VPC Network:

•**Network Admin**: Permissions to create, modify, and delete networking resources, except for firewall rules and SSL certificates.
•**Security Admin**: Permissions to create, modify, and delete firewall rules and SSL certificates.
Explore these roles by applying them to a service account, which is a special Google account that belongs to your VM instance, instead of to an individual end user. Rather than creating a new user, you will authorize **test-vm** to use the service account to demonstrate the permissions of the **Network Admin** and **Security Admin** roles.

Verify current permissions

Currently, **test-vm** uses the Compute Engine default service account, which is enabled on all instances created by Cloud Shell command-line and the Cloud Console.

Try to list or delete the available firewall rules from **test-vm**.

1.Return to the **SSH** terminal of the **test-vm** instance.

2.Try to list the available firewall rules:

```
gcloud compute firewall-rules list
```
content_copy

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

```
ERROR: (gcloud.compute.firewall-rules.list) Some requests did not succeed:
 - Insufficient Permission
```
content_copy

This should not work!

3.Try to delete the **allow-http-web-server** firewall rule:

```
gcloud compute firewall-rules delete allow-http-web-server
content_copy
```

4.Enter **Y**, if asked to continue.

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

```
ERROR: (gcloud.compute.firewall-rules.delete) Could not fetch resource:
 - Insufficient Permission
content_copy
```

This should not work!

The **Compute Engine default service account** does not have the right permissions to allow you to list or delete firewall rules. The same applies to other users who do not have the right roles.

Create a service account

Create a service account and apply the **Network Admin** role.

1.In the Console, navigate to **Navigation menu** () > **IAM & admin** > **Service Accounts**.

2.Notice the **Compute Engine default service account**.

3.Click **Create service account**.

4.Set the **Service account** name to **Network-admin** and click **CREATE AND CONTINUE**.

5.For **Select a role**, select **Compute Engine** > **Compute Network Admin** and click **CONTINUE** then click **DONE**.

6.After creating service account 'Network-admin', click on three dots at the right corner and click **Manage Key** in the dropdown, then click on **Add Key** and

select **Create new key** from the dropdown. Click **Create** to download your JSON output.

7.Click **Close**.

A JSON key file download to your local computer. Find this key file, you will upload it in to the VM in a later step.

8.Rename the JSON key file on your local machine to **credentials.json**

Test Completed Task
Click **Check my progress** to verify your performed task. If you have completed the task successfully you will granted with an assessment score.

Authorize test-vm and verify permissions

Authorize **test-vm** to use the **Network-admin** service account.

1.Return to the **SSH** terminal of the **test-vm** instance.

2.To upload **credentials.json** through the SSH VM terminal, click on the gear icon in the upper-right corner, and then click **Upload file**.

3.Select **credentials.json** and upload it.

4.Click **Close** in the File Transfer window.

5.Authorize the VM with the credentials you just uploaded:

```
gcloud auth activate-service-account --key-file credentials.json
```
content_copy

The image you are using has the Cloud SDK pre-installed; therefore, you don't need to initialize the Cloud SDK. If you are attempting this lab in a different environment, make sure you have followed the procedures regarding installing the Cloud SDK.

6.Try to list the available firewall rules:

```
gcloud compute firewall-rules list
content_copy
```

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

```
NAME                    NETWORK  DIRECTION  PRIORITY  ALLOW     DENY
allow-http-web-server   default  INGRESS    1000      tcp:80
default-allow-icmp      default  INGRESS    65534     icmp
default-allow-internal  default  INGRESS    65534     all
default-allow-rdp       default  INGRESS    65534     tcp:3389
default-allow-ssh       default  INGRESS    65534     tcp:22
content_copy
```

This should work!

7.Try to delete the **allow-http-web-server** firewall rule:

```
gcloud compute firewall-rules delete allow-http-web-server
content_copy
```

8.Enter **Y**, if asked to continue.

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

```
ERROR: (gcloud.compute.firewall-rules.delete) Could not fetch resource:
 - Required 'compute.firewalls.delete' permission for 'projects/[PROJECT_ID]/global/firewalls/allow-http-web-server'
content_copy
```

This should not work!

As expected, the **Network Admin** role has permissions to list but not modify/delete firewall rules.

Update service account and verify permissions

Update the **Network-admin** service account by providing it the **Security Admin** role.

1.In the Console, navigate to **Navigation menu** (☰) > **IAM & admin** > **IAM**.

2.Find the **Network-admin** account. Focus on the **Name** column to identify this account.

3.Click on the pencil icon for the **Network-admin** account.

4.Change **Role** to **Compute Engine > Compute Security Admin**.

5.Click **Save**.

6.Return to the **SSH** terminal of the **test-vm** instance.

7.Try to list the available firewall rules:

```
gcloud compute firewall-rules list
content_copy
```

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

```
NAME                    NETWORK  DIRECTION  PRIORITY  ALLOW     DENY
allow-http-web-server   default  INGRESS    1000      tcp:80
default-allow-icmp      default  INGRESS    65534     icmp
default-allow-internal  default  INGRESS    65534     all
default-allow-rdp       default  INGRESS    65534     tcp:3389
default-allow-ssh       default  INGRESS    65534     tcp:22
content_copy
```

This should work!

8.Try to delete the **allow-http-web-server** firewall rule:

```
gcloud compute firewall-rules delete allow-http-web-server
content_copy
```

9.Enter **Y**, if asked to continue.

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

```
Deleted [https://www.googleapis.com/compute/v1/projects/qwiklabs-gcp-00e186e4b1cec086/
global/firewalls/allow-http-web-server].
content_copy
```

This should work!

As expected, the **Security Admin** role has permissions to list and delete firewall rules.

Verify the deletion of the firewall rule

Verify that you can no longer HTTP access the external IP of the **blue** server, because you deleted the **allow-http-web-server** firewall rule.

1.Return to the **SSH** terminal of the **test-vm** instance.

2.To test HTTP connectivity to **blue**'s external IP, run the following command, replacing **blue**'s external IP:

```
curl -c 3 <Enter blue's external IP here>
```

content_copy

This should not work!

3.Press **CTRL+c** to stop the HTTP request.

Provide the **Security Admin** role to the right user or service account to avoid any unwanted changes to your firewall rules!

Congratulations!

In this lab, you created two nginx web servers and controlled external HTTP access using a tagged firewall rule. Then, you created a service account with first the **Network Admin** role and then the **Security Admin** role to explore the different permissions of these roles.

If your company has a security team that manages firewalls and SSL certificates and a networking team that manages the rest of the networking resources, then grant the security team the **Security Admin** role and the networking team the **Network Admin** role.

Finish Your Quest

This self-paced lab is part of the Qwiklabs Quest, Networking in the Google Cloud. A Quest is a series of related labs that form a learning path. Completing this Quest earns you the badge above to recognize your achievement. You can make your badge (or badges) public and link to them in your online resume or social media account. Enroll in this Quest and get immediate completion credit if you've taken this lab. See other available Qwiklabs Quests.

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•Service Accounts and Roles: Fundamentals

•Cloud Security Scanner: Qwik Start

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For information on the basic concepts of Google Cloud Identity and Access Management:

•Google Cloud Identity and Access Management Overview

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