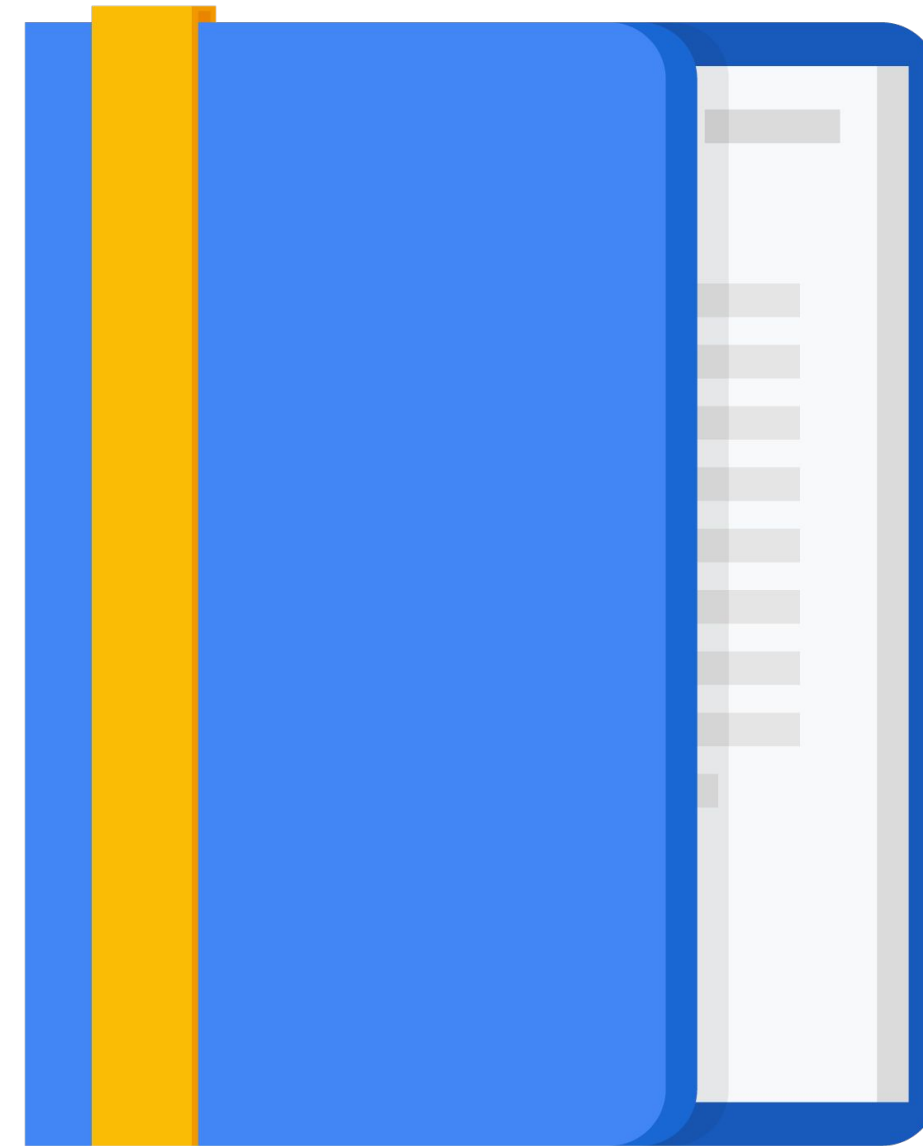# Interconnecting Networks

Agenda

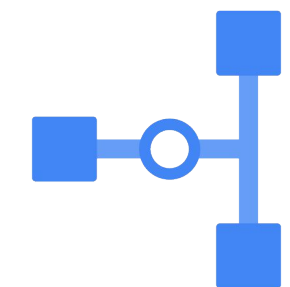Cloud VPN

Lab

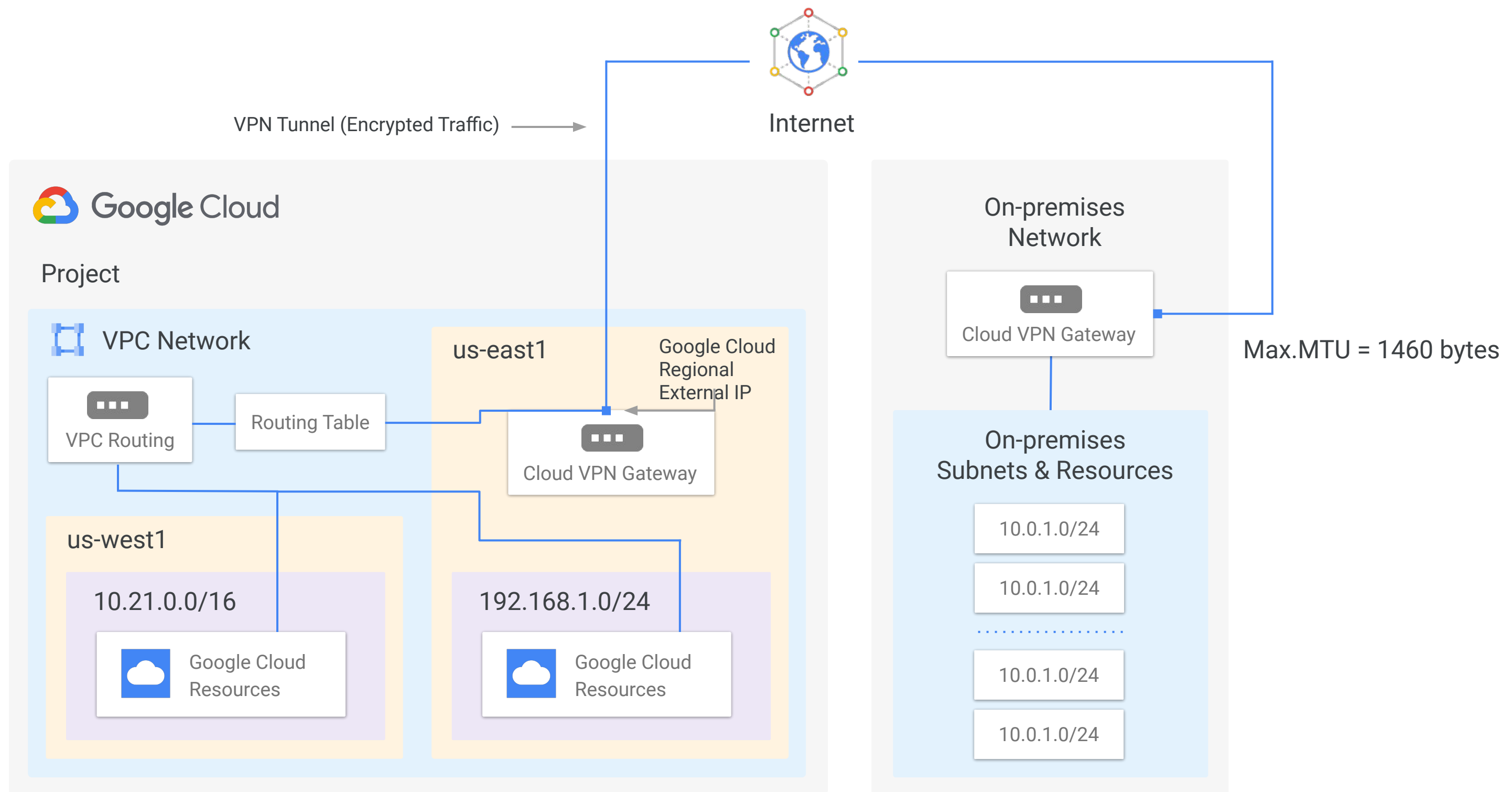Cloud Interconnect and Peering

Google Cloud

Cloud VPN securely connects your on-premises network to your Google Cloud VPC network

- Useful for low-volume data connections

- Classic VPN: 99.9% SLA

- High-availability (HA) VPN: 99.99% SLA

- Supports:
  - Site-to-site VPN
  - Static routes (Classic VPN only)
  - Dynamic routes (Cloud Router)
  - IKEv1 and IKEv2 ciphers

Cloud VPN

Google Cloud

Classic VPN topology

Internet

VPN Tunnel (Encrypted Traffic) →

Google Cloud

Project

VPC Network

us-east1

VPC Routing — Routing Table

Google Cloud Regional External IP

Cloud VPN Gateway

us-west1

10.21.0.0/16

Google Cloud Resources

192.168.1.0/24

Google Cloud Resources

On-premises Network

Cloud VPN Gateway

Max.MTU = 1460 bytes

On-premises Subnets & Resources

10.0.1.0/24

10.0.1.0/24

....

10.0.1.0/24

10.0.1.0/24

Google Cloud
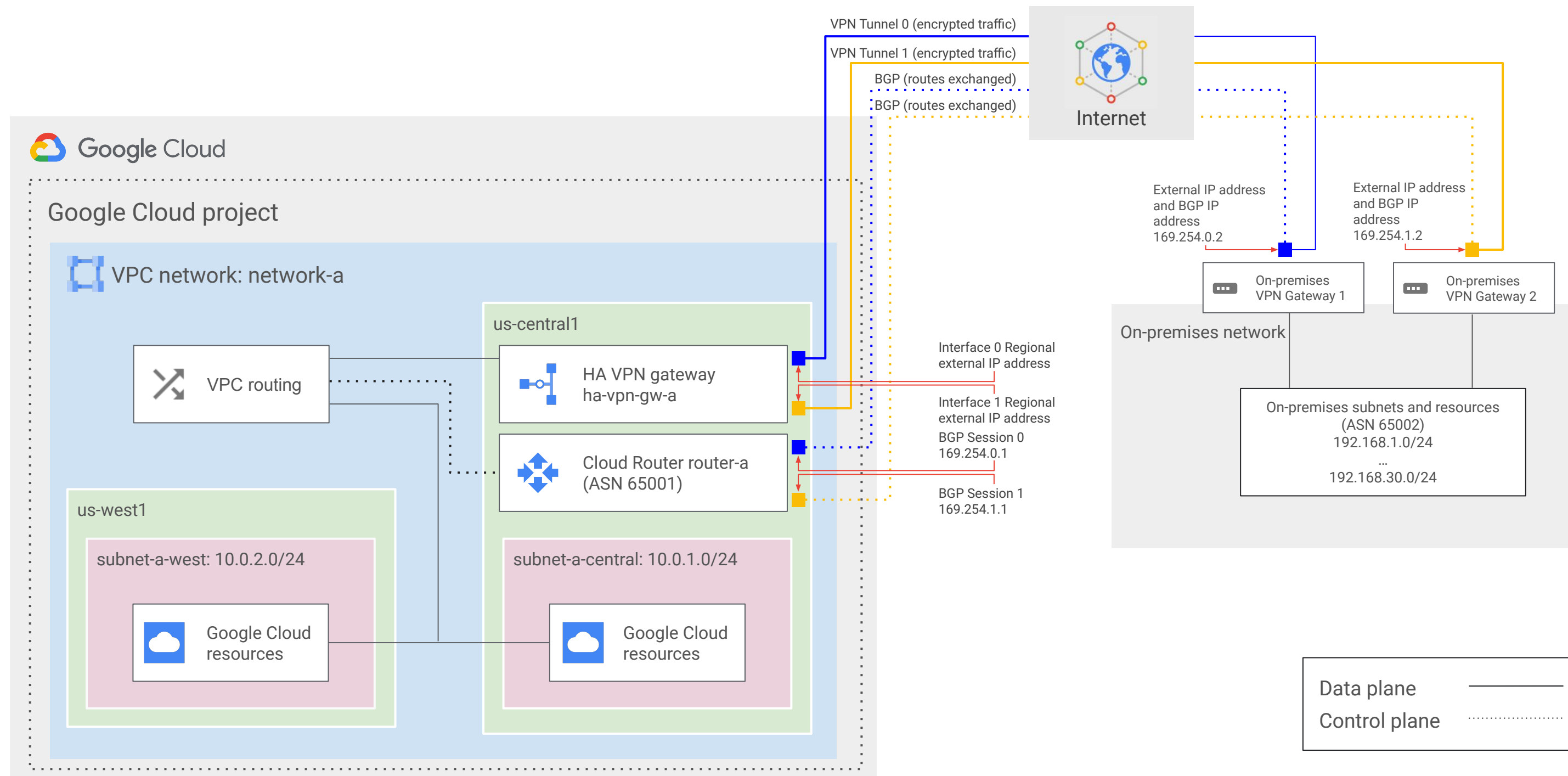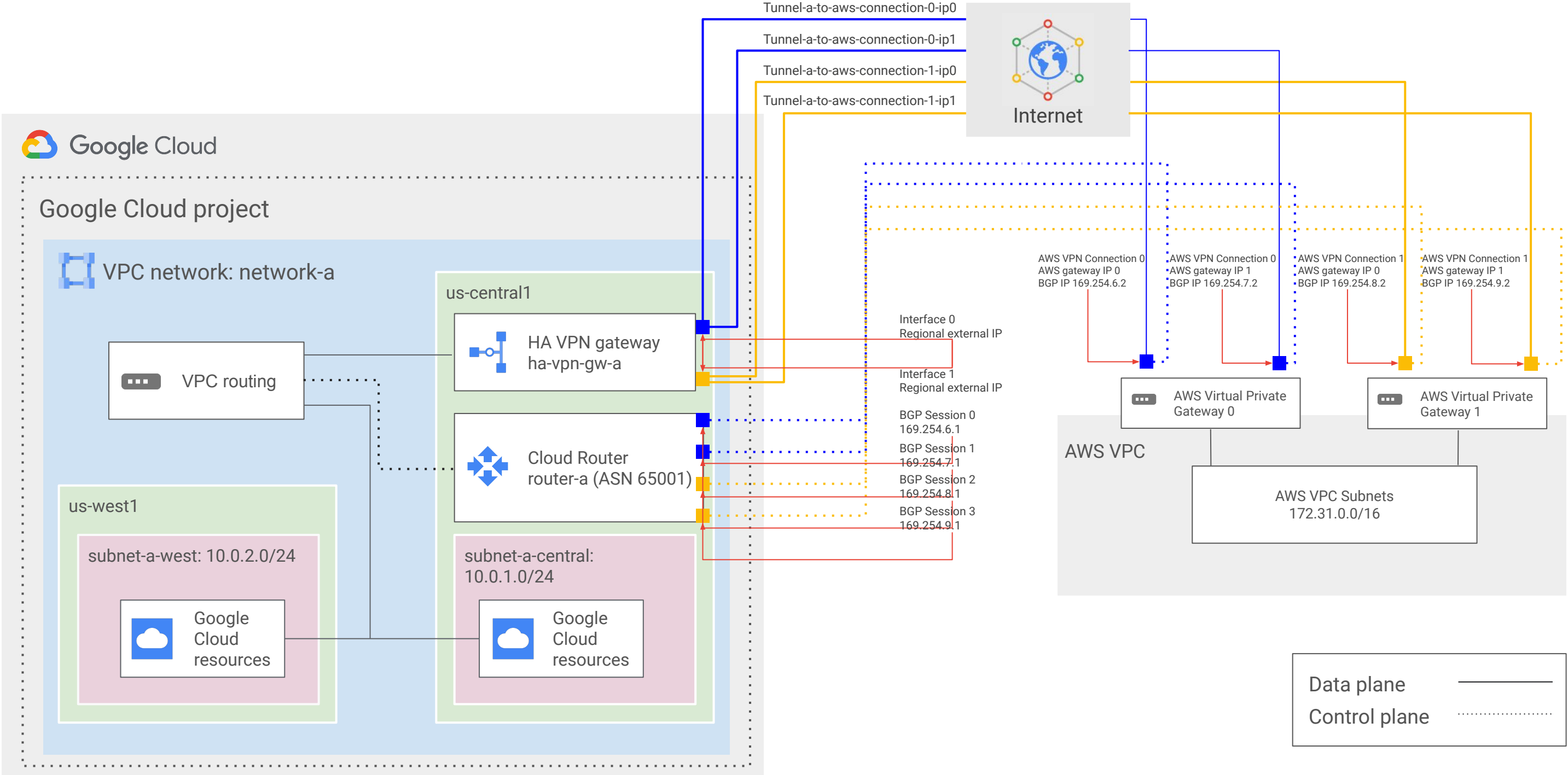
HA VPN overview

- Provides 99.99% service availability.

- Google Cloud automatically chooses two external IP addresses.
  - Supports multiple tunnels
  - VPN tunnels connected to HA VPN gateways must use dynamic (BGP) routing

- Supports site-to-site VPN for different topologies/configuration scenarios:
  - An HA VPN gateway to peer VPN devices
  - An HA VPN gateway to an Amazon Web Services (AWS) virtual private gateway
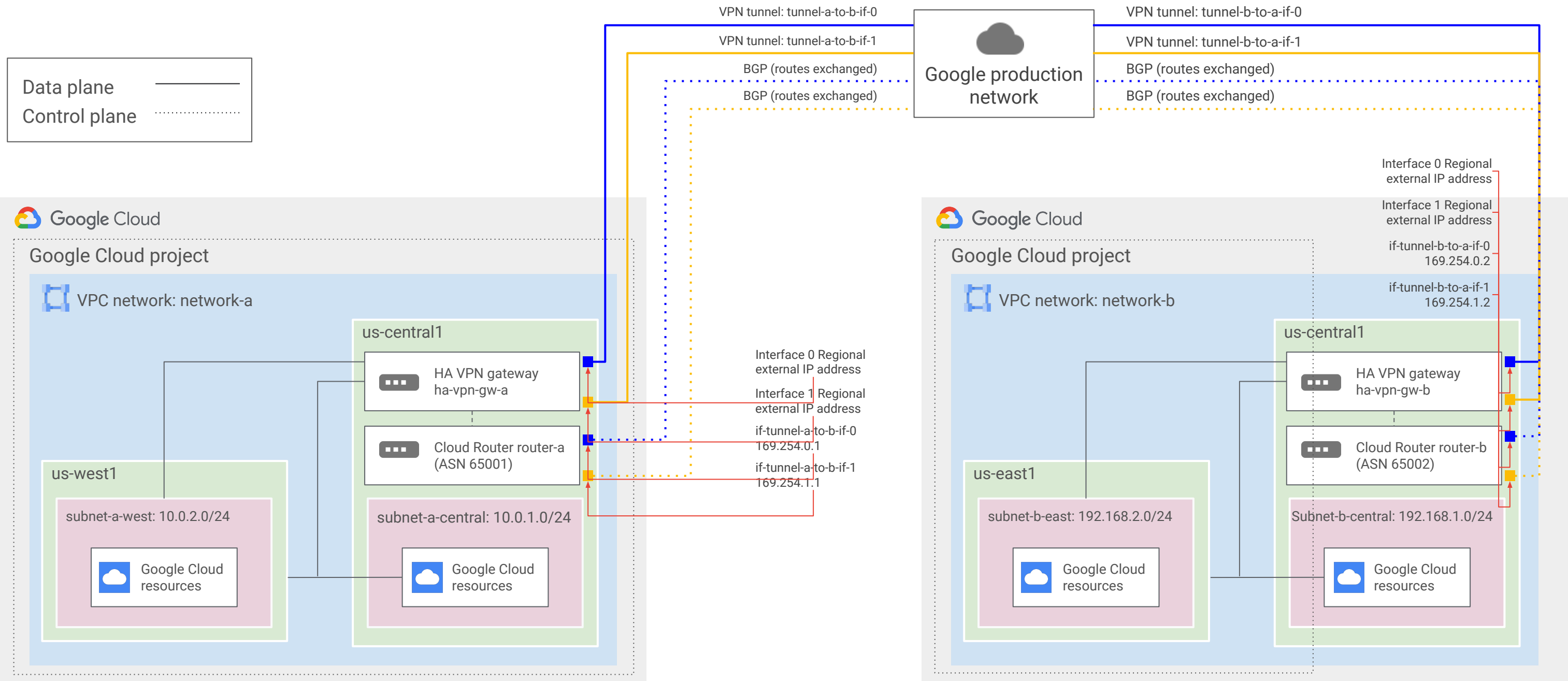 - Two HA VPN gateways connected to each other

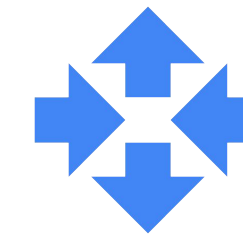Google Cloud

HA VPN to peer VPN gateway topology

VPN Tunnel 0 (encrypted traffic)
VPN Tunnel 1 (encrypted traffic)
BGP (routes exchanged)
BGP (routes exchanged)

Internet

Google Cloud

Google Cloud project

VPC network: network-a

us-central1

VPC routing

HA VPN gateway
ha-vpn-gw-a

Cloud Router router-a
(ASN 65001)

us-west1

subnet-a-west: 10.0.2.0/24

Google Cloud
resources

subnet-a-central: 10.0.1.0/24

Google Cloud
resources

Interface 0 Regional
external IP address

Interface 1 Regional
external IP address

BGP Session 0
169.254.0.1

BGP Session 1
169.254.1.1

External IP address
and BGP IP
address
169.254.0.2

External IP address
and BGP IP
address
169.254.1.2

On-premises
VPN Gateway 1

On-premises
VPN Gateway 2

On-premises network

On-premises subnets and resources
(ASN 65002)
192.168.1.0/24
...
192.168.30.0/24

Data plane
Control plane

HA VPN to AWS peer gateway topology

Tunnel-a-to-aws-connection-0-ip0
Tunnel-a-to-aws-connection-0-ip1
Tunnel-a-to-aws-connection-1-ip0
Tunnel-a-to-aws-connection-1-ip1

Internet

Google Cloud

Google Cloud project

VPC network: network-a

us-central1

HA VPN gateway
ha-vpn-gw-a

VPC routing

Cloud Router
router-a (ASN 65001)

Interface 0
Regional external IP

Interface 1
Regional external IP

BGP Session 0
169.254.6.1

BGP Session 1
169.254.7.1

BGP Session 2
169.254.8.1

BGP Session 3
169.254.9.1

us-west1

subnet-a-west: 10.0.2.0/24

Google
Cloud
resources

subnet-a-central:
10.0.1.0/24

Google
Cloud
resources

AWS VPN Connection 0
AWS gateway IP 0
BGP IP 169.254.6.2

AWS VPN Connection 0
AWS gateway IP 1
BGP IP 169.254.7.2

AWS VPN Connection 1
AWS gateway IP 0
BGP IP 169.254.8.2

AWS VPN Connection 1
AWS gateway IP 1
BGP IP 169.254.9.2

AWS Virtual Private
Gateway 0

AWS Virtual Private
Gateway 1

AWS VPC

AWS VPC Subnets
172.31.0.0/16

Data plane	——
Control plane	····

Google Cloud

HA VPN to peer VPN gateway topology

Dynamic routing with Cloud Router

Cloud Router

Google Cloud

10.20.0.0/16
(Test)

10.20.0.0/16
(Test)

10.20.0.0/16
(Test)

Google VPN
Gateway

169.254.1.1
Cloud Router

Peer Gateway with
graceful restart

BGP Session

Internet

Peer
Network

Peer Gateway
169.254.1.2

Rack 1: 10.0.1.0/24

Rack 2: 10.0.2.0/24

Rack 29: 10.0.29.0/24

Rack 30: 10.0.30.0/24

VPN tunnel using
dynamic routing

BGP link local IP
addresses

Google Cloud

Agenda

Cloud VPN

Lab
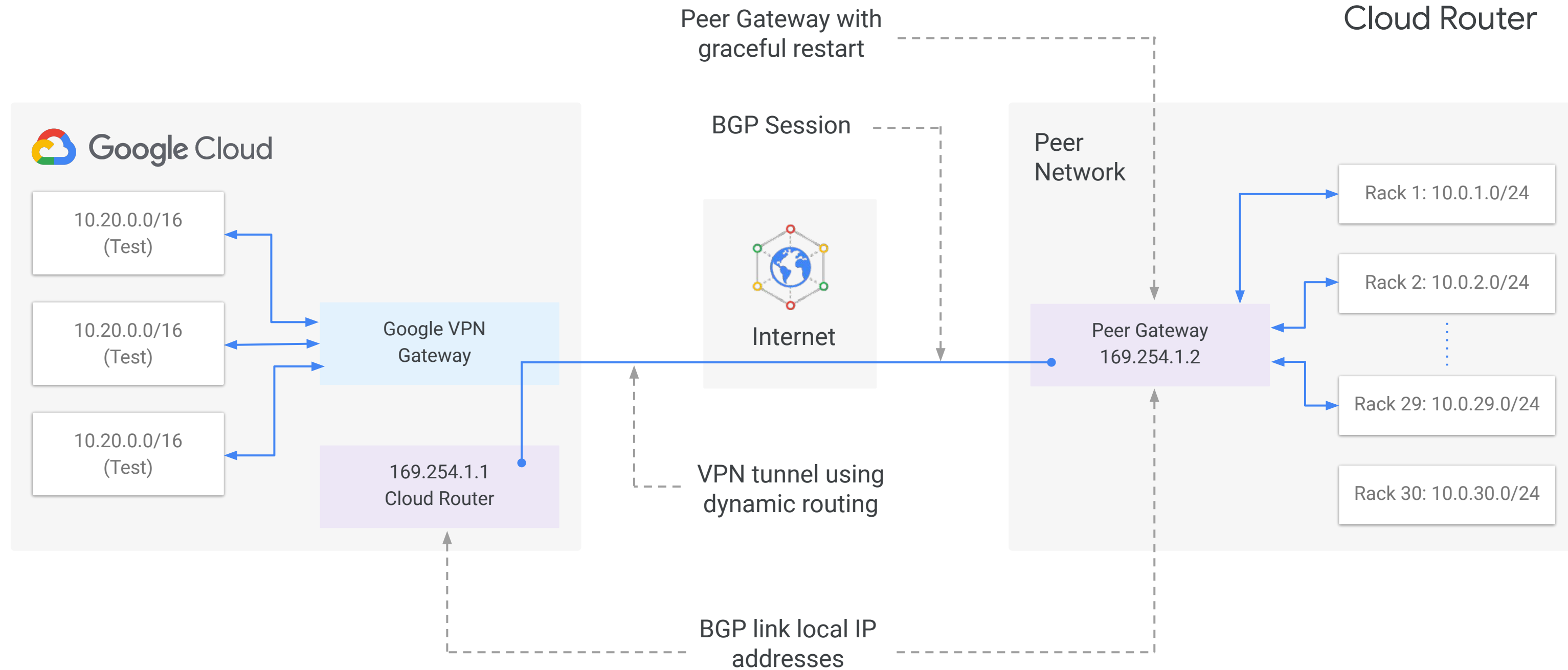
Cloud Interconnect and Peering
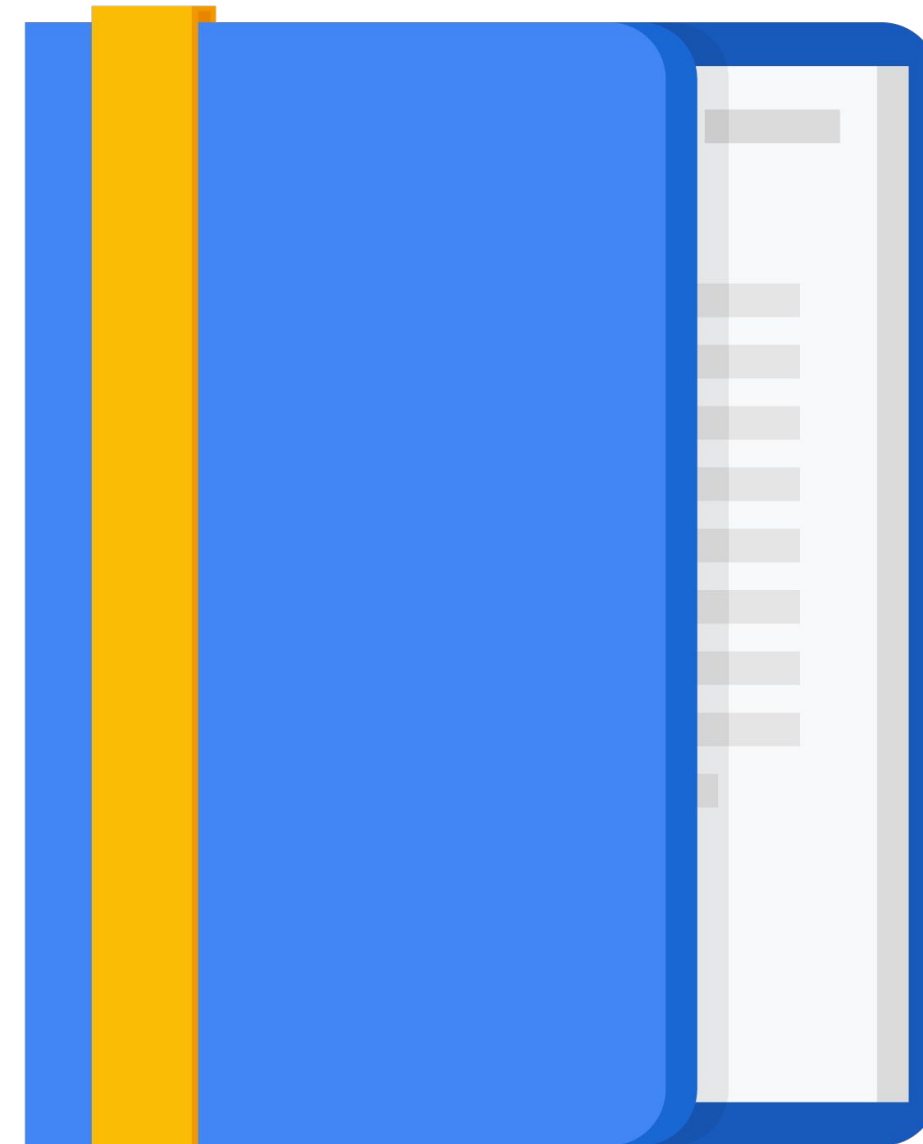
Google Cloud

Optional Lab
Configuring Google Cloud HA VPN

Duration: 1:00

Google Cloud

Lab Objectives

Cloud VPN

- Create two VPC networks and instances
- Configure HA VPN gateways
- Configure dynamic routing with VPN tunnels
- Configure global dynamic routing mode
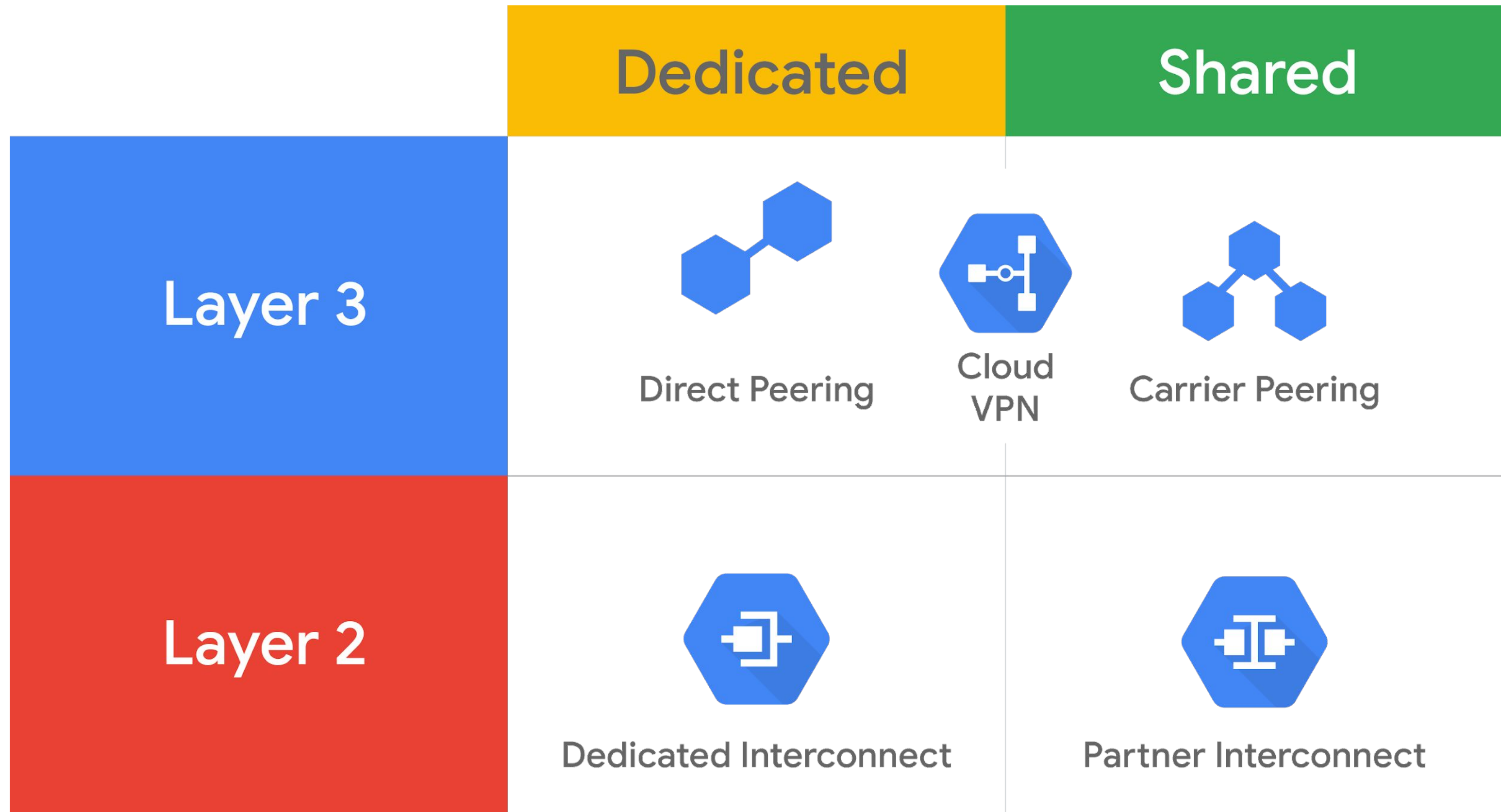- Verify and test HA VPN gateway configuration

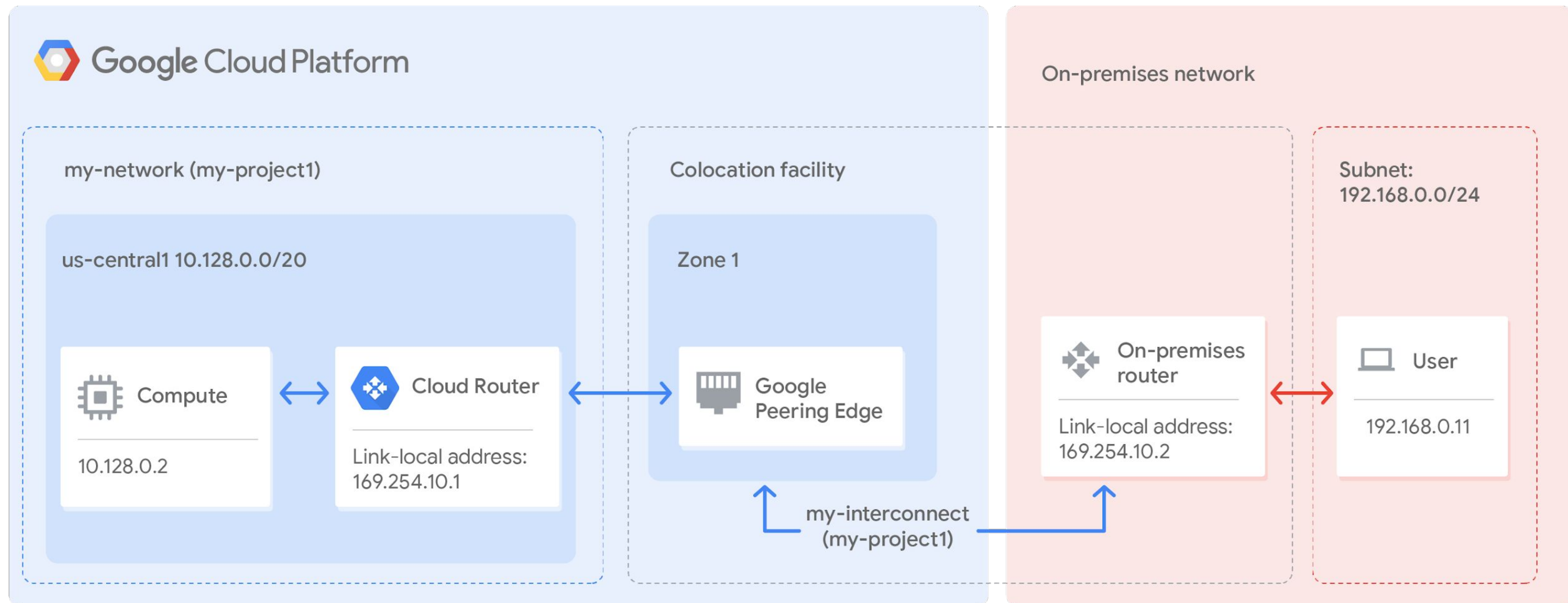Google Cloud

Agenda

Cloud VPN

Lab

Cloud Interconnect and Peering

Google Cloud

	Dedicated	Shared
Layer 3	Direct Peering Cloud VPN	Carrier Peering
Layer 2	Dedicated Interconnect	Partner Interconnect

Google Cloud
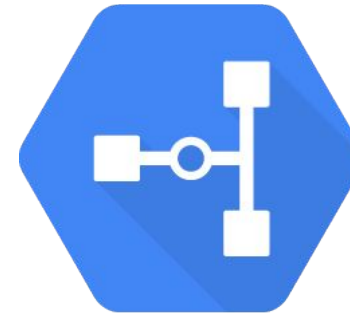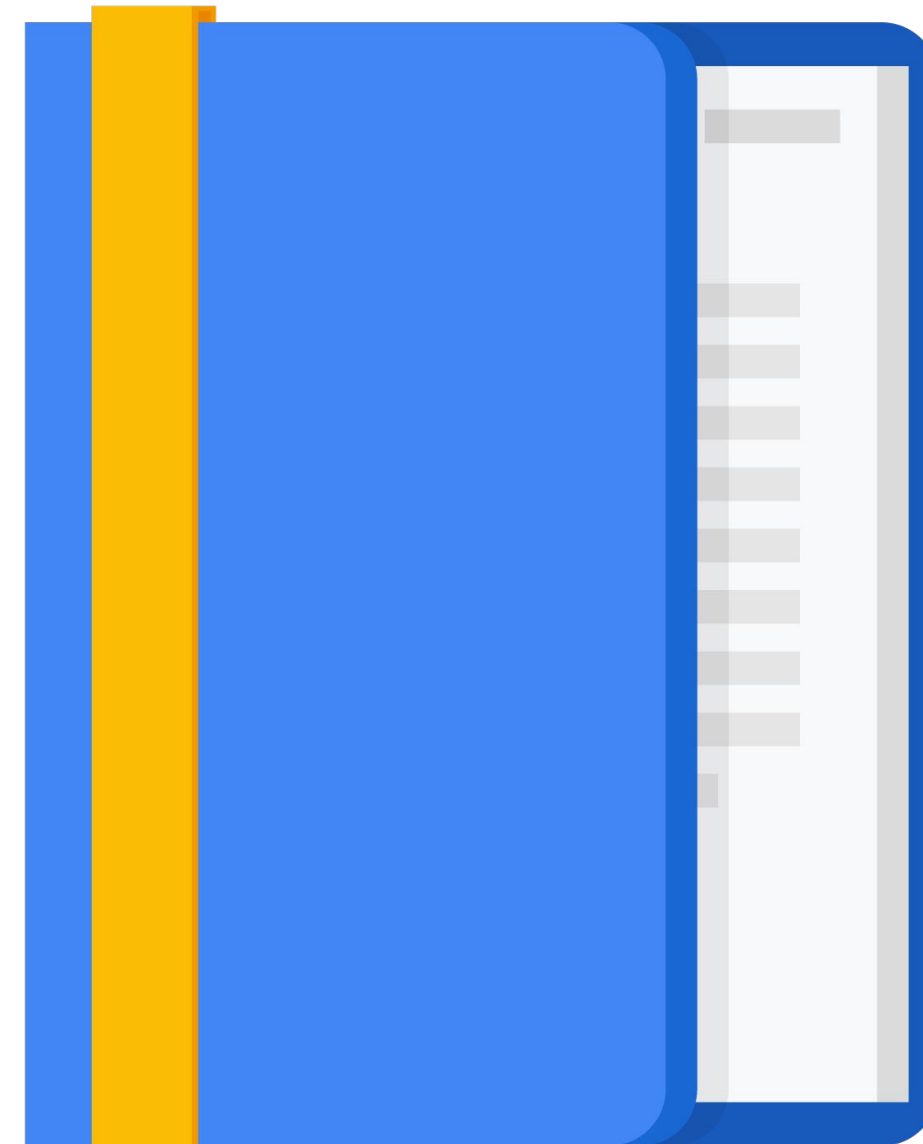
Dedicated Interconnect provides direct physical connections

Dedicated Interconnect

Google Cloud Platform

my-network (my-project1)

us-central1 10.128.0.0/20

Compute

10.128.0.2

Cloud Router

Link-local address:
169.254.10.1

Colocation facility

Zone 1

Google Peering Edge

my-interconnect (my-project1)

On-premises network

On-premises router

Link-local address:
169.254.10.2

Subnet: 192.168.0.0/24

User

192.168.0.11

Google Cloud

Colocation facility locations

Seattle
Denver
Salt Lake City
Chicago
Toronto
San Jose
Montréal
Los Angeles
New York
Las Vegas
Dallas
Ashburn
Council Bluffs
Atlanta
Queretaro
Miami

São Paulo
Rio de Janeiro
Buenos Aires

Amsterdam
Stockholm
London
Hamburg
Paris
Frankfurt
Marseille
Munich
Madrid
Zurich
Milan

Mumbai
Chennai
Kuala Lumpur
Singapore
Jakarta

Seoul
Osaka
Hong Kong
Tokyo
Taipei
Sydney

○ Dedicated Interconnect

Google Cloud

Partner Interconnect provides connectivity through a supported service provider

Partner Interconnect

Google Cloud Platform

Service provider network

On-premises network

VPC network

GCP region

VPC subnet

Cloud Router

Co-location facility

Cloud peering edge

Service provider peering edge

On-premises subnet

On-premises router

BGP

Google Cloud
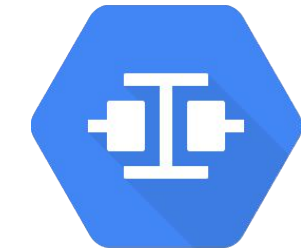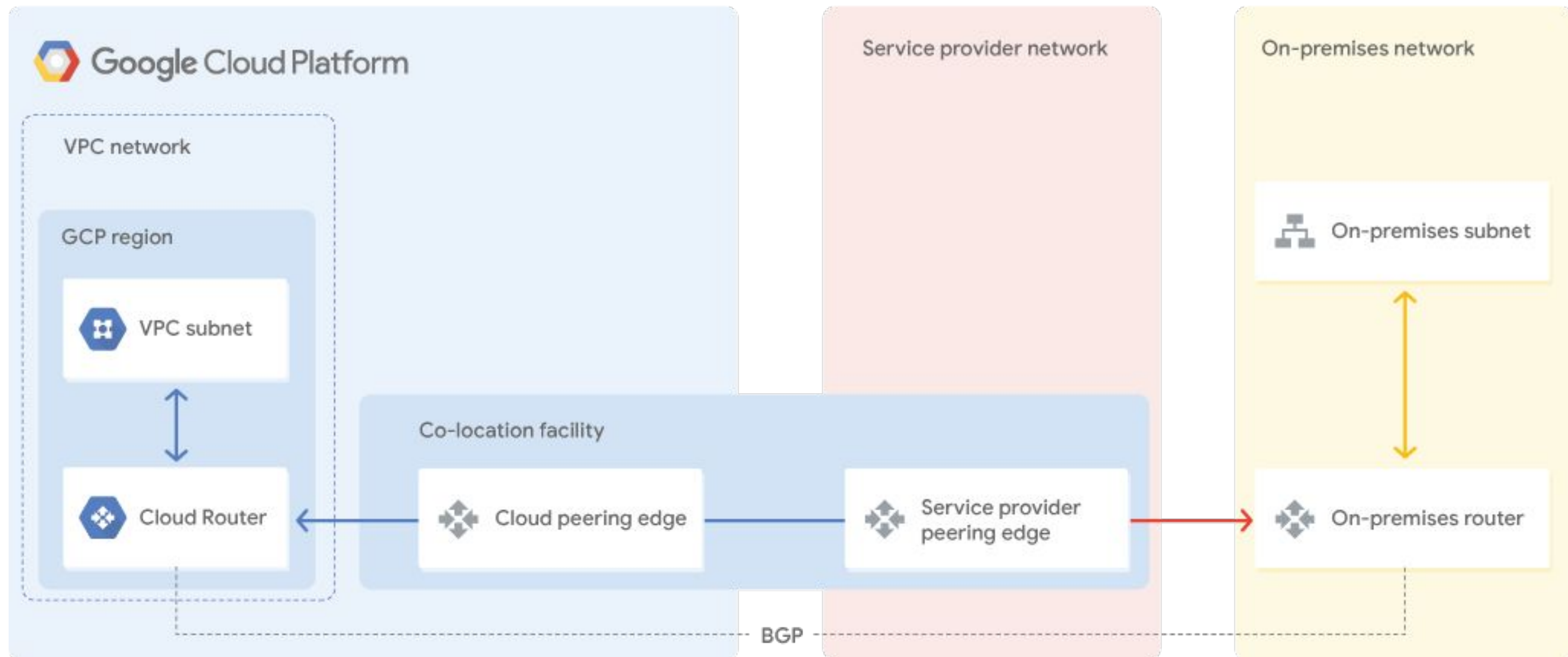
Comparison of Interconnect options

Connection	Provides	Capacity	Requirements	Access Type
IPsec VPN tunnel	Encrypted tunnel to VPC networks through the public internet	1.5-3 Gbps per tunnel	On-premises VPN gateway	Internal IP addresses
Dedicated Interconnect	Dedicated, direct connection to VPC networks	10 Gbps or 100 Gbps per link	Connection in colocation facility	
Partner Interconnect	Dedicated bandwidth, connection to VPC network through a service provider	50 Mbps – 10 Gbps per connection	Service provider	

Google Cloud

Direct Peering provides a direct connection between your business network and Google's

- Broad-reaching edge network locations
- Exchange BGP routes
- Reach all of Google's services
- Peering requirements
- No SLA

Google Cloud

Edge Points of Presence (PoPs)

Faster
(US, JP, TW)
2016

Grace Hopper
(US, UK, ES)
2022

Havfrue
(US, IE, DK)
2019

Dunant
(US, FR)
2020

PLCN
(US, TW)
2020

Equiano
(PT, NG, ZA)
2021

SJC
(JP, HK, SG)
2013

Unity
(US, JP)
2010

Curie
(CL, US)
2019

Monet
(US, BR)
2017

JGA-S
(GU, AU)
2019

Junior
(Rio, Santos)
2018

Tannat
(BR, UY, AR)
2018

Indigo
(SG, ID, AU)
2019

● Edge point
of presence

— Network

● Current region
with 3 zones

○ Future region
with 3 zones

Google Cloud

Carrier Peering provides connectivity through a supported partner

- Carrier Peering partner

- Reach all of Google's services

- Partner requirements

- No SLA

Google Cloud

Comparison of Peering options

Connection	Provides	Capacity	Requirements	Access Type
Direct Peering	Dedicated, direct connection to Google's network	10 Gbps Per link	Connection in Google Cloud PoPs	Public IP addresses
Carrier Peering	Peering through service provider to Google's public network	Varies based on partner offering	Service provider	

Google Cloud

5 ways to connect your infrastructure to Google Cloud

	Dedicated	**Shared**
Layer 3	Direct Peering Cloud VPN	Carrier Peering
Layer 2	Dedicated Interconnect	Partner Interconnect

Google Cloud
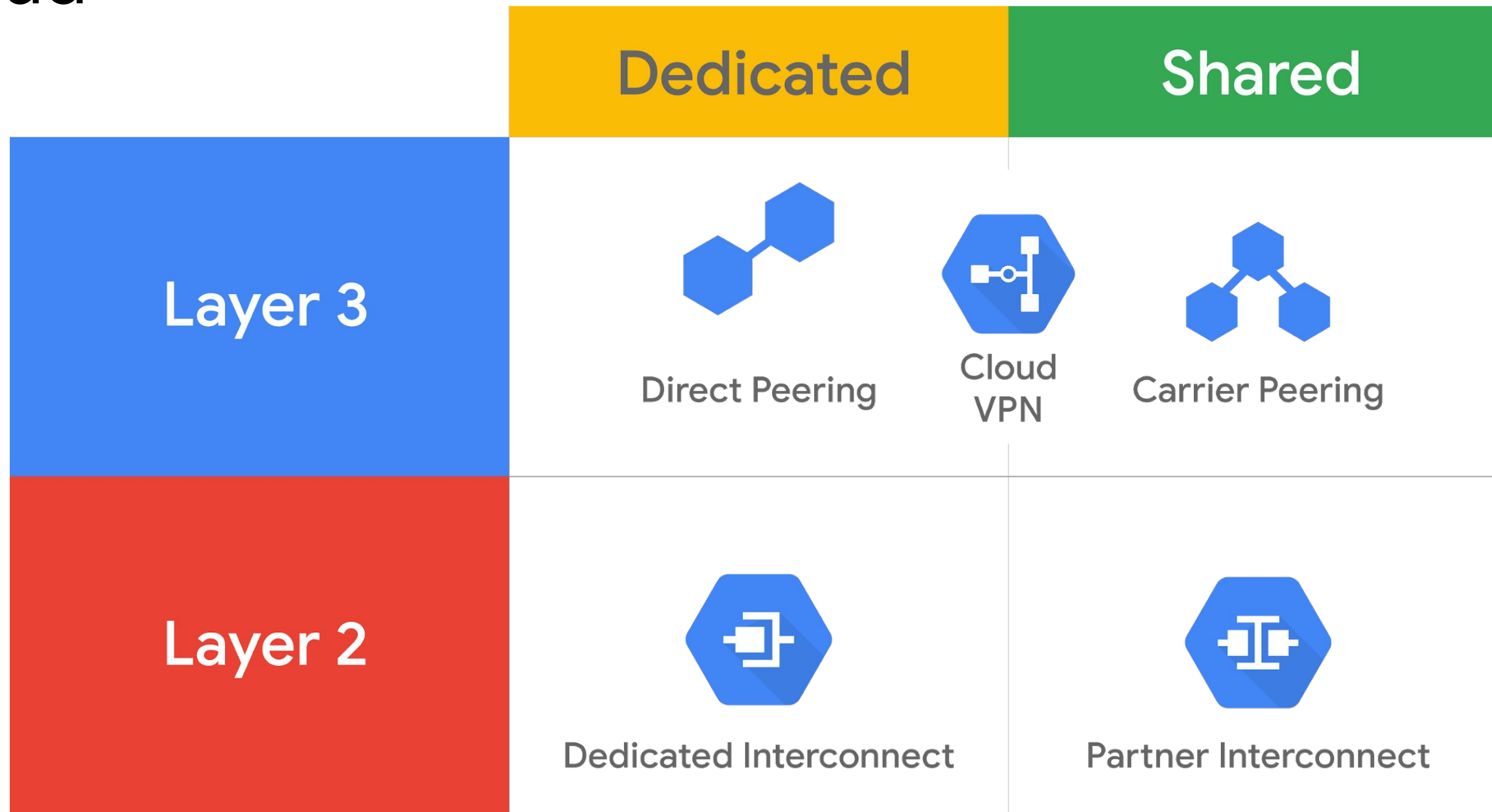
Choosing a network connection option

Interconnect	Peering
Direct access to RFC1918 IPs in your VPC – with SLA	Access to Google public IPs only – without SLA

Interconnect

Dedicated Interconnect

Partner Interconnect

Cloud VPN

Peering

Direct Peering

Carrier Peering

Google Cloud

Quiz

What is the purpose of virtual private networking (VPN)?

A. It is a method to detect intruders at the edge of a network boundary

B. VPNs are also called access control lists, or ACLs, and they limit network access

C. To enable a secure communication method (a tunnel) to connect two trusted environments through an untrusted environment, such as the internet

D. The main purpose is to encrypt data so that it can be stored in an encrypted format

Google Cloud

Quiz

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Google Cloud

Quiz

Which Google Cloud Interconnect service requires a connection in a Google Cloud colocation facility and provides 10 Gbps per link?

A. Cloud VPN

B. Dedicated Interconnect

C. Partner Interconnect

D. Direct Peering

E. Carrier Peering

Google Cloud

Quiz

Which Google Cloud Interconnect service requires a connection in a Google Cloud colocation facility and provides 10 Gbps per link?

A. Cloud VPN

B. Dedicated Interconnect

C. Partner Interconnect

D. Direct Peering

E. Carrier Peering

Google Cloud

Quiz

If you cannot meet Google's peering requirements, which network connection service should you choose to connect to Google Workspace and YouTube?

A. Dedicated Interconnect

B. Partner Interconnect

C. Direct Peering

D. Carrier Peering

Google Cloud

Quiz

If you cannot meet Google's peering requirements, which network connection service should you choose to connect to Google Workspace and YouTube?

A. Dedicated Interconnect

B. Partner Interconnect

C. Direct Peering

D. Carrier Peering

Google Cloud

Quiz

Which of the following approaches to multi-project networking, uses a centralized network administration model?

A. VPC Network Peering

B. Shared VPC

C. Cloud VPN

Google Cloud

Quiz

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Google Cloud