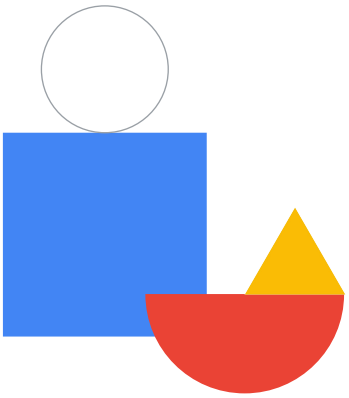
Google Cloud

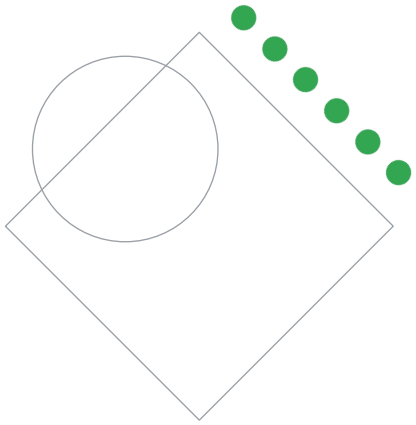


Preparing for Your Professional Cloud Security Engineer Journey

Module 2 : Configuring Perimeter and Boundary Security

Welcome to Module 2: Configuring Perimeter and Boundary Security.

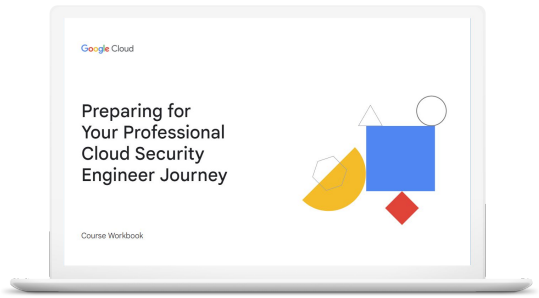
Review and study planning



Now let’s review how to use these diagnostic questions to help you identify what to include in your study plan.

Your study plan:

Configuring network security



2.1 Designing perimeter security

2.2 Configuring boundary segmentation

2.3 Establishing private connectivity

Google Cloud

We'll approach this review by looking at the key areas of this exam section and the questions you just answered about each one. We'll talk about where you can find out more about each area in the learning path for this certification and/or where to find the information in Google Cloud documentation.

As we go through each one, take notes on the specific courses (and modules!), quests, and documentation pages you'll want to emphasize in your study plan.

2.1 Designing perimiter security

Considerations include:

- Configuring network perimeter controls (firewall rules, hierarchical firewalls, Identity-Aware Proxy (IAP), load balancers, and Certificate Authority Service)
- Identifying differences between private and public addressing
- Configuring web application firewall (Google Cloud Armor)
- Configuring Cloud DNS security settings

As Professional Cloud Security Engineer, you are expected to help design and configure network security.

You tested your knowledge of securing load balancers and backends using firewall rules in question 1, and using SSL policies and certificates in question 2. Question 3 explored how to use IAP to authenticate and control access to services deployed to Google Cloud.

2.1 Diagnostic Question 01 Discussion

Cymbal Bank has published an API that internal teams will use through the HTTPS load balancer. You need to limit the API usage to 200 calls every hour. Any exceeding usage should inform the users that servers are busy.

Which gcloud command would you run to throttle the load balancing for the given specification?

A. gcloud compute security-policies rules create priority
--security-policy sec-policy
--src-ip-ranges=source-range
--action=throttle
--rate-limit-threshold-count=200
--rate-limit-threshold-interval-sec=3600
--conform-action=allow
--exceed-action=deny-429
--enforce-on-key=HTTP-HEADER

B. gcloud compute security-policies rules create priority
--security-policy sec-policy
--src-ip-ranges=source-range
--action=throttle
--rate-limit-threshold-count=200
--rate-limit-threshold-interval-sec=60
--conform-action=deny
--exceed-action=deny-404
--enforce-on-key=HTTP-HEADER

C. gcloud compute security-policies rules create priority
--security-policy sec-policy
--src-ip-ranges=source-range
--action=rate-based-ban
--rate-limit-threshold-count=200
--rate-limit-threshold-interval-sec=3600
--conform-action=deny
--exceed-action=deny-403
--enforce-on-key=HTTP-HEADER

D. gcloud compute security-policies rules create priority
--security-policy sec-policy
--src-ip-ranges="<source range>"
--action=rate-based-ban
--rate-limit-threshold-count=200
--rate-limit-threshold-interval-sec=3600
--conform-action=allow
--exceed-action=deny-500
--enforce-on-key=IP

Feedback:
A. Correct! Action should be set to throttle, rate-limit-threshold-count must be 200, and rate-limit-threshold-interval-sec for 1 hour must be 60 seconds X 60 = 3600 seconds. A 429 error code will convey to the user that they have placed too many requests.

B. Incorrect. This command will set the throttle limit to 200 API calls per minute instead of per hour. Error code 404 will indicate that the resource was not found, which is not the error code you want to convey. Action should be allowed, not denied.

C. Incorrect. Rate-based-ban would be helpful if you wanted to disable the incoming services for a time period. You need a throttle limit. Error 403 is incorrect; it indicates invalid authorization, which is not your use case. Action should be allowed, not denied.

D. Incorrect. Rate-based-ban would be helpful if you wanted to disable the incoming services for a time period. You need a throttle limit. Error 500 indicates internal server error, which would mean your API had an exception or failure, which is not the expected outcome.

Where to look:
- https://cloud.google.com/sdk/gcloud/reference/compute/security-policies/rules/update
- https://cloud.google.com/sdk/gcloud/reference/compute/security-policies

Content mapping:
Partial coverage in:

- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security
  - M8 Securing Google Kubernetes Engine: Techniques and Best Practices
  - M9 Protecting Against DDOS Attacks

- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Security Best Practices in Google Cloud**
  - M4 Securing Google Kubernetes Engine: Techniques and Best Practices

- On-demand course: **Mitigating Security Vulnerabilities on Google Cloud**
  - M1 Protecting Against DDOS Attacks

- ILT course: **Networking in Google Cloud**
  - M2 Controlling Access to VPC Networks
  - M4 Load balancing
  - M8 Network Monitoring and Troubleshooting

- On-demand course: **Networking in Google Cloud: Defining and Implementing Networks**
  - M2 Controlling Access to VPC Networks
  - M4 Load Balancing

- On-demand course: **Networking in Google Cloud: Hybrid Connectivity and Network Management**
  - M4 Network Monitoring and Troubleshooting

- Quest: Build and Secure Networks in Google Cloud

Summary:
Google Cloud Armor provides capabilities to help protect your Google Cloud applications against a variety of Layer 3 and Layer 7 attacks. Google Cloud Armor security policies filter incoming traffic that is destined to global external HTTP(S) load balancers or global external HTTP(S) load balancer (classic)s. Rate-based rules help you protect your applications from a large volume of requests that flood your instances and block access for legitimate users.

2.1 Diagnostic Question 02 Discussion

Cymbal Bank is releasing a new loan management application using a Compute Engine managed instance group. External users will connect to the application using a domain name or IP address protected with TLS 1.2. A load balancer already hosts this application and preserves the source IP address. You are tasked with setting up the SSL certificate for this load balancer.

What should you do?

A. Create a Google-managed SSL certificate. Attach a global dynamic external IP address to the internal HTTPS load balancer. Validate that an existing URL map will route the incoming service to your managed instance group backend. Load your certificate and create an HTTPS proxy routing to your URL map. Create a global forwarding rule that routes incoming requests to the proxy.

B. Create a Google-managed SSL certificate. Attach a global static external IP address to the external HTTPS load balancer. Validate that an existing URL map will route the incoming service to your managed instance group backend. Load your certificate and create an HTTPS proxy routing to your URL map. Create a global forwarding rule that routes incoming requests to the proxy.

C. Import a self-managed SSL certificate. Attach a global static external IP address to the TCP Proxy load balancer. Validate that an existing URL map will route the incoming service to your managed instance group backend. Load your certificate and create a TCP proxy routing to your URL map. Create a global forwarding rule that routes incoming requests to the proxy.

D. Import a self-managed SSL certificate. Attach a global static external IP address to the SSL Proxy load balancer. Validate that an existing URL map will route the incoming service to your managed instance group backend. Load your certificate and create an SSL proxy routing to your URL map. Create a global forwarding rule that routes incoming requests to the proxy.

Google Cloud

Feedback:
A. Incorrect. You need a global static external IP address. An SSL certificate is only applied to an external HTTPS load balancer. So configuring an internal load balancer (HTTP not HTTPS) with a static or dynamic IP address will not accomplish your goal.

B. Correct! Attaching a global static external IP address will expose your load balancer to internet users. Creating HTTPS proxy (and global forwarding rules) will help route the request to the existing backend.

C. Incorrect. A TCP Proxy load balancer does not preserve client IP addresses. The TCP connection is terminated at the load balancer.

D. Incorrect. Although SSL Proxy can handle HTTPS traffic, it is not a recommended practice due to client-side limitations. SSL Proxy will not be able to establish TLS connections from clients, which is also a requirement.

Where to look:
- https://cloud.google.com/load-balancing/docs/https/ext-https-lb-simple
- https://cloud.google.com/load-balancing/docs/ssl-certificates/google-managed-certs#load-balancer

Content mapping:
Partial coverage in:

- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

Summary:
When dealing with external HTTPS traffic, you need an external HTTPS load balancer for end-to-end TLS and SSL support. An HTTPS load balancer lets you create HTTPS proxy routing that forwards requests to the appropriate backend. External users can reach this proxy with the help of global forwarding rules.

2.1 Diagnostic Question 03 Discussion

Your organization has a website running on Compute Engine. This instance only has a private IP address. You need to provide SSH access to an on-premises developer who will debug the website from the authorized on-premises location only.

How do you enable this?

A. Set up Cloud VPN. Set up an unencrypted tunnel to one of the hosts in the network. Create outbound or egress firewall rules. Use the private IP address to log in using a gcloud ssh command.

B. Use SOCKS proxy over SSH. Set up an SSH tunnel to one of the hosts in the network. Create the SOCKS proxy on the client side.

C. Use the default VPC's firewall. Open port 22 for TCP protocol using the Google Cloud Console.

D. Use Identity-Aware Proxy (IAP). Set up IAP TCP forwarding by creating ingress firewall rules on port 22 for TCP using the gcloud command.

Google Cloud

Feedback:
A. Incorrect. You need ingress and not egress firewall rules.

B. Incorrect. SOCKS proxy must be created on the server side for applications to be discovered. Applying this solution will set up the opposite of what you need.

C. Incorrect. This approach will expose your Compute Engine instance to the public internet. Anyone will be able to access your Compute Engine instance, not just your on-premises developer.

D. Correct! IAP TCP forwarding establishes an encrypted tunnel that supports both SSH and RDP requests.

Where to look:

- https://cloud.google.com/iap/docs/using-tcp-forwarding#preparing_your_project_for_tcp_forwarding
- https://cloud.google.com/solutions/connecting-securely#preventing_vms_from_being_reached_from_the_public_internet

Content mapping:

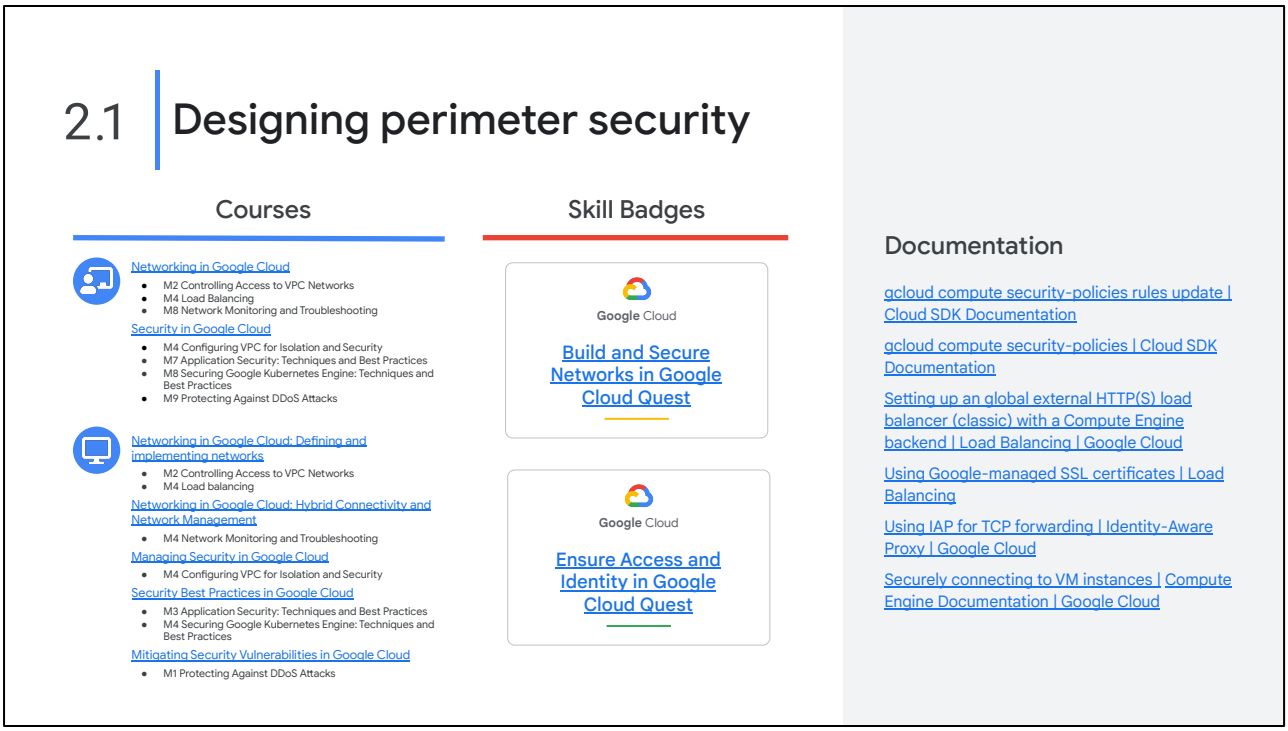
- ILT course: **Security in Google Cloud**
  - M7 Application Security: Techniques and Best Practices

- On-demand course: **Security Best Practices in Google Cloud**

    - M3 Application Security: Techniques and Best Practices

- Quests:
    - Build and Secure Networks in Google Cloud
    - Ensure Access and Identity in Google Cloud

Summary:
Cloud Identity-Aware Proxy (IAP) can help manage users and VM instances that users can connect to. Users and groups can connect to Cloud IAP first and can access the underlying permitted resources after authorization. Users and Group access can be controlled at the Project level using IAM.



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic questions we just reviewed are covered in these modules and in this documentation. Reviewing the documentation is highly recommended. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

- https://cloud.google.com/sdk/gcloud/reference/compute/security-policies/rules/update
- https://cloud.google.com/sdk/gcloud/reference/compute/security-policies
- https://cloud.google.com/load-balancing/docs/https/ext-https-lb-simple
- https://cloud.google.com/load-balancing/docs/ssl-certificates/google-managed-certs#load-balancer
- https://cloud.google.com/iap/docs/using-tcp-forwarding#preparing_your_project_for_tcp_forwarding
- https://cloud.google.com/solutions/connecting-securely#preventing_vms_from_being_reached_from_the_public_internet

2.2 Configuring boundary segmentation

Considerations include:

- Configuring security properties of a VPC Network, VPC Peering, Shared VPC, and Firewall Rules
- Configuring network isolation and data encapsulation for N-tier application design
- Configuring VPC Service Controls

A Professional Cloud Security Engineer needs to understand the considerations involved in configuring network segmentation.

Question 4 tested your knowledge of securing Cloud DNS zones using DNSSEC. Question 5 asked you to apply firewall rules with service accounts to secure applications. Question 6 examined the use of VPC subnets for secure resource communication and isolation.

2.2 Diagnostic Question 04 Discussion

You have recently joined Cymbal Bank as a cloud engineer. You created a custom VPC network, selecting to use the automatic subnet creation mode and nothing else. The default network still exists in your project. You create a new Linux VM instance and select the custom VPC as the network interface. You try to SSH into your instance, but you are getting a "connection failed" error.

What answer best explains why you cannot SSH into the instance?

A. You should have deleted the default network. When you have multiple VPCs in your project, Compute Engine can't allow you to connect because overlapping IP ranges prevent the API from establishing a root connection.

B. You should have used the default network when setting up your instance. While custom networks support instance creation, they should only be used for internal communication.

C. You should have used custom subnet creation mode. Since the default VPC still exists, automatic mode created subnets in the same regions, which led to overlapping IP addresses.

D. You did not set up any firewall rules on your custom VPC network. While the default VPC comes with a predefined firewall rule that allows SSH traffic, these need to be added to any custom VPCs.

Google Cloud

Feedback:
A. Incorrect. You are allowed to have multiple VPCs in your project. When creating custom subnetwork with auto creation mode, Google Cloud ensures that there are no overlapping CIDR ranges.

B. Incorrect. You do not need to create VM instances using the default network. Custom networks allow for internal and external network traffic.

C. Incorrect. Creating your subnets in the custom network with auto mode ensures that there will be no overlapping IP ranges across your subnets.

D. Correct! You did not create any firewalls to allow SSH traffic.

Where to look:
- https://cloud.google.com/vpc/docs/firewalls

Content mapping:
- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security
  - M5 Securing Compute Engine: Techniques and Best Practices

- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Security Best Practices in Google Cloud**
  - M1 Securing Compute Engine

- ILT course: **Networking in Google Cloud**
  - M1 Google Cloud VPC Networking Fundamentals

- On-demand course: **Networking in Google Cloud: Defining and Implementing Networks**
  - M1 Google Cloud VPC Networking Fundamentals

Summary:
The default network is pre-populated with firewall rules that allow incoming connections to instances. These allow you to connect to instances with tools such as SSH, RDP, ping, and also allow for communication between VM instances within the same VPC network.

You need to create similar firewall rules for networks other than the default network.

2.2 Diagnostic Question 05 Discussion

Cymbal Bank needs to connect its employee MongoDB database to a new human resources web application on the same network. Both the database and the application are autoscaled with the help of Instance templates. As the Security Administrator and Project Editor, you have been tasked with allowing the application to read port 27017 on the database.

What should you do?

A. Create service accounts for the application and database. Create a firewall rule using:
gcloud compute firewall-rules create ALLOW_MONGO_DB
--network network-name
--allow TCP:27017
--source-service-accounts web-application-service-account
--target-service-accounts database-service-account

B. Create service accounts for the application and database. Create a firewall rule using:
gcloud compute firewall-rules create ALLOW_MONGO_DB
--network network-name
--allow ICMP:27017
--source-service-accounts web-application-service-account
--target-service-accounts database-service-account

C. Create a user account for the database admin and a service account for the application. Create a firewall rule using:
gcloud compute firewall-rules create ALLOW_MONGO_DB
--network network-name
--allow TCP:27017
--source-service-accounts web-application-service-account
--target-service-accounts database-admin-user-account

D. Create user accounts for the application and database. Create a firewall rule using:
gcloud compute firewall-rules create ALLOW_MONGO_DB
--network network-name
--deny UDP:27017
--source-service-accounts web-application-user-account
--target-service-accounts database-admin-user-account

Google Cloud

Feedback:
A. Correct! Use service accounts to automate the identification, authentication, and authorization process between the n-tier services. Allow TCP protocol on the port for reading.

B. Incorrect. In order to work with a database, you need TCP connection. ICMP can only send error codes and operational messages.

C. Incorrect. You need a service account, not a user account, to automate the templates for the database.

D. Incorrect. You need service accounts, not user accounts, to automate the templates for both the database and the application. This request will deny the database access instead of allowing it. UDP is an incorrect protocol to connect to a database for transactions.

Where to look:
https://cloud.google.com/vpc/docs/using-firewalls#serviceaccounts

Content mapping:
- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security
  - M8 Securing Google Kubernetes Engine

- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Security Best Practices in Google Cloud**
  - M4 Securing Google Kubernetes Engine

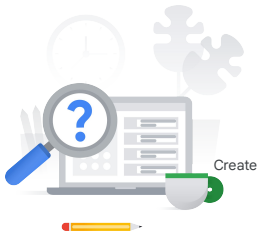
- ILT course: **Networking in Google Cloud**
  - M2 Controlling Access to VPC Networks
  - M8 Network Monitoring and Troubleshooting

- On-demand course: **Networking in Google Cloud: Defining and Implementing Networks**
  - M2 Controlling Access to VPC Networks

- On-demand course: **Networking in Google Cloud: Hybrid Connectivity and Network Management**
  - Module 4: Network Monitoring and Troubleshooting

Summary:
Only one firewall rules set is applied on all the subnets in the same network. When resources are in various subnets of the same network, you can create service accounts for each of those resources and apply firewall rules at the service account level.

2.2 Diagnostic Question 06 Discussion



Cymbal Bank has designed an application to detect credit card fraud that will analyze sensitive information. The application that's running on a Compute Engine instance is hosted in a new subnet on an existing VPC. Multiple teams who have access to other VMs in the same VPC must access the VM. You want to configure the access so that unauthorized VMs or users from the internet can't access the fraud detection VM.

What should you do?

A. Use subnet isolation. Create a service account for the fraud detection VM. Create one service account for all the teams' Compute Engine instances that will access the fraud detection VM. Create a new firewall rule using:
gcloud compute firewall-rules create ACCESS_FRAUD_ENGINE
--network <network name>
--allow TCP:80
--source-service-accounts <one service account for all teams>
--target-service-accounts <fraud detection engine's service account>

B. Use target filtering. Create two tags called 'app' and 'data'. Assign the 'app' tag to the Compute Engine instance hosting the Fraud Detection App (source), and assign the 'data' tag to the other Compute Engine instances (target). Create a firewall rule to allow all ingress communication on this tag.

C. Use subnet isolation. Create a service account for the fraud detection engine. Create service accounts for each of the teams' Compute Engine instances that will access the engine. Add a firewall rule using:
gcloud compute firewall-rules create ACCESS_FRAUD_ENGINE
--network <network name>
--allow TCP:80
--source-service-accounts <list of service accounts>
--target-service-accounts <fraud detection engine's service account>

D. Use target filtering. Create a tag called 'app', and assign the tag to both the source and the target. Create a firewall rule to allow all ingress communication on this tag.

Google Cloud

Feedback:
A. Incorrect. Create one service account for each resource with fine-grained limited permissions. Each application has a specific task, and it's rare for multiple applications to require the same access and permissions. Following the principle of least privileges, provide only limited access to each service account separately.

B. Incorrect. For the firewall rule to allow clients to access the Fraud Detection App, other Compute Engine instances should be the source, and the Compute Engine instance hosting the app should be the target.

C. Correct! Using subnet isolation, you have to authorize every request entering your subnet. The recommended solution is to create a firewall rule that allows only a limited set of service accounts to access the shared target.

D. Incorrect. Target filtering can help with selecting the right resources to apply firewall rules. However, creating an ingress tag to all resources does not achieve the desired communication flow between the API and the database.

Where to look:
- https://cloud.google.com/architecture/best-practices-vpc-design#isolate-data
- https://cloud.google.com/architecture/best-practices-vpc-design#isolate-vms-service-accounts
- https://cloud.google.com/iam/docs/best-practices-for-securing-service-accounts

Content mapping:

- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

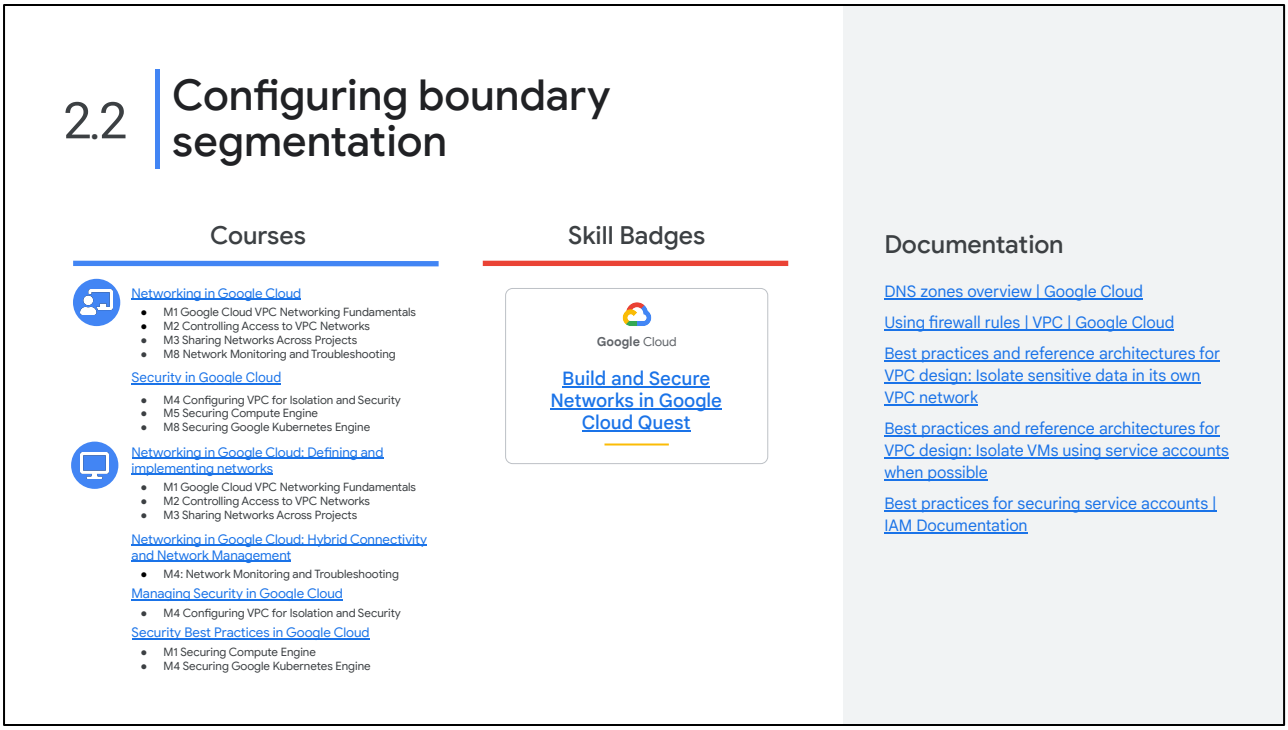
- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- ILT course: **Networking in Google Cloud**
  - M1 Google Cloud VPC Networking Fundamentals
  - M2 Controlling Access to VPC Networks
  - M3 Sharing Networks Across Projects
  -
- On-demand course: **Networking in Google Cloud: Defining and Implementing Networks**
  - M1 Google Cloud VPC Networking Fundamentals
  - M2 Controlling Access to VPC Networks
  - M3 Sharing Networks Across Projects

- Quest: Build and Secure Networks in Google Cloud

Summary:

VPCs allow secure communication between resources. The specific rules for resource communication should be added to the firewall. Firewalls can use target filtering with the help of tags or subnet isolation. Subnet isolation with the help of service accounts is the recommended method for this situation.



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- https://cloud.google.com/dns/docs/zones/zones-overview#peering_zones
- https://cloud.google.com/vpc/docs/using-firewalls#serviceaccounts
- https://cloud.google.com/architecture/best-practices-vpc-design#isolate-data
- https://cloud.google.com/architecture/best-practices-vpc-design#isolate-vms-service-accounts
- https://cloud.google.com/iam/docs/best-practices-for-securing-service-accounts

2.3 Establishing private connectivity

Considerations include:

- Designing and configuring private connectivity between VPC networks and Google Cloud Projects (Shared VPC, VPC Peering, and Private Google Access for on-premises hosts)
- Designing and configuring private connectivity between data centers and VPC network (IPSEC and Cloud Interconnect)
- Establishing private connectivity between VPC and Google APIs (Private Google Access, restricted Google access, Private Google Access for on-premise hosts, Private Services Connect)
- Using Cloud NAT to enable outbound traffic

As a Professional Cloud Security Engineer, you will need to design and configure private connectivity between networks using Shared VPC, VPC Peering, IPSEC, and Cloud Interconnect. You also need to establish private connectivity between a VPC and Google CPAs.

Question 7 tested your knowledge of using NAT IP address ranges to ensure secure connectivity between a Shared VPC and connectors. Question 8 asked you to differentiate between options to connect between on-premises applications and Google Cloud. Question 9 tested your ability to set up an environment for on-premises users to access Google Cloud privately. Question 10 tested your knowledge of Cloud NAT.

2.3 Diagnostic Question 07 Discussion

The data from Cymbal Bank's loan applicants resides in a shared VPC. A credit analysis team uses a CRM tool hosted in the App Engine standard environment. You need to provide credit analysts with access to this data. You want the charges to be incurred by the credit analysis team.

What should you do?

A. Add egress firewall rules to allow TCP and UDP ports for the App Engine standard environment in the Shared VPC network. Create either a client-side connector in the Service Project or a server-side connector in the Host Project using the IP Range or Project ID of the target VPC. Verify that the connector is in a READY state. Create an egress rule on the Shared VPC network to allow the connector using Network Tags or IP ranges.

B. Add egress firewall rules to allow SSH and/or RDP ports for the App Engine standard environment in the Shared VPC network. Create a client-side connector in the Service Project using the IP range of the target VPC. Verify that the connector is in a READY state. Create an egress rule on the Shared VPC network to allow the connector using Network Tags or IP ranges.

C. Add ingress firewall rules to allow NAT and Health Check ranges for the App Engine standard environment in the Shared VPC network. Create a client-side connector in the Service Project using the Shared VPC Project ID. Verify that the connector is in a READY state. Create an ingress rule on the Shared VPC network to allow the connector using Network Tags or IP ranges.

D. Add ingress firewall rules to allow NAT and Health Check ranges for App Engine standard environment in the Shared VPC network. Create a server-side connector in the Host Project using the Shared VPC Project ID. Verify that the connector is in a READY state. Create an ingress rule on the Shared VPC network to allow the connector using Network Tags or IP ranges.

Google Cloud

Feedback:
A. Incorrect. You need to use the NAT and Health Check IP address ranges for the App Engine standard environment. In order to communicate to a shared VPC, you need to create ingress firewall rules.

B. Incorrect. This command would work if the VPC was not a Shared VPC. Also, in order to communicate to a shared VPC, you need to create ingress rules in Firewall.

C. Correct! App Engine uses a fixed set of NAT and health check IP address ranges that must be permitted into the VPC. Because the charges must be incurred by the credit analysis team, you need to create the connector on the client side.

D. Incorrect. Creating a connector in the server side will incur charges to the Host Project instead of to the credit analysis team's project.

Where to look:
- https://cloud.google.com/appengine/docs/standard/python3/connecting-shared-vpc
- https://cloud.google.com/vpc/docs/configure-serverless-vpc-access#create-connector

Content mapping:
- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- ILT course: **Networking in Google Cloud**
  - M3 Sharing Networks Across Projects

- On-demand course: **Networking in Google Cloud: Defining and Implementing Networks**
  - M3 Sharing Networks Across Projects

- Quests:
  - Build and Secure Networks in Google Cloud
  - Ensure Access and Identity in Google Cloud

Summary:
App Engine standard environment uses NAT IP address ranges and Health Checks that ensure secure connectivity between a Shared VPC and connectors. These ranges, 107.178.230.64/26 and 35.199.244.0/19, along with Health Check ranges, are the origin of requests from Cloud Run, Cloud Functions, and the App Engine standard environment.

Use these ranges to create ingress Firewall rules in a Shared VPC to allow connectors from the App Engine standard environment.

2.3 Diagnostic Question 08 Discussion

Cymbal Bank's Customer Details API runs on a Compute Engine instance with only an internal IP address. Cymbal Bank's new branch is co-located outside the Google Cloud points-of-presence (PoPs) and requires a low-latency way for its on-premises apps to consume the API without exposing the requests to the public internet.

Which solution would you recommend?

A. Use a Content Delivery Network (CDN). Establish direct peering with one of Google's nearby edge-enabled PoPs.

B. Use Carrier Peering. Use a service provider to access their enterprise grade infrastructure to connect to the Google Cloud environment.

C. Use Partner Interconnect. Use a service provider to access their enterprise grade infrastructure to connect to the Google Cloud environment.

D. Use Dedicated Interconnect. Establish direct peering with one of Google's nearby edge-enabled PoPs.

Google Cloud

Feedback:
A. Incorrect. CDNs can help direct traffic and static content from VPCs and are cached on the edge. CDNs still need an internet connection.

B. Incorrect. Carrier Peering would require a public IP address attached to the Compute Engine instance.

C. Correct! When you are co-located in one of the Google Cloud PoPs, use Dedicated Interconnect. Otherwise, use Partner Interconnect to connect to Google Cloud with a private IP address.

D. Incorrect. You can only use Dedicated Interconnect if you are co-located in Google Cloud PoPs.

Where to look:
- https://cloud.google.com/vpc-service-controls/docs/overview#hybrid_access
- https://cloud.google.com/network-connectivity/docs/how-to/choose-product

Content mapping:
- ILT course: **Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Managing Security in Google Cloud**
  - M4 Configuring Virtual Private Cloud for Isolation and Security

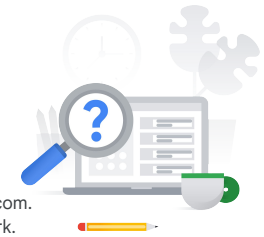
- ILT course: **Networking in Google Cloud**
  - M5 Hybrid Connectivity

- On-demand course: **Networking in Google Cloud: Hybrid Connectivity and Network Management**
  - M1 Hybrid Connectivity

Summary:
You can connect to Google Cloud resources using private IP addresses with Interconnect. If you are co-located in Google Cloud Points-of-presence (PoPs), you can use Direct Interconnect and configure VLAN attachments on-premises.

If you are located outside of the PoP edge locations, you need to use Partner Interconnect. Partner Interconnect provides an intermediate access point, which then provides connectivity to Google Cloud.

2.3 Diagnostic Question 09 Discussion



An external audit agency needs to perform a one-time review of Cymbal Bank's Google Cloud usage. The auditors should be able to access a Default VPC containing BigQuery, Cloud Storage, and Compute Engine instances where all the usage information is stored. You have been tasked with enabling the access from their on-premises environment, which already has a configured VPN.

What should you do?

A. Use a Cloud VPN tunnel. Use your DNS provider to create DNS zones and records for private.googleapis.com. Connect the DNS provider to your on-premises network. Broadcast the request from the on-premises environment. Use a software-defined firewall to manage incoming and outgoing requests.

B. Use Partner Interconnect. Configure an encrypted tunnel in the auditor's on-premises environment. Use Cloud DNS to create DNS zones and A records for private.googleapis.com.

C. Use a Cloud VPN tunnel. Use Cloud DNS to create DNS zones and records for *.googleapis.com. Set up on-premises routing with Cloud Router. Use Cloud Router custom route advertisements to announce routes for Google Cloud destinations.

D. Use Dedicated Interconnect. Configure a VLAN in the auditor's on-premises environment. Use Cloud DNS to create DNS zones and records for restricted.googleapis.com and private.googleapis.com. Set up on-premises routing with Cloud Router. Add custom static routes in the VPC to connect individually to BigQuery, Cloud Storage, and Compute Engine instances.

Google Cloud

Feedback:
A. Incorrect. Use DNS forwarding to connect to external DNS. VPCs will not accept broadcast or multicast IP addresses. A software-defined firewall has application-level controls only. This solution doesn't meet the requirement to connect to Google Cloud.

B. Incorrect. Using Interconnect for a one-time audit is an expensive choice. Additionally, you will need to add records for both private.googleapis.com and restricted.googleapis.com. Instead, create records for *.googleapis.com.

C. Correct! Cloud VPN provides a cost-effective and easily set-up environment for on-premises users to access Google Cloud privately. Using *.googleapis.com enables requests for both private.googleapis.com and restricted.googleapis.com. Use Cloud Router to set up and announce Google Cloud routes on-premises.

D. Incorrect. Using Interconnect for a one-time audit is an expensive choice. Additional static routes are required if the default routing has changed.

Where to look:
- https://cloud.google.com/vpc/docs/private-google-access#pga-supported
- https://cloud.google.com/dns/docs/zones#create-private-zone
- https://cloud.google.com/vpc/docs/private-google-access-hybrid

Content mapping:
- ILT course: **Security in Google Cloud**

    - M4 Configuring Virtual Private Cloud for Isolation and Security
    - M5 Securing Compute Engine: Techniques and Best Practices

- On-demand course: **Managing Security in Google Cloud**
    - M4 Configuring Virtual Private Cloud for Isolation and Security

- On-demand course: **Security Best Practices in Google Cloud**
    - M1 Securing Compute Engine: Techniques and Best Practices

- ILT course: **Networking in Google Cloud**
    - M5 Hybrid Connectivity

- On-demand course: **Networking in Google Cloud: Hybrid Connectivity and Network Management**
    - M1 Hybrid Connectivity

- Quest: Ensure Access and Identity in Google Cloud

Summary:
Cloud VPN and Interconnect are ideal options for private connectivity. Use Cloud VPN if initial setup and cost are challenges, but latency is acceptable. Use Interconnect for dedicated long-term usage for large throughput.

You also need to configure DNS records and on-premises routing, for which you can use Cloud DNS and Cloud Router. The private usage requires announcing and adding routes on-premises for private.googleapis.com and restricted.googleapis.com.

After the Firewall rules have been configured on-premises and on the VPC, the VPC containing the private resources will be accessible to on-premises systems. If you are using a default VPC, the VPC will contain a default route. Otherwise, you will also need to add custom static routes for private Google Cloud access.

2.3 Diagnostic Question 10 Discussion

An ecommerce portal uses Google Kubernetes Engine to deploy its recommendation engine in Docker containers. This cluster instance does not have an external IP address. You need to provide internet access to the pods in the Kubernetes cluster. What configuration would you add?

What should you do?

A. Cloud DNS, subnet primary IP address range for nodes, and subnet secondary IP address range for pods and services in the cluster

B. Cloud VPN, subnet secondary IP address range for nodes, and subnet secondary IP address range for pods and services in the cluster

C. Nginx load balancer, subnet secondary IP address range for nodes, and subnet secondary IP address range for pods and services in the cluster

D. Cloud NAT gateway, subnet primary IP address range for nodes, and subnet secondary IP address range for pods and services in the cluster

Google Cloud

Feedback:
A. Incorrect. Cloud DNS is required for domain name resolution; it cannot decide upon internet access.

B. Incorrect. You need to set the primary, not secondary, IP address range for nodes. Cloud VPN would be used if you need to connect on-premises users to the GKE cluster, which is not the requirement.

C. Incorrect. Load balancers help with distributing incoming traffic between machines. You need an outbound connection.

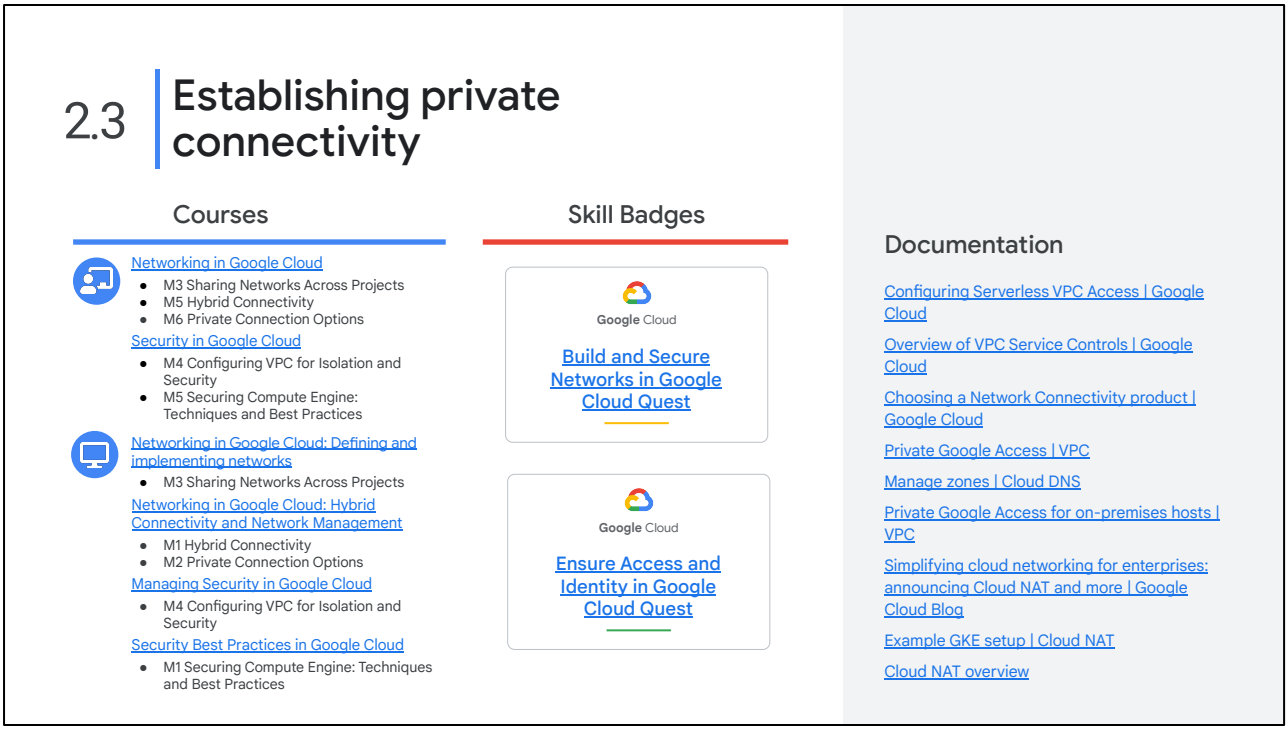
D. Correct! Cloud NAT gateways help provide internet access (outbound) without requiring a public IP address.

Where to look:
- https://cloud.google.com/blog/products/networking/simplifying-cloud-networking-for-enterprises-announcing-cloud-nat-and-more
- https://cloud.google.com/nat/docs/gke-example
- https://cloud.google.com/nat/docs/overview

Content mapping:
- ILT course: **Networking in Google Cloud**
  - M6 Private Connection Options

- On-demand course: **Networking in Google Cloud: Hybrid Connectivity and Network Management**
    - M2 Private Connection Options

Summary:
Cloud NAT can provide outbound internet access to certain resources such as Compute Engine, Google Kubernetes Engine, Cloud Functions, and Cloud Run (using Serverless VPC), and App Engine standard environment.



Let's take a moment to consider resources that can help you build your knowledge and skills in this area.

The concepts in the diagnostic questions we just reviewed are covered in these modules and in this documentation. Reviewing the documentation is highly recommended. You'll find this list in your workbook so you can take a note of what you want to include later when you build your study plan. Based on your experience with the diagnostic questions, you may want to include some or all of these.

- https://cloud.google.com/appengine/docs/standard/python3/connecting-shared-vpc
- https://cloud.google.com/vpc/docs/configure-serverless-vpc-access#create-connector
- https://cloud.google.com/vpc-service-controls/docs/overview#hybrid_access
- https://cloud.google.com/network-connectivity/docs/how-to/choose-product
- https://cloud.google.com/vpc/docs/private-google-access#pga-supported
- https://cloud.google.com/dns/docs/zones#create-private-zone
- https://cloud.google.com/vpc/docs/private-google-access-hybrid
- https://cloud.google.com/blog/products/networking/simplifying-cloud-networking-for-enterprises-announcing-cloud-nat-and-more
- https://cloud.google.com/nat/docs/gke-example
- https://cloud.google.com/nat/docs/overview